WEMS Electronics



Discrete and Multi-Circuit Filters

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WEMS Electronics

Company Overview

Established in 1959, WEMS Electronics is a full service turn-key Veteran-Owned Small Business (VOSB) with an extensive AS9100:D / ISO 9001:2015 registered complex specializing in state-of-the-art EMI custom filters, engineering and manufacturing services. We are one of the few companies that offer a completely integrated approach to the design and fabrication of precision electronic components, assemblies and subsystems. In addition, our EMI/RFI filter division manufactures high reliability multi-circuit & discreet feed-through (F/T) input, output, power and signal line filters for military, aerospace, space, and commercial applications.

Our EMI filter division specializes in engineering services and includes:

- EMI Filter Design
- EMI Filter Circuit Analysis
- EMI Filter & Power Magnetics Design
- Magnetics Analysis
- EMI Filter Circuit Lay-Out and Packaging
- EMI Filter Source / Specification Control Drawings
- Acceptance Test Procedures
- Qualification Test Procedures
- Base Line Documentation



For practical reasons, it is impossible to include in our capability brochures all the designs we have created. However, WEMS specializes in developing unique filters, electronic assemblies & systems for nonstandard applications. We are ready to solve your most challenging requirements and would welcome any opportunity to demonstrate our expertise on your new & upgrade program requirements.

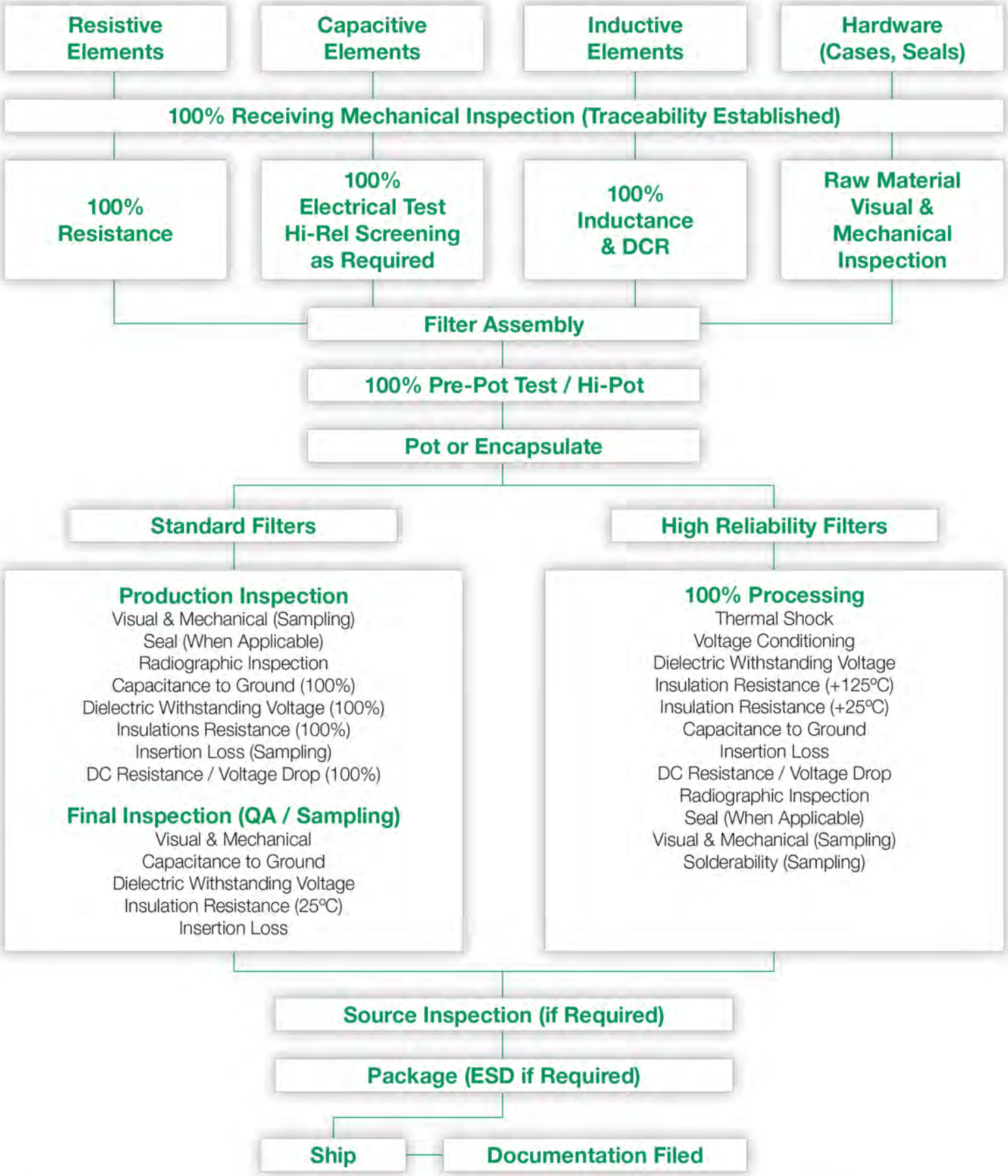
WEMS is committed to providing a wide range of state-of-the-art engineering and innovative manufacturing services and high quality products delivered on time with superior value while always conducting our business in a responsible and ethical manner. We pledge to our customers and to each other that we will continually improve our level of customer satisfaction through our commitment to excellence.



