

MILITARY SPECIFICATION

FILTERS; HIGH PASS, LOW PASS, BAND PASS,  
BAND SUPPRESSION, AND DUAL FUNCTIONING,  
GENERAL SPECIFICATION FOR

INACTIVE FOR NEW DESIGN  
after 31 March 1999

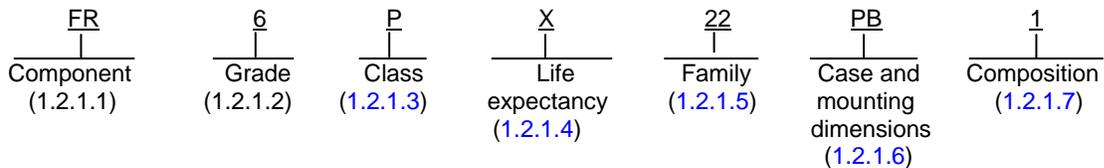
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for passive frequency-selective networks, such as dual functioning, band suppression, band pass, low pass, and high pass (or any combination thereof) electric-wave filters, including those employing electromechanical and piezoelectric elements, for use over the frequency range of 0 to 500 megahertz. Filters covered by this specification are intended for use where operation under various environmental conditions is required. This specification covers filters weighing not more than 50 pounds and requiring root-mean-square test voltage ratings not greater than 5,000 volts.

1.2 Classification.

1.2.1 Type designation. The type designation is in the following form and as specified. The type designation does not describe a discrete item. For complete identification, the part number and type designation should be referenced.



1.2.1.1 Component. Filters are identified by the two-letter symbol "FR".

1.2.1.2 Grade. The grade is identified by a single digit in accordance with table I, denoting the type of enclosure and the vibration frequency level (see 4.7.12).

TABLE I. Grade.

Symbol	Type of enclosure	Vibration frequency level
		Hz
4	Metal-encased	10 - 55
5	Encapsulated	10 - 55
6	Metal-encased	10 - 2,000
7	Encapsulated	10 - 2,000
8	Metal-encased	10 - 500
9	Encapsulated	10 - 500

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, DSCC-VAT, Post Office Box 3990, Columbus, OH 43218-3990 or e-mailed to [capacitorfilter@dla.mil](mailto:capacitorfilter@dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

1.2.1.3 Class. The class is identified by a single letter in accordance with table II, denoting the maximum operating temperature (see 6.4) for the realization of the life expectancy indicated in table III.

TABLE II. Class.

Symbol	Maximum operating temperature °C
P	65
Q	85
R	105
S	125
V	Above 125

1.2.1.4 Life expectancy. The life expectancy is identified by a single letter in accordance with table III.

TABLE III. Life expectancy.

Symbol	Life (hours, minimum)
X	10,000
Y	2,500

1.2.1.5 Family. The family is identified by a two-digit symbol in accordance with table IV.

TABLE IV. Family.

Family	Application
11	Filter, low pass
12	Filter, low pass and band pass (combination)
13	Filter, low pass and high pass (combination)
22	Filter, band pass
24	Filter, band pass and band suppression (combination)
33	Filter, high pass
44	Filter, band suppression

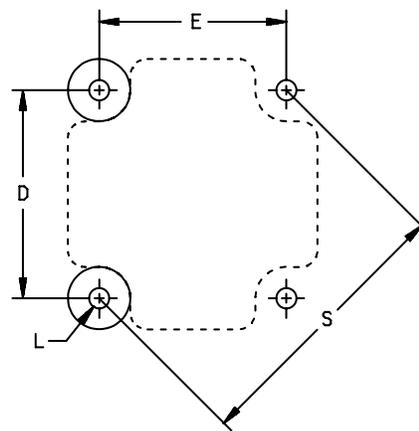
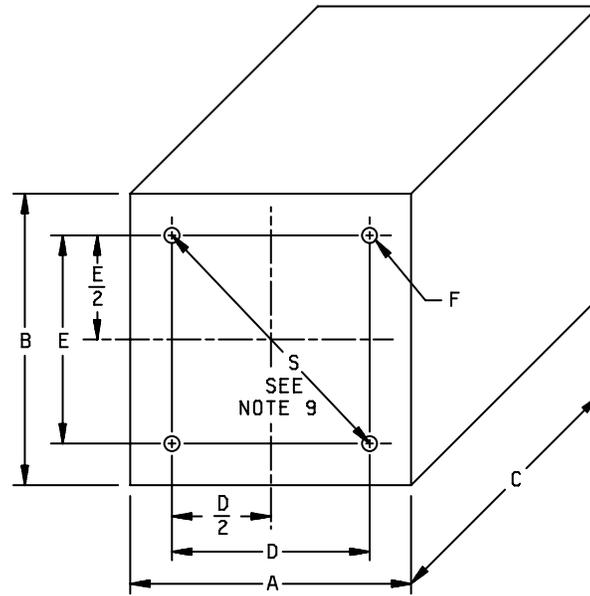
1.2.1.6 Case and mounting dimensions. The case and mounting dimensions are designated by a two-letter symbol in accordance with figures 1 to 6 inclusive.

1.2.1.6.1 Envelope and mounting dimensions for grades 5, 7, and 9 filters. Maximum envelope dimensions for grades 5, 7, and 9 filters are specified on figure 1. Mounting dimensions are identical to the dimensions specified for the equivalent cased-filter size.

1.2.1.7 Composition. The composition of the filter is identified by a single-digit symbol denoting the principal resonators in accordance with table V.

TABLE V. Composition.

Symbol	Principal resonators
1	LC
2	Crystal
3	Other electromechanical



INSPECTION TEMPLATE  
SEE NOTE 12

FIGURE 1. Envelope and mounting dimensions.

Case symbol	Envelope dimensions			Mounting dimensions				Template
	A	B	C	D	E	S	F (Stud)	L
AF	.750 ( 19.05)	.750 ( 19.05)	1.125 ( 28.58)	--	--	0.562 ( 14.27)	.112-40x.375	.147 (3.73)
AG	1.000 ( 25.40)	1.000 ( 25.40)	1.375 ( 34.93)	--	--	0.750 ( 19.05)	.112-40x.375	.147 (3.73)
AH	1.312 ( 33.32)	1.312 ( 33.32)	1.750 ( 44.45)	--	--	1.250 ( 31.75)	.138-32x.375	.173 (4.39)
AJ	1.625 ( 41.28)	1.625 ( 41.28)	2.375 ( 60.33)	1.188 ( 30.18)	1.188 (30.18)	1.680 ( 42.67)	.138-32x.375	.173 (4.39)
EA	1.938 ( 49.23)	1.812 ( 46.02)	2.750 ( 69.85)	1.375 ( 34.93)	1.250 (31.75)	1.858 ( 47.19)	.138-32x.375	.173 (4.39)
EB	1.938 ( 49.23)	1.812 ( 46.02)	2.438 ( 61.93)	1.375 ( 34.93)	1.250 (31.75)	1.858 ( 47.19)	.138-32x.375	.173 (4.39)
FA	2.312 ( 58.72)	2.062 ( 52.37)	3.125 ( 79.38)	1.688 ( 42.88)	1.438 (36.53)	2.217 ( 56.31)	.138-32x.375	.173 (4.39)
FB	2.312 ( 58.72)	2.062 ( 52.37)	2.500 ( 63.50)	1.688 ( 42.88)	1.438 (36.53)	2.217 ( 56.31)	.138-32x.375	.173 (4.39)
GA	2.750 ( 69.85)	2.375 ( 60.33)	3.812 ( 96.82)	2.125 ( 53.98)	1.750 (44.45)	2.753 ( 69.93)	.138-32x.375	.173 (4.39)
GB	2.750 ( 69.85)	2.375 ( 60.33)	2.812 ( 71.42)	2.125 ( 53.98)	1.750 (44.45)	2.753 ( 69.93)	.138-32x.375	.173 (4.39)
HA	3.062 ( 77.77)	2.625 ( 66.68)	4.250 (107.95)	2.297 ( 58.34)	1.859 (47.22)	2.955 ( 75.06)	.164-32x.375	.199 (5.05)
HB	3.062 ( 77.77)	2.625 ( 66.68)	3.188 ( 80.98)	2.297 ( 58.34)	1.859 (47.22)	2.955 ( 75.06)	.164-32x.375	.199 (5.05)
JA	3.562 ( 90.47)	3.062 ( 77.77)	4.875 (123.83)	2.625 ( 66.68)	2.125 (53.98)	3.377 ( 85.78)	.164-32x.375	.199 (5.05)
JB	3.562 ( 90.47)	3.062 ( 77.77)	3.875 ( 98.43)	2.625 ( 66.68)	2.125 (53.98)	3.377 ( 85.78)	.164-32x.375	.199 (5.05)
KA	3.938 (100.03)	3.375 ( 85.73)	5.250 (133.35)	3.000 ( 76.20)	2.438 (61.93)	3.866 ( 98.20)	.190-32x.500	.228 (5.79)
KB	3.938 (100.03)	3.375 ( 85.73)	4.312 (109.52)	3.000 ( 76.20)	2.438 (61.93)	3.866 ( 98.20)	.190-32x.500	.228 (5.79)
LA	4.312 (109.52)	3.688 ( 93.68)	5.562 (141.27)	3.312 ( 84.12)	2.688 (68.28)	4.266 (108.36)	.190-32x.500	.228 (5.79)
LB	4.312 (109.52)	3.688 ( 93.68)	4.500 (114.30)	3.312 ( 84.12)	2.688 (68.28)	4.266 (108.36)	.190-32x.500	.228 (5.79)
MA	4.688 (119.08)	4.000 (101.60)	6.000 (152.40)	3.688 ( 93.68)	3.000 (76.20)	4.754 (120.75)	.250-20x.625	.316 (8.03)
MB	4.688 (119.08)	4.000 (101.60)	4.938 (125.43)	3.688 ( 93.68)	3.000 (76.20)	4.754 (120.75)	.250-20x.625	.316 (8.03)
NA	5.062 (128.57)	4.312 (109.52)	6.812 (173.02)	4.062 (103.17)	3.312 (84.12)	5.243 (133.17)	.250-20x.625	.316 (8.03)
NB	5.062 (128.57)	4.312 (109.52)	5.500 (139.70)	4.062 (103.17)	3.312 (84.12)	5.243 (133.17)	.250-20x.625	.316 (8.03)
OA	5.500 (139.70)	4.500 (114.30)	6.750 (171.45)	3.750 ( 95.25)	3.000 (76.20)	4.802 (121.97)	.250-20x.625	.316 (8.03)
YY	All metal cases not included above							
ZZ	All encapsulated units not included above							