DESCRIPTION						PAGE
Filter Process Protocol						2
Filter Test Protocol						3
Filter Design Information						4-6
SERIES	FILTER TYPE	CIRCUIT TYPE	MAXIMUM VOLTAGE		MAX CURRENT	PAGE
			DC	AC		
CF6-00X	Feed Thru Capacitor Filters-Bolt Style Epoxy Sealed	C	200	–	5	7
CF7-00X			200	–	10	8
CF9-00X			200	125, 400 Hz	10	9
CF12-00X	Feed Thru Capacitor Filters-Solder-In Style Hermetically Sealed		200	–	10	10-11
FA-5XX-MXX	Feed Thru Capacitor Filters-General Purpose-Epoxy & Hermetic Sealed		200	125, 400 Hz	15	12-13
CF6-00X	Low Pass Filters-Bolt Style Epoxy Sealed	L	200	–	5	7
CF7-00X		Pi	200	–	5	8
CF9-00X		Pi	200	–	5	9
CF12-00X	Low Pass Filters-Solder-In Style Hermetically Sealed	L	200	–	5	10-11
Mini Filter Part Numbering System						14
FA-103-XAA	Low Pass Filters High Performance Hermetically Sealed		50	–	15	15
FA-113-XAA			100	–	15	16
FA-123-XAA			200	125, 400 Hz	15	17
FA-116-XAA			100	–	15	18
FA-126-XAA			200	125, 400 Hz	15	18
FA-103-MAX	Low Pass Filters General Purpose Hermetic & Epoxy Sealed		50	–	15	19
FA-303-XAA	Low Pass Filters High Performance Hermetically Sealed	Pi	50	–	15	20
FA-313-XAA			100	–	15	21
FA-323-XAA			200	125, 400 Hz	15	22
FA-316-XAA			100	–	15	23
FA-326-XAA			200	125, 400 Hz	15	23
FA-403-XAA	Low Pass Filters High Performance Hermetically Sealed	T	50	–	15	24
FA-413-XAA			100	–	15	25
FA-423-XAA			200	125, 400 Hz	15	26
F5000-X	Low Pass Filters General Purpose High Current Hermetically Sealed	Pi	–	250, 50/60 Hz	50	27
F5500-X			–	440, 50/60 Hz	50	28
WCFXXXXX	High Performance RFI Power Line Filters	Pi	600	250, 5/60 HJz	100	29-32
Multi-Circuit Filters						33-37

Filter Process Protocol

The following flow chart is the protocol of the many inspections and tests required in the manufacture of WEMS standard filters and high reliability filters.