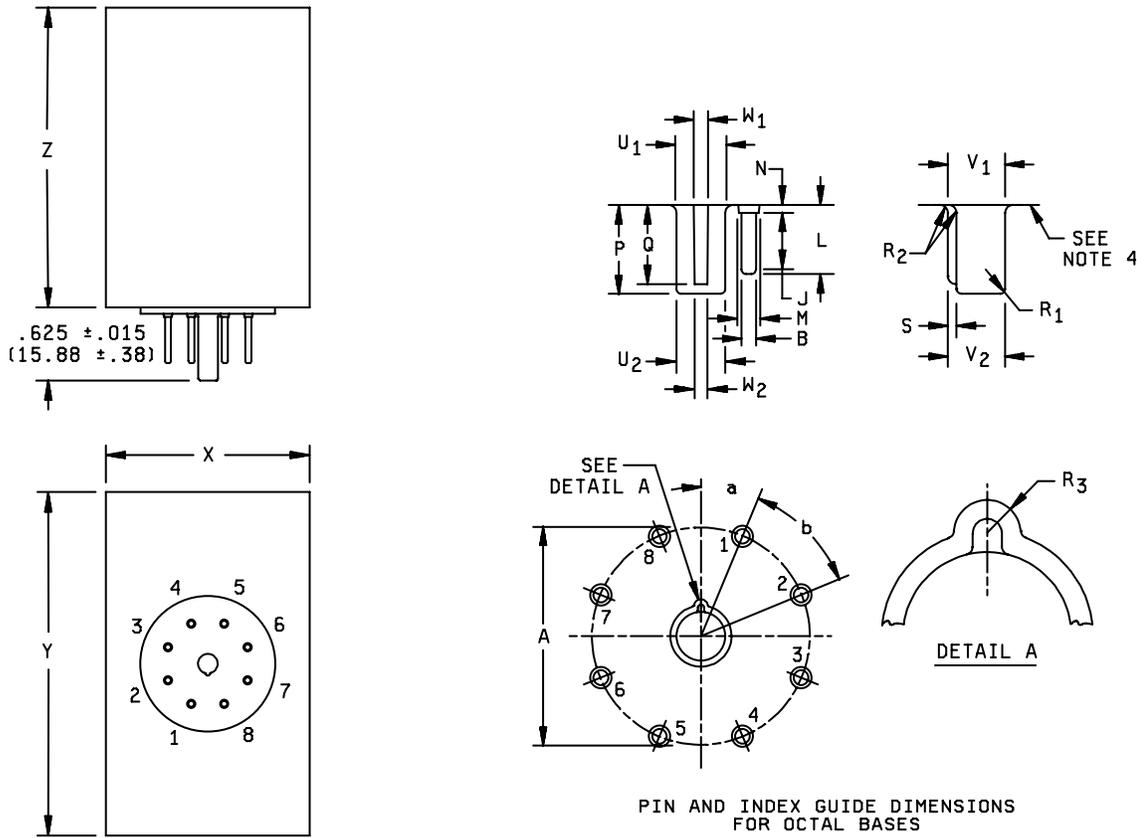
See footnotes at top of next page.

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NOTES:

1. Cases AF through OA inclusive have studs and terminals on same face. Stud size and length are as shown in dimension F.
2. Dimensions are in inches.
3. Metric equivalents are given for general information only.
4. Tolerances on dimensions A and B are  $+0.000, -.062$  ( $+0.00, -1.57$  mm) for cases AF, AG, AH, and AJ;  $+0.000, -.125$  ( $+0.00 -3.18$  mm) for all other cases.
5. Tolerances on dimensions C are  $+0.000, -.125$  ( $+0.00, -3.18$  mm) for cases AF, AG, AH, and AJ;  $+0.000, -.185$  ( $+0.00, -4.78$  mm) for all other cases.
6. Tolerances on dimensions D and E are  $\pm .016$  (0.41 mm) for cases AJ to JB inclusive;  $\pm .031$  (0.79 mm) for cases KA to LB inclusive; and  $\pm .047$  (1.19 mm) for cases MA to OA inclusive. The centerlines of the drawings are the centerlines of the case; D/2 and E/2 are the reference dimensions.
7. Tolerances for cases YY and ZZ are as follows: Dimensions not exceeding those for the AJ case have the same tolerances as the AJ cases. For larger dimensions up to case size OA, the tolerances in notes 4, 5, and 6 apply. For case sizes larger than OA, tolerances are as specified. Dimensions A, B, and C for ZZ cases are considered maximum dimensions (see 3.1).
8. Tolerances on dimension S for two-stud mounting are  $\pm .016$  (0.41 mm) for cases AF to AH inclusive. For four-stud mounting, the difference between the two diagonal S dimensions should not exceed 1.5 times the tolerance specified for dimensions D and E in note 6.
9. Screw-stud lengths are measured from the mounting surface and have a length tolerance of  $\pm .062$  (1.57 mm) on studs .500 (12.70 mm) long or less, and  $\pm .125$  (3.18 mm) on studs over .500 (12.70 mm) long. Mounting screw inserts may be supplied instead of studs for case sizes AF, AG, and AH, or units of equivalent volume and have a minimum depth equivalent to eight full threads (grades 4, 6, and 8 only) of the same diameter as the stud of the corresponding case size. Inserts meet all stud requirements.
10. Rectangular cases may have corner radii not to exceed one-quarter of the smallest envelope dimensions.
11. When mounted, tilt of units (overhand only) measured horizontally or vertically, may not exceed  $.016$  (0.41 mm) per inch of height but need not be less than  $.016$  (0.41 mm) for any height, and are referenced to the maximum specified case dimensions.
12. Templates used for verifying mounting stud dimensions are a minimum of  $.375$  (9.52 mm) inch thick and have nominal D, E, S, and L dimensions shown for each case size. The tolerance for template dimensions D, E, and S is  $\pm .001$  (0.03 mm) inch, and  $\pm .0005$  (0.013 mm) inch for dimension L.

FIGURE 1. Envelope and mounting dimensions – Continued.



PIN AND INDEX GUIDE DIMENSIONS FOR OCTAL BASES

Case symbol	Dimensions ± .062		
	X	Y	Z
PA	1.750 (44.45)	1.750 (44.45)	3.000 (76.20)
PB	2.062 (52.37)	2.937 (74.60)	2.562 (65.07)
PC	2.562 (65.07)	4.937 (125.40)	2.562 (65.07)
PY	All sizes not included above.		
PZ	All encapsulated units not included above and all open type units.		

FIGURE 2. Case and mounting dimensions for PA, PB, PC, PY, and PZ.

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Ref	Inches			Millimeters			Degrees	Notes
	Min	Nom	Max	Min	Nom	Max		
A	---	.687	---	---	17.45	---		
B	.090	.093	.096	2.286	2.362	2.438		5
J	.320	---	---	8.13	---	---		
L	.427	.437	.447	10.85	11.10	11.35		6
M	---	---	.135	---	---	3.42		
N	---	---	.050	---	---	1.27		
P	.550	.560	.570	13.97	14.22	14.47		
Q	.490	.500	.510	12.45	12.70	12.95		7
R <sub>1</sub>	---	.031r	---	---	0.79r	---		
R <sub>2</sub>	---	---	.050r	---	---	1.27r		
R <sub>3</sub>	---	.040r	---	---	1.02r	---		
S	.040	.047	.055	1.02	1.19	1.39		
U <sub>1</sub>	.305	.312	.317	7.75	7.92	8.05		
U <sub>2</sub>	.300	.308	.315	7.62	7.82	8.00		
V <sub>1</sub>	.352	.362	.372	8.95	9.19	9.44		
V <sub>2</sub>	.343	.353	.363	8.72	8.97	9.22		
W <sub>1</sub>	.085	.090	.095	2.159	2.286	2.413		
W <sub>2</sub>	.075	.080	.085	1.905	2.032	2.159		
a	---	---	---	---	---	---	22.5	
b	---	---	---	---	---	---	45	

For the purpose of establishing interchangeability, the dimensional limits given here are standard for the orientation of base pins and index guide of Group No. 1 bases. (Formerly known as Octal Bases.)

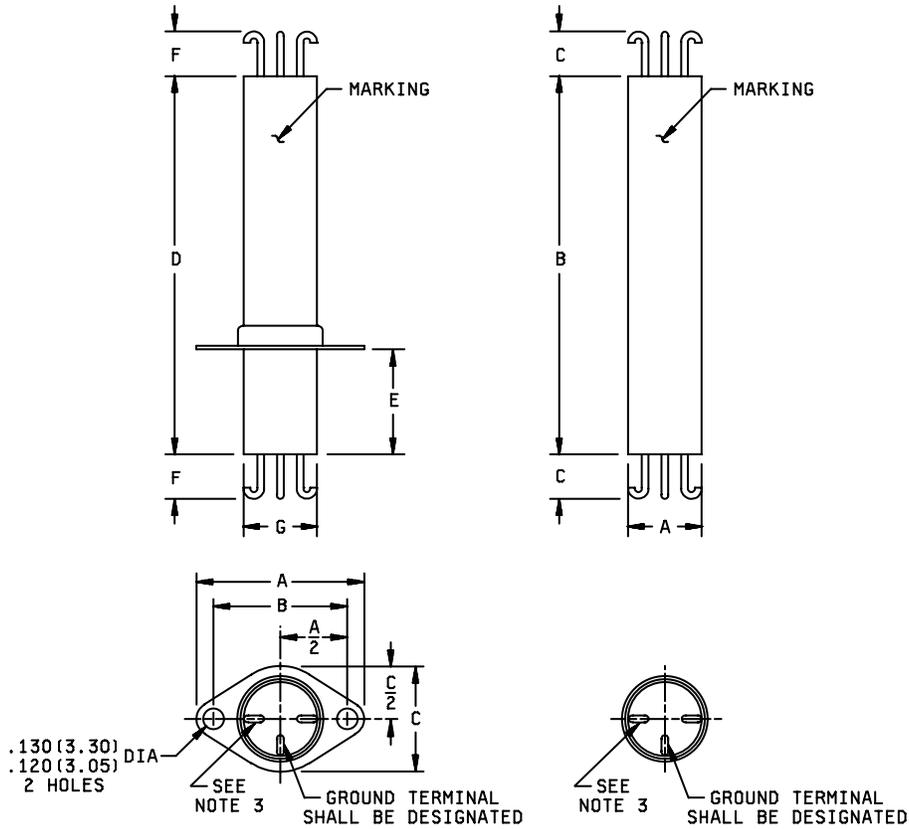
The vertical dimensions are referred to the underside of a base as differentiated from the general practice in this standard of dimensioning from the outer rim.

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions fixing the contact pin positions refer to their fixed ends and are given for information only. Pin positions may be checked by means of alignment gauge No. GB8-1 in accordance with EIA Standard RS-209-A. For bases with coaxial lead, use gauge GB8-1 with pin 4 pin hole,  $.1600 \pm .0005$  ( $4.064 \pm 0.013$  mm) diameter to a depth of 1.25 (31.8 mm) minimum.
4. Underside of base.
5. Dimension B does not include increase in pin diameter due to solder.
6. Dimension L may be increased by .030 (0.76 mm) maximum for solder.
7. Any projection on the under-surface of the base other than those shown, such as a rim or external barriers, have a height not exceeding .045 (1.14 mm).
8. Pin numbering is viewed from the pin ends. The drawing shows the numbering of the pins as seen from their free ends.
9. External mounting support required for plug in type filters having no means of support other than socket.
10. The numbers indicated above each base drawing refer to the Group Number of Pin and Index Guide Dimensional Limits.

FIGURE 2. Case and mounting dimensions for PA, PB, PC, PY, and PZ - Continued.

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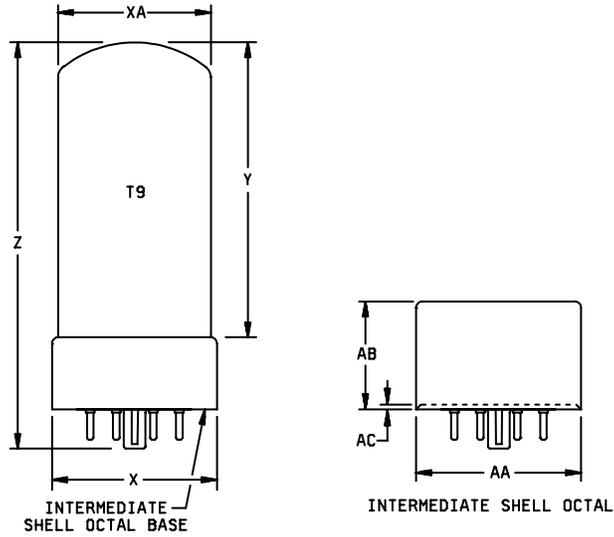
Case symbol	Mounting dimensions flange mount							Case symbol	Mounting dimensions clamp mount		
	A±.015 (0.38)	B±.005 (0.13)	C±.016 (0.41)	D±.015 (0.38)	E±.031 (0.79)	F±.015 (0.38)	G±.005 (0.13)		A±.015 (0.38)	B±.031 (0.79)	C±.015 (0.38)
QC	1.423 (36.14)	1.125 (28.58)	1.016 (25.81)	2.766 (70.26)	.625 (15.88)	.266 (6.76)	.775 (19.68)	QA	.775 (19.68)	3.500 (88.90)	.266 (6.76)
QD	1.000 (25.40)	.750 (19.05)	.625 (15.88)	2.250 (57.15)	.625 (15.88)	.266 (6.76)	.437 (11.10)	QB	.438 (11.13)	2.188 (55.58)	.141 (3.58)
QY	All sizes not included above.							QZ	All sizes not included above		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Terminal positions are optional.

FIGURE 3. Case and mounting dimensions for QA, QB, QC, QD, QY, and QZ.

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Case symbol	X max	XA max	Y max	Z max	AA	AB	AC max
SA	1.281 (32.54)	1.187 (30.15)	2.312 (58.72)	2.875 (73.03)	1.235 (31.37) 1.275 (32.29)	.843 (21.41)	.020 (0.51)
SB	1.250 (31.75)	1.187 (30.15)	2.250 (57.15)	2.875 (73.03)	1.235 (31.37) 1.275 (32.39)	.843 (21.41)	.020 (0.51)
SY	All sizes not included above						

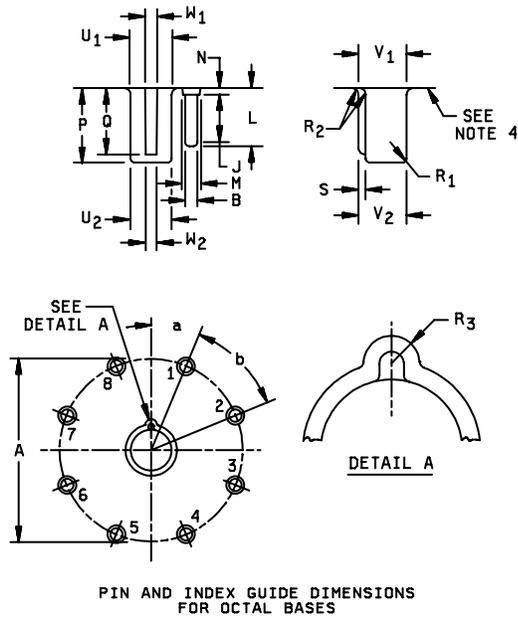


FIGURE 4. Case and mounting dimensions for SA, SB, and SY.