Standard Filters

The test listing below is the test protocol for the WEMS Standard Filters using MIL-PRF-15733, Group A as a guide.

TESTS 100% INSPECTION	METHODS		TEST REQUIREMENTS
	MIL-PRF-15733	MIL-STD-202	
Visual & Mechanical (Sampling)	4.6.1	–	Materials, design, construction, dimensions, marking & workmanship
Seal (When Applicable)	4.6.2	112	Test Condition A or D
Radiographic Inspection	–	209	Two views normal to the major axis (90° apart)
Capacitance To Ground	4.6.3	305	@ 1000±Hz with 0.1 to 1.2 Vrms applied
Dielectric Withstanding Voltage	4.6.5	301	DC rated filters-> 2.5 x rated voltage DC /AC rated filters- 2.5 x rated voltage AC rated only- 2.8 x rated AC voltage
Insulation Resistance (+25°C)	4.6.7	302	100 VDC or rated DC voltage, whichever is less
Insertion Loss	4.6.9	MIL-STD-220	Full load over the frequency range of 150 kHz to 20 MHz No load above 20 MHz
DC Resistance	–	303	Test is optional if DC Voltage Drop is performed
AC Voltage Drop	4.6.8.1	–	See MIL-PRF-15733 for voltage drop tests
DC Voltage Drop	4.6.8.2	–	

High Reliability Filters

The test listing below is the test protocol for the WEMS High Reliability Filters using MIL-PRF-28861, Group A as a guide. MIL-PRF-28861 Class S and Class B testing is available upon request.

TESTS 100% INSPECTION	METHODS		TEST REQUIREMENTS
	MIL-PRF-28861	MIL-STD-202	
Thermal Shock	4.6.2.1	107	Test condition A except in step 3 test units at +125°C
Voltage Conditioning (Burn-In)	4.6.2.2	108	DC rated - 164 ± 4 hrs at 2 x rated voltage at +125°C AC / DC or AC only - 164 ± 4 hrs at 1.2 x rated rms voltage at +125°C
Dielectric Withstanding Voltage	4.6.3	301	DC rated filters-> 2.5 x rated voltage DC /AC rated filters- 2.5 x rated voltage AC rated only- 2.8 x rated AC voltage
Insulation Resistance (+125°C)	4.6.13.2	302	The value at +125°C will be 10% of specified value at +25°C 100 VDC or rated DC voltage, whichever is less
Insulation Resistance (+25°C)	4.6.13.1	302	The value shall be IAW the applicable specification sheets 100 VDC or rated DC voltage, whichever is less
Capacitance To Ground	4.6.4	305	@ 1000±Hz with 0.1 to 1.2 Vrms applied
Insertion Loss	4.6.5	MIL-STD-220	Full load over the frequency range of 150 kHz to 20 MHz No load above 20 MHz
DC Resistance	4.6.7	303	Test is optional if DC Voltage Drop is performed
AC Voltage Drop	4.6.6.1	–	See MIL-PRF-15733 for voltage drop tests
DC Voltage Drop	4.6.6.2	–	
Radiographic Inspection	4.6.8	209	Two views normal to the major axis (90° apart)
Seal (When Applicable)	4.6.9	112	Test Condition A or D
Visual & Mechanical (Sampling)	4.6.1	–	Materials, design, construction, dimensions, marking & workmanship
Solderability (Sampling)	4.6.25.1	208	Two terminations tested