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Ref	Inches			Millimeters			Degrees	Notes
	Min	Nom	Max	Min	Nom	Max		
A	---	.687	---	---	17.45	---		
B	.090	.093	.096	2.286	2.362	2.438		5
J	.320	---	---	8.13	---	---		
L	.427	.437	.447	10.85	11.10	11.35		6
M	---	---	.135	---	---	3.42		
N	---	---	.050	---	---	1.27		
P	.550	.560	.570	13.97	14.22	14.47		
Q	.490	.500	.510	12.45	12.70	12.95		7
R <sub>1</sub>	---	.031r	---	---	0.79r	---		
R <sub>2</sub>	---	---	.050r	---	---	1.27r		
R <sub>3</sub>	---	.040r	---	---	1.02r	---		
S	.040	.047	.055	1.02	1.19	1.39		
U <sub>1</sub>	.305	.312	.317	7.75	7.92	8.05		
U <sub>2</sub>	.300	.308	.315	7.62	7.82	8.00		
V <sub>1</sub>	.352	.362	.372	8.95	9.19	9.44		
V <sub>2</sub>	.343	.353	.363	8.72	8.97	9.22		
W <sub>1</sub>	.085	.090	.095	2.159	2.286	2.413		
W <sub>2</sub>	.075	.080	.085	1.905	2.032	2.159		
a	---	---	---	---	---	---	22.5	
b	---	---	---	---	---	---	45	

For the purpose of establishing interchangeability, the dimensional limits given here are standard for the orientation of base pins and index guide of Group No. 1 bases. (Formerly known as Octal Bases.)

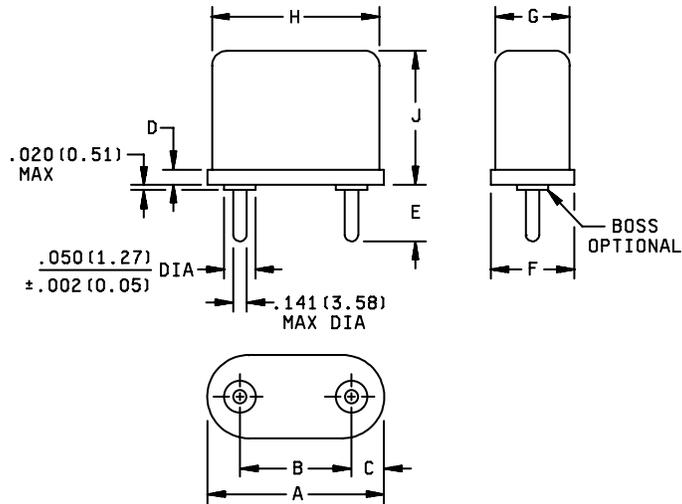
The vertical dimensions are referred to the underside of a base as differentiated from the general practice of dimensioning from the outer rim.

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only
3. Dimensions fixing the contact pin positions refer to their fixed ends and are given for information only. Pin positions may be checked only by means of alignment gauge No. GB8-1 in accordance with EIA Standard RS-209-A. For bases with coaxial lead, use gauge GB8-1 with pin 4 pin hole,  $.1600 \pm .0005$  ( $4.064 \pm 0.013$  mm) diameter to a depth of 1.25 (31.75 mm) minimum.
4. Underside of base.
5. Dimension B does not include increase in pin diameter due to solder.
6. Dimension L may be increased by .030 (0.76 mm) maximum for solder.
7. Any projection on the under-surface of the base other than these shown, such as a rim or external barriers, have a height not exceeding .045 (1.14 mm).
8. Pin numbering is viewed from the pin ends. The drawing shows the numbering of the pins as seen from their free ends.
9. The numbers indicated above each base drawing refer to the Group Number of Pin and Index Guide Dimensional Limits.

FIGURE 4. Case and mounting dimensions for SA, SB, and SY (continued).

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Case symbol	Dimensions								
	A	B	C	D	E	F	G	H	J
RA	.418 (10.62)	.192 (4.88)	.182 (4.62)	.045 (1.14)	.150 (3.81)	.166 (4.22)	.147 (3.73)	.399 (10.13)	.515 (13.08)
RB	.750 (19.05)	.486 (12.34)	.132 (3.35)	.065 (1.65)	.238 (6.05)	.345 (8.76)	.315 (8.00)	.720 (18.29)	1.516 (38.51)
RC	.750 (19.05)	.486 (12.34)	.352 (8.98)	.065 (1.65)	.238 (6.05)	.345 (8.76)	.315 (8.00)	.720 (18.29)	.765 (19.43)
RY	All sizes not included above.								

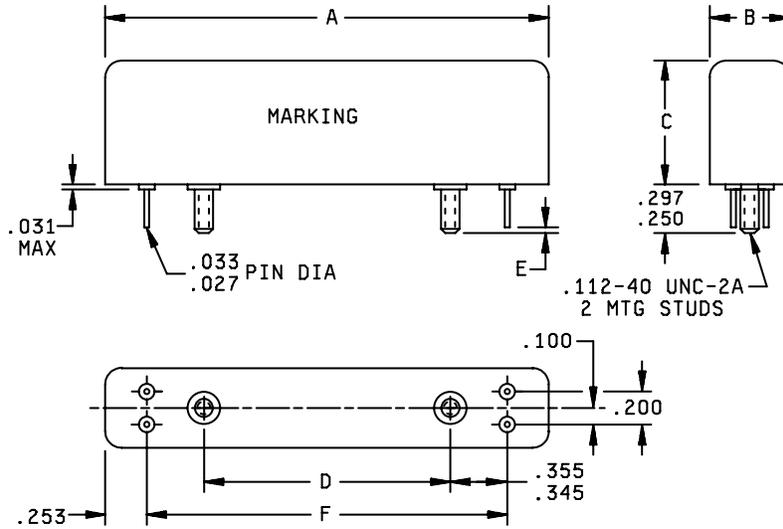
Case tolerances			
Dim.	RA	RB	RC
A	-.005(0.13)	-.005(0.13)	+.010(0.25)
B	±.008(0.20)	±.008(0.20)	±.008(0.20)
C	±.005(0.13)	±.005(0.13)	±.005(0.13)
D	±.010(0.25)	±.010(0.25)	±.005(0.13)
E	+.010(0.25)	+.010(0.25)	1.50(38.10) min
F	-.005(0.13)	-.005(0.13)	+.010(0.25)
G	+.002(0.05) -.005(0.13)	+.002(0.05) -.005(0.13)	+.002(0.05) -.005(0.13)
H	+.002(0.05) -.005(0.13)	+.002(0.05) -.005(0.13)	+.002(0.05) -.005(0.13)
J	±.010(0.25)	±.010(0.25)	+.010(0.25) -.015(0.38)

NOTES:

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

FIGURE 5. Case and mounting dimensions for RA, RB, RC, and RY.

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Case symbol	Mounting dimensions					
	A±.015 (0.38)	B±.015 (0.38)	C Max	D±.005 (0.13)	E±.031 (0.79)	F±.005 (0.13)
TA	2.704 (68.68)	.485 (12.32)	.753 (19.13)	1.500 (38.10)	.281 (7.14)	2.200 (55.88)
TY	All sizes not included above.					

Inches	mm
.027	0.69
.031	0.79
.033	0.84
.100	2.54
.200	5.08
.250	6.35
.253	6.43
.297	7.54
.345	8.76
.355	9.02

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ± .005 (0.13 mm).

FIGURE 6. Case and mounting dimensions for TA and TY.

## 2. APPLICABLE DOCUMENTS

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

### 2.2 Government documents.

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

#### FEDERAL STANDARDS

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

#### DEPARTMENT OF DEFENSE SPECIFICATIONS

[MIL-PRF-1](#) - Electron Tubes, General Specification for.  
[MIL-DTL-15090](#) - Enamel, Equipment, Light-gray (Formula No. 111).

#### DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202](#) - Test Methods for Electronic and Electrical Component Parts.  
[MIL-STD-810](#) - Environmental Test Methods.  
[MIL-STD-1285](#) - Marking of Electrical and Electronic Parts.

Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

#### INTERNATIONAL ORGANIZATION FOR STANDARDS (ISO)

[ISO 10012](#) - Measurement Management Systems – Requirements for Measurement Processes and Measuring Equipment – First Edition

(Copies of this document may be ordered online at <http://www.iso.org> or from the International Organization for Standardization American National Standards Institute, 11 West 42<sup>nd</sup> Street, 13<sup>th</sup> Floor, New York, NY 10036)

#### NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

[NCSL Z540.1](#) - Calibration and Measuring and Test Equipment – General Requirements

(Copies of this document may be ordered online at <http://www.ncsli.org> or from National Conference of Standards Laboratories (NCSL), 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404)

3. REQUIREMENTS

3.1 Procurement document. The individual part requirements shall be as specified herein and in accordance with the applicable procurement document or drawing. In the event of any conflict between requirements of this specification and the procurement document or drawing, the latter shall govern.

3.2 First article. When specified (see 6.2 and 6.3), a sample shall be subjected to first article inspection in accordance with 4.5.

3.3 Material. The material shall be as specified herein. When a definite material is not specified, a material shall be used which will enable the filters 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.

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

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

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

3.4 Design and construction.

3.4.1 Mounting and terminal screws and nuts. Screw threads shall be class 2A or 2B, as applicable, in accordance with FED-STD-H28. After receiving a finish, screw threads, class 2A fit, shall be capable of accepting a nut of class 2B with maximum installation torque in accordance with the following:

<u>Screw size</u>	<u>Maximum torque (pounds-inches)</u>
.112-40 - - - -	3
.138-32 - - - -	5
.164-32 - - - -	6
.190-32 - - - -	8
.250-20 - - - -	8
.3125-18 - - - -	8

Nuts shall run down to within two threads of mounting surface. All mounting and terminal screws, nuts, and washers shall be corrosion-resistant material or shall be protected against corrosion.

3.4.2 Terminals.

3.4.2.1 Solder terminals. Solder terminals may be of any shape, and shall be capable of being readily soldered. The height of the solder terminals shall be considered as the maximum distance from the terminal mounting surface to the highest point, including the additional height obtained if semi-flexible terminals are straightened. (It is not intended that the "hook" in the "button-hook" type terminal should be straightened from its normal hooked position). The type of terminal and the maximum size of round wire which the terminal will accept externally shall be as specified (see 3.1).

3.4.2.2 Screw terminals. When external screw terminals are specified (see 3.1), they shall be supplied with two nuts, two flat washers, and one lockwasher. Radially-tapped permanent stud terminals shall be supplied with one screw and one lockwasher. For cased filters, the height of the terminal assembly shall be the distance from the free end of the screw to the terminal mounting surface. The type of terminal, size of screw thread, and, for all screw terminals, the exposed length of threads  $\pm 1/16$  inch shall be as specified (e.g., screw, No. .164-32 x .375) (see 3.1).

3.4.2.3 Pin-type terminals. Pin-type terminals, for use with vacuum tube type sockets, shall conform with standard 7-pin button base E7-1, 8-pin octal base, or standard 9-pin button base E9-1 of MIL-PRF-1.

3.4.3 Mounting studs. When external mounting studs are specified (see 3.1), they shall be supplied with a locknut; or with a flat washer, a lockwasher, and a nut.

3.4.4 Internal lead wires. Internal lead wires shall be attached to the internal components and terminals or case in such a manner as to provide adequate electrical connection and mechanical strength.

3.4.5 Paint color. When a paint finish is specified (see 3.1), the color of the paint shall be light-gray, semigloss, in accordance with MIL-DTL-15090 (Formula No. 111). Unless otherwise specified, the supplier shall omit paint from the mounting and terminal area surface.

3.5 Terminal strength. When filters are tested as specified in 4.7.2, no part of the terminals shall loosen or rupture and no other damage shall result. Bends shall not be considered as damage unless surface cracking is evident. Except for flexible leads, permanent rotation of any terminal shall not exceed 10°. Rotation of the external portion of the metallic portion of a hook type terminal, such as buttonhook, exceeding 10° shall not constitute a failure.

3.6 Solderability (when specified, see 3.1). When filters are tested as specified in 4.7.3, the dipped surface leads shall be at least 95 percent covered with continuous new solder coating. The remaining 5 percent of the lead surface may show only small pinholes or voids and these shall not be concentrated in one area. Bare base metal and areas where the solder dip fails to cover the original coating are indications of poor solderability, and shall be cause for rejection.

3.7 Resistance to soldering heat (when specified, see 3.1). When filters are tested as specified in 4.7.4, there shall be no evidence of loosening of the terminals, mechanical damage, or evidence of damage to the filters.

3.8 Seal (see 4.7.5).

3.8.1 All filters. When tested as specified in 4.7.5.1, filters shall show no continuous flow of air bubbles or leakage of compound from the body of the filter.

3.8.2 Liquid-filled filters. When tested as specified in 4.7.5.2, filters shall show no evidence of liquid leakage.

3.9 Dielectric withstanding voltage. When filters are tested as specified in 4.7.6, there shall be no arcing, flashover, breakdown of insulation, or evidence of damage.

3.10 Insulation resistance. When measured as specified in 4.7.7, the insulation resistance between each terminal and case or mounting shall be not less than 10,000 megohms or 1,000 megohms, as specified (see 3.1).

3.11 Electrical characteristics. When filters are tested as specified in 4.7.8, the applicable electrical characteristics shall be as specified (see 3.1).

3.12 Stability at temperature extremes. When tested as specified in 4.7.9, filters shall meet the following requirements:

Dielectric withstanding voltage ----- Shall be as specified in 3.9.  
Electrical characteristics ----- Shall be as specified (see 3.1).

3.13 Life (at elevated ambient temperature). When filters are tested as specified in 4.7.10, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Insulation resistance -----Shall be as specified (see 3.10).
- Electrical characteristics -----Shall be as specified (see 3.1).

3.14 Temperature rise (when specified, see 3.1). When filters are tested as specified in 4.7.11, the temperature rise above the specified maximum ambient temperature (see 3.1) shall not exceed the value specified (see 3.1), and there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case.

3.15 Vibration. When filters are tested as specified in 4.7.12, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting or bulging of the case. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Electrical characteristics -----Shall be as specified (see 3.1).

3.16 Shock. When filters are tested as specified in 4.7.13, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Electrical characteristics -----Shall be as specified (see 3.1).

3.17 Thermal shock. When filters are tested as specified in 4.7.14, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case, or corrosion affecting the mechanical or electrical operation. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Insulation resistance -----Shall be as specified (see 3.10).

3.18 Immersion. When filters are tested as specified in 4.7.15, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case, or corrosion affecting the mechanical or electrical operation. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Insulation resistance -----Shall be as specified (see 3.10).

3.19 Moisture resistance. When filters are tested as specified in 4.7.16, there shall be no excessive peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating, no leakage of filling material, and no evidence of other physical damage such as cracks, bursting, or bulging of the case, or corrosion affecting the mechanical or electrical operation. Following the test, these requirements shall be met:

- Dielectric withstanding voltage -----Shall be as specified in 3.9.
- Insulation resistance -----Shall be as specified (see 3.10).

3.20 Salt atmosphere (when specified, see 3.1). When filters are tested as specified in 4.7.17, there shall be no evidence of degradation of the coating material, leakage of the potting or filling material, corrosion of metallic parts, legibility of marking, or other physical damage.

3.21 Acceleration (when specified, see 3.1). When filters are tested as specified in 4.7.18, the insertion loss shall be as specified (see 3.1).

3.22 Flammability (external flame) (grades 5, 7, and 9 only). When filters are tested as specified in 4.7.19, there shall be no evidence of violent burning which results in an explosive-type flame, and the coating material used on the filters shall be self-extinguishing. Material shall be considered self-extinguishing if the following conditions are met:

- a. The duration of visible flame shall not exceed 3 minutes after removal of the applied flame.
- b. There shall be no explosion, nor shall there be any violent burning which results in an explosive-type flame.
- c. There shall be no dripping of flaming material from the filter under test.

3.23 Resistance to solvents. When filters are tested as specified in 4.7.20, there shall be no evidence of mechanical damage and the markings shall remain legible. The paint or exterior finish shall not soften, peel, or show other signs of deterioration.

3.24 Fungus. All external materials shall be non-nutrient to fungus growth or shall be suitably treated to retard fungus growth. The manufacturer shall certify that all external materials are fungus resistant (see 4.7.21) or shall perform the test as specified in 4.7.21. There shall be no evidence of fungus growth on external surfaces.

3.25 Marking. Marking of filters shall conform to MIL-STD-1285 and shall include the part number, type designation, source code, date code, lot symbol, trademark, discrimination characteristics, terminal identification, and source and load impedance. Where lack of space prohibits the inclusion of the discrimination characteristics, the nominal center frequency shall be marked on the case for band pass and band suppression filters, and the cutoff frequency shall be marked on the case for low pass and high pass filters. Any marking of a classified nature shall not be included. The following is an example of the complete marking:

M18327/007-001	- Part number.
FR6PX22PB1	- Type designation.
12345 7133A	- Source code, date code, and lot symbol.
<u>ZZZ</u>	- Trademark.
17.4kHz-3dB MAX	- Discrimination characteristics.
IN 1-2 600Ω } OUT 3-4 600Ω }	- Terminal identification, and source and load impedance.

3.26 Workmanship. Filters shall be processed in such a manner as to be uniform in quality and shall be free from cracks, bursting of the case, leakage of filling material, or other defects that will affect life, serviceability, and appearance.

#### 4. VERIFICATION

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

- a. First article inspection (see 4.5).
- b. Conformance inspection (see 4.6).

4.2 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 contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ANSI/NCSL Z540-1, ISO 10012-1 or approved equivalent.

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

4.4 Test voltage. The test voltage shall be sufficiently free of distortion and noise to permit measurements to be made to the degree of accuracy required herein.