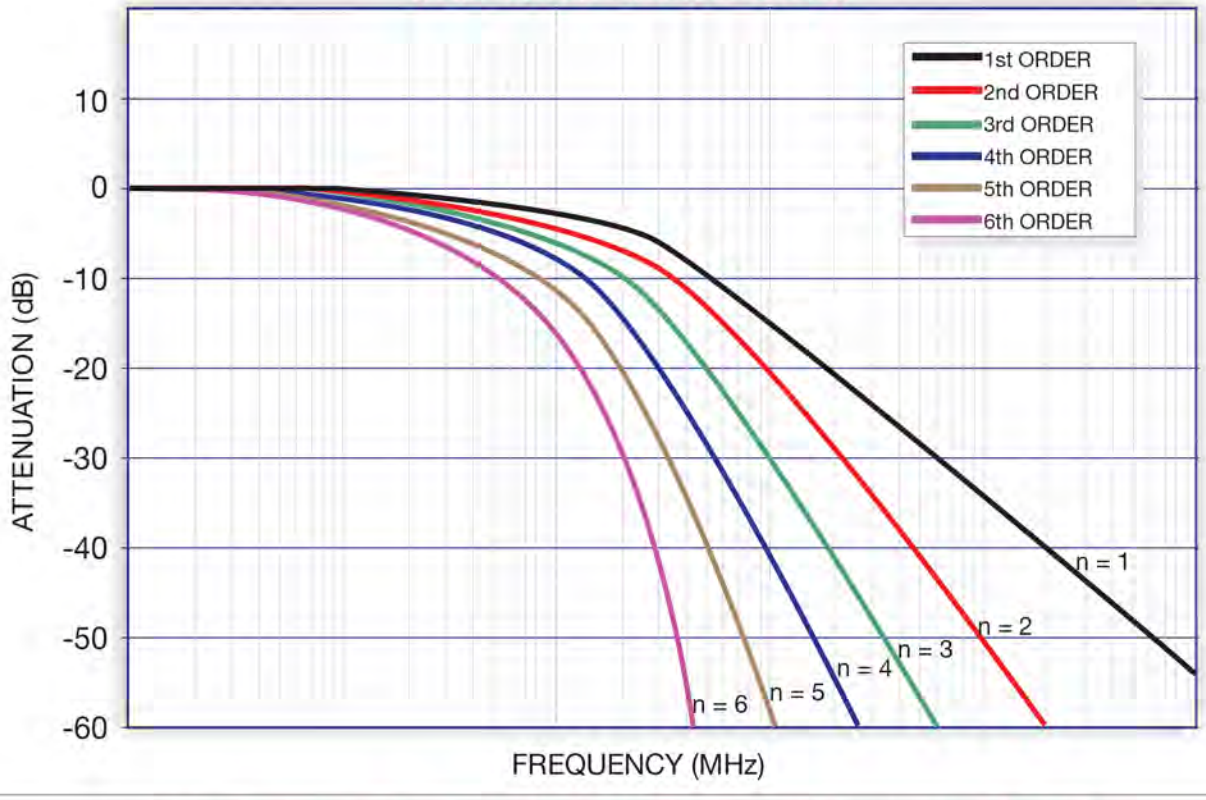
EMI Filter Circuits

The following is a brief description of the most popular types of EMI Filter circuits and their application.It should be pointed out that these are only general guidelines due to the fact that most impedance conditions and EMI profiles are dynamic, complex, and change with frequency.

- **C Circuit Feedthrough Capacitor, 1st Order:** A single element shunt feedthrough capacitor has attenuation characteristics that increases at a rate of 20 dB per decade. A feedthrough capacitor filter is usually the best choice for filtering lines that exhibit very high source and load impedances.
- **L-Circuit Filter, 2nd Order:** A two element network consisting of a series inductive component connected to a shunt feedthrough capacitor. This type of filter network has attenuation characteristics that increases at a rate of 40 dB per decade. An "L" circuit filter is best suited for filtering lines when the source and load impedances exhibit large differences. For most applications this type of network provides the greatest performance when the inductor is facing the lower of the two impedances.
- **PI-Circuit Filter, 3rd Order:** This is a three element filter consisting of two shunt feedthrough capacitors with a series inductive component connected between them. This three element filter has attenuation characteristics that increases at a rate of 60 dB per decade. A "PI" circuit filter is usually the best choice when high levels of attenuation are required and when the source and load impedances are of similar values and relatively high.
- **T-Circuit Filter, 3rd Order:** This also is a three element filter consisting of two inductive components with a single shunt feedthrough capacitors connected between them. Like the "PI" circuit filter, this device has attenuation characteristics that also increase at a rate of 60 dB per decade. A "T" circuit filter is the best choice when high levels of attenuation are required and when the source and load impedances are of similar values and relatively low.
- **Double Circuits, 4th, 5th, 6th Orders:** Double circuits consisting of four, five, and six elements are best suited when extremely high levels of attenuation are required. Double "L's" have a theoretical attenuation of 80 dB per decade, while double "PI's" and double "T's" have a theoretical attenuation of 100 dB per decade. The source and load impedance conditions that apply to the single circuit devices apply to the double circuit filters.