4.5 First article inspection. First article inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units which have been produced with equipment and procedures normally used in production.

4.5.1 Sample size. Eight filters shall be subjected to the first article inspection for complete testing. Two additional sample units shall be required for group IV if the fungus test is performed.

4.5.2 Inspection routine. Sample units shall be subjected to the inspections specified in table VI, in the order shown. All sample units shall be subjected to the inspections of group I. The samples shall then be divided as specified in table VI for groups II, III, and IV.

TABLE VI. First article inspection.

Inspection	Grades		Requirement paragraph	Test paragraph	Number of sample units to be inspected
	4, 6 8	5, 7 9			
<u>Group I</u>					
Visual and mechanical inspection (external) <u>1/</u> -----	X	X	3.1, 3.3, 3.4 to 3.4.3 incl., 3.4.5, 3.25, and 3.26	4.7.1.1	} 10
Terminal strength <u>2/</u> -----	X	X		4.7.2	
Solderability (when specified) -----	X	X		4.7.3	
Resistance to soldering heat (when specified)-----	X	X		4.7.4	
Seal -----	X	X		4.7.5	
Dielectric withstanding voltage -----	X	X		4.7.6	
Insulation resistance -----	X	X		4.7.7	
Electrical characteristics -----	X	X		4.7.8	
Stability at temperature extremes-----	X	X	4.7.9		
<u>Group II</u>					
Life (at elevated ambient temperature)- -	X	X	3.13	4.7.10	2
<u>Group III</u>					
Temperature rise (when specified) <u>1/ 3/</u>	X	X	3.14	4.7.11	} 6
Vibration-----	X	X	3.15	4.7.12	
Shock -----	X	X	3.16	4.7.13	
Thermal shock -----	X	X	3.17	4.7.14	
Immersion -----	X	X	3.18	4.7.15	
Moisture resistance <u>4/</u> -----	X	X	3.19	4.7.16	

See footnotes at end of table.

TABLE VI. First article inspection - Continued.

Inspection	Grades		Requirement paragraph	Test paragraph	Number of sample units to be inspected
	4, 6 8	5, 7 9			
<u>Group III - Continued</u>					
Salt atmosphere (when specified ) <u>4/</u>	X	X	3.20	4.7.17	} 6
Acceleration (when specified)-----	X	X	3.21	4.7.18	
Electrical characteristics -----	X	X	3.11	4.7.8	
Visual and mechanical inspection (external) <u>1/</u> -----	X	X	3.1, 3.3, 3.4 to 3.4.3 incl., 3.4.5, 3.25 and 3.26	4.7.1.1	
Resistance to solvents -----	X	X	3.23	4.7.20	
Flammability (external flame) (grades 5, 7, and 9 only) -----	---	X	3.24	4.7.19	
Visual and mechanical inspection (internal) -----	X	X	3.1, 3.3, 3.3.2, 3.4.4, and 3.26	4.7.1.2	3
<u>Group IV</u>					
Fungus <u>5/</u> -----	X	X	3.24	4.7.21	2

1/ Nondestructive tests.

2/ For grades 4, 6, and 8 the torque test is applicable only to terminals with screw threads.

3/ Two sample units only.

4/ When salt atmosphere is specified, the six sample units shall be divided into two equal groups. Each group shall be inspected, independently for moisture resistance and salt atmosphere. When these examinations are performed in the foregoing manner, separate test data shall be submitted for each group.

5/ Test shall not be performed if the manufacturer provides certification that all external materials are fungus resistant.

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

4.6 Conformance inspection.

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

4.6.1.1 Inspection lot. An inspection lot shall consist of all filters covered by a single procurement document or drawing, produced under essentially the same conditions and offered for inspection at one time.

4.6.2 Group A inspection. Group A inspection shall consist of the inspections specified in [table VII](#), in the order shown.

4.6.2.1 Sampling plan. A sample of parts shall be randomly selected in accordance with [table VIII](#). If one or more defects are found, the lot shall be 100 percent screened for those quality characteristics found defective in the sample 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.

TABLE VII. Group A inspection.

Inspection	Requirement paragraph	Test paragraph	Sampling procedure
Visual and mechanical inspection (external) -----	3.1, 3.3, 3.4 to 3.4.3 inclusive, 3.4.5, 3.25, and 3.26	4.7.1.1	See table VIII
Seal 1/ 2/ -----	3.8	4.7.5	
Dielectric withstanding voltage -----	3.9	4.7.6	
Insulation resistance -----	3.10	4.7.7	
Insertion loss (at reference frequency)---	3.11	4.7.8.2	

- 1/ The seal test may be done in group A, or at the end of group B, using the group A sample size.
- 2/ Any filter which shows evidence of leakage may be given remedial treatment if evidence is submitted to show that such remedial treatment is adequate and that all of the other filters in the lot have been given similar remedial treatment where required.

TABLE VIII. C = 0 sampling plan.

Lot size	Sample size	
	Group A	Group B
2 to 3	100 percent	100 percent
4 to 13	100 percent	3
14 to 25	13	3
26 to 50	13	5
51 to 90	13	6
91 to 150	13	7
151 to 280	20	10
281 to 500	29	11
501 to 1,200	34	15
1,201 to 3,200	42	18
3,201 to 10,000	50	22

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

TABLE IX. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Discrimination -----	3.11	4.7.8.3
Special characteristics -----	3.11	4.7.8.4
Terminal impedance (when specified) --	3.11	4.7.8.1
Stability at temperature extremes-----	3.12	4.7.9

4.6.3.1 Sampling plan. A sample of parts shall be randomly selected in accordance with table VIII. If one or more defects are found, the lot shall be 100 percent rescreened for those quality characteristics found defective in the sample and defects removed. After rescreening, 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.

4.6.3.2 Disposition of sample units. Sample units which have passed all the group B inspections may be delivered on the contract or purchase order, if the lot is accepted.

4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection.

4.7.1.1 External. Filters shall be examined to verify that the materials, external design and construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4 to 3.4.3 inclusive, 3.4.5, 3.25, and 3.26).

4.7.1.2 Internal. Filters shall be disassembled and examined to verify that the materials, internal design and construction, and workmanship are in accordance with the applicable requirements. For first article inspection, examination of filters, which are normally furnished filled, shall be performed on one additional sample unit furnished unfilled (see 3.1, 3.3, 3.3.2, 3.4.4, and 3.26).

4.7.2 Terminal strength (see 3.5). Filters shall be tested in accordance with 4.7.2.1 to 4.7.2.3 inclusive, as applicable (see 3.1). After completion of each applicable test, the tested terminal shall be examined for loosening, rupturing, and other mechanical damage.

4.7.2.1 Pull test. Filters shall be tested in accordance with method 211, MIL-STD-202. The following details shall apply:

- a. Test condition letter: A.
- b. Magnitude of applied force shall be as follows:
  - (1) Solid-wire lead terminals (other than printed circuit terminals): In accordance with table X.
  - (2) Solder terminals: In accordance with table X.
  - (3) Printed circuit and pin-type terminals: 2 pounds.

TABLE X. Pull.

Cross-sectional area of electrode at its smallest point at which lead from external circuit connects	Force
<u>Circular mils</u>	<u>Pounds</u>
≤ 2,000	2.0
> 2,000	5.0

- c. Direction and application of applied force:
  - (1) Solid-wire lead terminals (other than printed circuit terminals): The force shall be applied in the direction of the axis of termination, and gradually increased from zero pounds to the magnitude specified in table X (see 3.1).
  - (2) Solder terminals: The force shall be applied to each terminal at the point where the lead from the external circuit connects to it, and shall be gradually increased from zero pounds to the magnitude specified in table X (see 3.1).
  - (3) Printed circuit and pin-type terminals: The force shall be applied in the direction of the axis of the terminal as shown in figure 7, and shall be gradually increased from zero to 2 pounds.

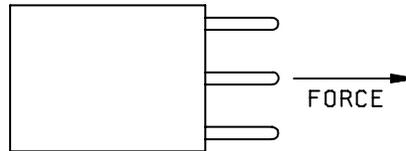


FIGURE 7. Direction of force to be applied to each pin on the unit.

4.7.2.2 Flat terminal bend test. Filters shall be tested in accordance with [method 211, MIL-STD-202](#).

- a. Test condition letter: B.
- b. Number of bending cycles: 5.

4.7.2.3 Twist test (solid-wire load terminals other than printed circuit terminals). Filters shall be tested in accordance with [method 211, MIL-STD-202](#). Terminals shall be subjected to the twist test following completion of their subjection to the pull test specified in [4.7.2.1](#).

- a. Test condition letter: D.
- b. Number of 360 degree rotations: Five (total of 1,800 angular degrees).

4.7.2.4 Torque test. Filters shall be tested in accordance with [method 211, MIL-STD-202](#), test condition E. For grades 4, 6, and 8, this test is applicable only to terminals with external screw threads.

4.7.3 Solderability (when specified, [see 3.1](#)) ([see 3.6](#)). Filters shall be tested in accordance with [method 208, MIL-STD-202](#). The following detailed requirements shall be as specified ([see 3.1](#)):

- a. The number of terminations of each filter to be tested.
- b. Special preparation of terminals, if applicable.
- c. Application of standard solderable wire (if greater than No. 18 AWG size, or solid wire greater than .045 inch diameter).
- d. Depth of immersion if other than .05 inch.
- e. Solder dip dwell time.
- f. Examination of terminations which have been subjected to the test.

4.7.4 Resistance to soldering heat (when specified, [see 3.1](#)) ([see 3.7](#)). Filters shall be tested in accordance with [method 210, MIL-STD-202](#). The following detailed requirements shall be as specified ([see 3.1](#)):

- a. Use of heat sinks.
- b. Solder terminations that are not to be tested, if applicable.
- c. Special preparation of specimens, if applicable.
- d. Immersion of terminations in flux, if applicable.

- e. Test condition letter.
- f. Depth of immersion in the molten solder (if applicable to the specified test condition).
- g. Cooling time prior to final examinations and measurements.
- h. Examinations and measurements before and after test, as applicable.
- i. Method of internal inspection, when specified ([see 3.1](#)).

4.7.5 Seal ([see 3.8](#)). Filters shall be tested in accordance with 4.7.5.1, and 4.7.5.2, when applicable. When specified ([see 3.1](#)), the alternate test specified in 4.7.5.1.1 shall be used in lieu of the test specified in 4.7.5.1.

4.7.5.1 All filters. Filters shall be immersed for 2 to 3 minutes in a bath of water or any other suitable liquid of no greater density, and maintained at a temperature of at least 85°C. The temperature of the filter shall not exceed 40°C at the time of immersion.

4.7.5.1.1 Alternate test. When specified ([see 3.1](#)), the filters shall be immersed in a container of water containing approximately 1 percent aerosol which shall then be placed in a vacuum chamber. A vacuum resulting in an absolute pressure not greater than 3.4 inches of mercury shall be drawn over the bath and held for a minimum of 3 minutes.

4.7.5.2 Liquid-filled filters. Grade 4 liquid-filled filters shall be heated in an oven for not less than 3 hours for filters weighing 20 pounds or less, and for not less than 6 hours for filters weighing over 20 pounds.

4.7.5.2.1 Oven temperature. The oven shall be maintained at a temperature equal to or greater than the sum of the specified maximum ambient temperature and the allowable temperature rise for the class ([see 3.1](#)).

4.7.6 Dielectric withstanding voltage ([see 3.9](#)). Filters shall be tested in accordance with [method 301, MIL-STD-202](#). The following details shall apply:

- a. Magnitude of test voltage.
  - (1) Initial test: As specified ([see 3.1](#)).
  - (2) Tests subsequent to initial test: 90 percent of initial test voltage.
- b. Nature of potential: Alternating current (ac).
- c. Duration of application of test voltage.
  - (1) Initial test: 60 seconds.
  - (2) Tests subsequent to initial test: 5 seconds.
- d. Points of application of test voltage: As specified ([see 3.1](#)).
- e. Examinations after dielectric withstanding voltage test: Filters shall be examined for evidence of arcing, flashover, breakdown of insulation, and damage.

4.7.7 Insulation resistance ([see 3.10](#)). Filters shall be tested in accordance with [method 302, MIL-STD-202](#). The following details shall apply:

- a. Test condition letter: A, unless otherwise specified ([see 3.1](#)).
- b. Points of measurement: Between the terminals and mountings or terminals and case.

4.7.8 Electrical characteristics (see 3.11). The electrical characteristics specified shall be determined with rated voltage applied over the specified frequency range with the specified source and load impedance (see 3.1). Insertion loss and discrimination characteristics shall be included for all filters. Special characteristics, such as impedance, phase shift in the pass band, special stability, transient response, harmonic and intermodulation distortion limits, and reflection coefficient and return loss shall be measured, when specified (see 3.1).

4.7.8.1 Terminal impedance (when specified, see 3.1). Terminal input impedance shall be measured with a rated load connected across the output terminals of the filter. Terminal output impedance shall be measured with a rated source impedance connected across the input terminals of the filter. Impedances including vector angles shall be measured at the specified frequencies (see 3.1) by a bridge or equivalent method approved by the Government.

4.7.8.2 Insertion loss (see 6.5.4) (at reference frequency). The reference frequency and the source and load impedances shall be as specified (see 3.1). With a constant input voltage,  $E_g$ , across the generator, the load voltage, with and without the filter in the circuit, shall be recorded at the reference frequency. The insertion loss, in decibels, shall be calculated using the following formula:

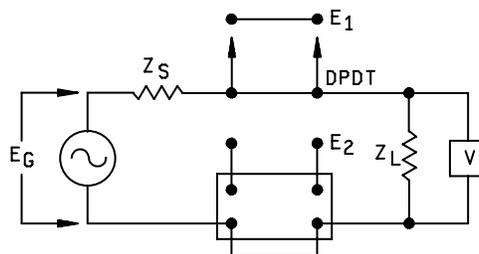
$$IL_{fr} = 20 \log \frac{E_1}{E_2} \text{ dB, } E_1 > E_2.$$

Where:

- $IL_{fr}$  = Insertion loss at reference frequency in decibels, with  $E_g$  constant.
- $E_1$  = The load voltage with the filters not in the circuit at the reference frequency.
- $E_2$  = The load voltage with the filters in the circuit at the reference frequency.
- $E_1 > E_2$ .

A typical test circuit is shown in figure 8.

4.7.8.3 Discrimination. Insertion loss at frequencies other than the reference frequency shall be measured using a test circuit such as that shown on figure 8. Measurements shall be made at frequencies or over frequency bands, as specified (see 3.1). The algebraic difference between the insertion loss at a specified frequency and the insertion loss at the reference frequency, shall be defined as the discrimination ( $\alpha$ ) at the specified frequency.



- $Z_S$  = Source impedance.
- $Z_L$  = Load impedance.
- $E_G$  = Constant voltage across generator.
- $E_1$  = The load voltage with the filter not in the circuit at the reference frequency.
- $E_2$  = The load voltage with the filter in the circuit at the same frequency.

FIGURE 8. Typical measurement circuit for insertion loss and discrimination.

4.7.8.4 Special characteristics. Special characteristics shall be measured as specified (see 3.1).

4.7.9 Stability at temperature extremes (see 3.12). Filters shall be exposed to a temperature of  $-55^{\circ}\text{C}$   $+0^{\circ}$ ,  $-3^{\circ}\text{C}$  for the minimum number of hours specified in table XI (see 3.1). At the end of this exposure period and while the filters are at this temperature, the electrical characteristics (see 3.1) shall be measured as specified in 4.7.8. The filters shall then be exposed at the maximum operating temperature for the class,  $+3^{\circ}$   $-0^{\circ}\text{C}$ , for the minimum number of hours specified in table XI (see 3.1). At the end of this exposure period and while the filters are at this temperature, the electrical characteristics (see 3.1) shall again be measured as specified in 4.7.8. The filters shall then be subjected to the dielectric withstanding voltage test specified in 4.7.6.

TABLE XI. Exposure time at temperature extremes.

Weight of filter	Minimum time
Pounds	Hours
0.3 and below	1
Above 0.3 to 3 inclusive	2
Above 3 to 30 inclusive	4
Above 30 to 50 inclusive	8

4.7.10 Life (at elevated ambient temperature) (see 3.13). Filters shall be tested in accordance with method 108, MIL-STD-202. The following details and exceptions shall apply:

- a. Distance of temperature measurements from specimens: 6 inches.
- b. Test temperature and tolerance: Maximum operating temperature for the class.  
Tolerance shall be  $+10^{\circ}$ ,  $-5^{\circ}\text{C}$ .
- c. Operating conditions: Rated voltage at the reference frequency operating into the rated source and load impedances.
  - (1) Composition 1 filters (see 1.2.1.7) which dissipate less than 0.1 watt average output need not be subjected to the foregoing phase of the life test.
  - (2) DC operating voltages or requirements shall be applied as specified (see 3.1).
- d. Test condition letter (see 1.2.1.4):
  - (1) F: For filters with life expectancy X.
  - (2) D: For filters with life expectancy Y.
- e. Measurement after exposure: Dielectric withstanding voltage, insulation resistance, and electrical characteristics shall be measured as specified in 4.7.6, 4.7.7, and 4.7.8, respectively. Filters shall then be examined externally and internally for evidence of leakage and physical damage. Before measurements, all units shall be removed from the test chamber and stabilized at room temperature.

4.7.11 Temperature rise (when specified, see 3.1) (see 3.14). Filters rated at more than 0.8 watt average output shall be tested using one or more thermocouples, as required, attached to the outside of the filter. Rated voltage (see 3.1) shall be applied to the filter for a sufficient period until two consecutive thermocouple measurements, taken 30 minutes apart, are the same. The temperature rise shall be the difference between the temperature obtained and the ambient temperature existing at this time. The filters shall then be examined for evidence of leakage and physical damage.

4.7.12 Vibration (see 3.15). Filters shall be tested in accordance with 4.7.12.1 or 4.7.12.2, as specified (see 3.1).

4.7.12.1 Vibration (grades 4 and 5). Filters shall be tested in accordance with [method 201, MIL-STD-202](#). The following details shall apply:

- a. Tests and measurements prior to vibration: Not applicable.
- b. Method of mounting: Filters shall be rigidly mounted by their normal mounting means.
- c. Electrical load as specified (see 3.1).
- d. Tests and measurements after vibration: Dielectric withstanding voltage and electrical characteristics shall be measured as specified in 4.7.6 and 4.7.8, respectively. Filters shall then be examined for evidence of leakage and physical damage.

4.7.12.2 Vibration, high frequency (grades 6, 7, 8, and 9). Filters shall be tested in accordance with [method 204, MIL-STD-202](#). The following details shall apply:

- a. Method of mounting: Filters shall be rigidly mounted by their normal mounting means.
- b. Electrical load: As specified (see 3.1).
- c. Test condition letter:
  - (1) A: For grades 8 and 9.
  - (2) B: For grades 6 and 7.
- d. Measurements after test: Dielectric withstanding voltage and electrical characteristics shall be measured as specified in 4.7.6 and 4.7.8, respectively. Filters shall then be examined for evidence of leakage and physical damage.

4.7.13 Shock (see 3.16). Filters shall be tested in accordance with 4.7.13.1 or 4.7.13.2, as specified (see 3.1).

4.7.13.1 Shock (specified pulse). Filters shall be tested in accordance with [method 213, MIL-STD-202](#). The following details and exceptions shall apply:

- a. Mounting: By normal means.
- b. Test condition letter: I.
- c. Measurements after shock: Dielectric withstanding voltage and electrical characteristics shall be measured as specified in 4.7.6 and 4.7.8, respectively. Filters shall then be examined for evidence of leakage and physical damage.

4.7.13.2 High-impact shock (when specified, see 3.1). Filters shall be tested in accordance with [method 207, MIL-STD-202](#). The following details shall apply:

- a. Mounting fixture: Figure 207-5 of method 207.
- b. Measurements after test: Dielectric withstanding voltage and electrical characteristics shall be measured as specified in 4.7.6 and 4.7.8, respectively. Filters shall then be examined for evidence of leakage and physical damage.

4.7.14 Thermal shock (see 3.17). Filters shall be tested in accordance with [method 107, MIL-STD-202](#). the following details and exceptions shall apply:

- a. Test condition letter: A, except that step 3 shall be at the maximum operating temperature for the class (see 6.4).
- b. Measurements after cycling: Filters shall be subjected to the dielectric withstanding voltage and insulation resistance tests as specified in 4.7.6 and 4.7.7, respectively, and shall then be examined for evidence of leakage and physical damage.

4.7.15 Immersion (see 3.18). Filters shall be tested in accordance with [method 104, MIL-STD-202](#). The following details and exceptions shall apply:

- a. Test condition letter:
  - (1) A: For grades 5, 7, and 9.
  - (2) B: For grades 4, 6, and 8.
- b. Measurements after final cycle: Filters shall be washed under running tap water and dried. After the drying period, filters shall be subjected to the dielectric withstanding voltage and insulation resistance tests specified in 4.7.6 and 4.7.7, respectively, and shall then be examined for evidence of leakage and physical damage.

4.7.16 Moisture resistance (see 3.19). Filters shall be tested in accordance with [method 106, MIL-STD-202](#). The following details and exceptions shall apply:

- a. Conditioning: For grades 4, 6, and 8 filters, the 24-hour initial drying period prior to the first cycle may be omitted.
- b. Initial measurements: Not applicable.
- c. Polarization voltage: Unless otherwise specified (see 3.1), polarization is applicable. The polarizing voltage shall be applied during steps 1 to 6 inclusive, between all ungrounded terminals and the mounting means. The polarizing voltage shall be positive with respect to the mounting means.
- d. Loading voltage: Not applicable.
- e. Final measurements: Upon completion of step 6 of the final cycle, the filters shall be removed from the humidity chamber and shall be conditioned for 4 to 24 hours at the inspection conditions specified in 4.3. After this conditioning period, the filters shall be subjected to the dielectric withstanding voltage and insulation resistance tests specified in 4.7.6 and 4.7.7, respectively, and shall then be examined for evidence of leakage and physical damage.

4.7.17 Salt atmosphere (when specified, see 3.1) (see 3.20). Filters shall be tested in accordance with [method 101, MIL-STD-202](#). The following detailed requirements shall be as specified (see 3.1).

- a. Special mounting, if applicable.
- b. Test condition letter, as specified, see 3.1.
- c. Measurements after exposure.

4.7.18 Acceleration (when specified, see 3.1) (see 3.21). Filters shall be tested in accordance with [method 212, MIL-STD-202](#). The following detailed requirements shall be as specified ([see 3.1](#)).

- a. Special mounting, if applicable.
- b. Electrical loading, if applicable.
- c. Test condition letter ([see 3.1](#)):
  - (1) If test condition A is specified, the value of "g" ([see 3.1](#)).
  - (2) If test condition B is specified, the directions of application of acceleration and value of "g" ([see 3.1](#)).
  - (3) If test condition C is specified, the value of acceleration ([see 3.1](#)).
- d. Measurements during and after test shall be as specified ([see 3.1](#)).

4.7.19 Flammability (external flame) (grades 5, 7, and 9 only) (see 3.22). Filters whose displaced volume is greater than 0.3 cubic inch, shall be tested in accordance with [method 111, MIL-STD-202](#). The following details shall apply:

- a. Point of impingement of applied flame: One of the lower free corners of the filter, so that the flame is just in contact with the filter. The free corners of the filter are those corners which are the greatest distance from the mounting studs or brackets.
- b. Allowable time for burning of visible flame on specimen: 3 minutes.
- c. Measurements during and after test: Filters shall be observed for explosion, violent burning which results in an explosive type flame, or dripping of flaming material.

4.7.20 Resistance to solvents (see 3.23). Filters shall be tested in accordance with [method 215, MIL-STD-202](#). The following details shall apply:

- a. The marked portion of the filter shall be brushed.
- b. Filters shall be examined for mechanical damage.

4.7.21 Fungus (see 3.24). Unless certification is provided, filters shall be tested in accordance with [method 508 of MIL-STD-810](#). Filters shall be examined for evidence of fungus.

## 5. PACKAGING

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

## 6. NOTES

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

6.1 Intended use. The filters covered by this general specification are intended for use as passive frequency-selective networks such as low pass, high pass, band pass, band suppression, dual functioning (or any combination thereof) in military systems operating under separate or a combination of demanding environments.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification, the applicable procurement document or drawing and the complete PIN (see 3.1).
- b. Packaging requirements (see 5.1).
- c. Whether first article inspection is required (see 3.2 and 6.3).

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, or, a standard production item from the contractor's current inventory (see 3.2), and the number of items to be tested as specified in 4.5. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.4 Maximum operating temperature. The maximum operating temperature is defined as the maximum ambient temperature plus temperature rise; however, since generally the temperature rise of filters is negligible, the maximum operating temperature and maximum ambient temperature in most cases are the same.

6.5 Definitions, electrical parameters. Definitions have been restricted to the terms used in this specification.

6.5.1 Source impedance. Source impedance is the impedance of the circuit from which the filter is driven.

6.5.2 Load impedance. Load impedance is the impedance presented by the load.

6.5.3 Reference frequency. Reference frequency is the frequency at which insertion loss is measured and to which all discrimination measurements are referred.

6.5.4 Insertion loss. Insertion loss resulting from the insertion of a filter in a transmission system is the ratio of the voltage delivered before the insertion to that part of the system following the filter, to the voltage delivered to the same part after the insertion at the reference frequency.

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

6.7. Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmentally Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals is available on their website at <http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm>. Further information is available at the following EPA site: <http://www.epa.gov/epaoswer/hazwaste/minimize/>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of the materials on the list should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.8 Subject term (key word) listing.

Insertion loss  
Discrimination

MIL-F-18327F

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

Custodians:

Army – ER  
Navy – EC  
Air Force – 85  
DLA-CC

Preparing activity:  
DLA-CC

(Project 5915-2006-001)

Review activities:

Army – AR, MI  
Navy – AS, MC, OS  
Air Force – 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using ASSIST Online database at <http://assist.daps.dla.mil>.