Low Pass Filter Frequency Response

(1st, 2nd, 3rd, 4th, 5th, 6th Orders)



Filter Installation Guides

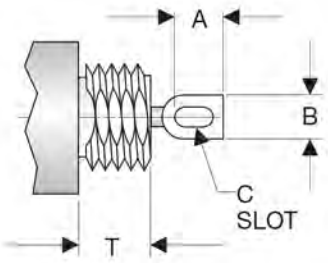
Cylindrical Style Working Practices

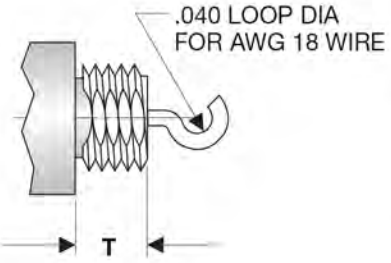
- Observe the recommended torque requirements for the specific thread size; 1/4-28 UNF-2A require 44±4 oz-in. and 5/16-24-UNF-2A require 60±4 oz-in.
- Avoid mechanical stress on the filter body. Pliers or other tools capable of excessive pressure on the case must be avoided in all instances. The pressure is capable of cracking the internal ceramic capacitor and/or the glass seals on the terminals.
- Filters are capable of withstanding temperature extremes but care should be observed to avoid rapid heat up and cool down as this can crack the internal ceramic capacitor.
  - Pre-heating the filter prior to soldering is recommended whenever possible.
  - Recommended pre-heat: +120°C ±5°C, for 15/20 minutes.
  - Forced air cool down post soldering is not recommended.
- Soldering techniques:
  - Use a heat sink between the filter body and the point of soldering whenever possible.
  - Use a temperature controlled soldering iron with a tip temperature of +325°C ±25°C.
  - Use of an 25-40 watt soldering iron is recommended, the use of a larger wattage iron may cause the high temperature solder used in the inside diameter of the terminal tubelet to reflow defeating the hermetic seal and possibly cause heat related damage the ceramic capacitor (thermal fractures).
  - Use 60/40 or SN 63 RMA flux core solder.
  - Solder iron tip to point of contact on the terminal flag should be limited to 5-10 seconds when soldering wire to the terminal. Excessive contact may possibly reflow the high temperature solder at the tubelet and damage the hermetic seal.
  - **Use caution when soldering wire to the terminal flag. Assure that the correct wire size is specified for the flag terminal slot. Forcing a size wire through the terminal slot that is larger than the slot may cause undue mechanical stress on the terminal and may crack the glass seal. This may also transmit stress to the ceramic capacitor causing micro-fractures.**

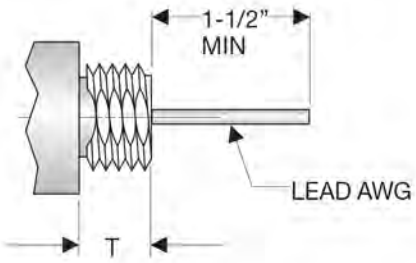
Solder-In Style WorkingPractices

- Soldering techniques:
  - Pre-Heat unit to +150°C prior to installation
  - Increase soldering temperature at a rate of 2°C-3°C / second until solder temperature, 300°C max., is achieved.
  - The maximum time at solder temperature is 30 seconds;
    - If lead length permits a heat sink clip is recommended.
    - A 15 to 20 watt iron is recommended with an iron tip temperature of 238°C max. and do not apply heat longer than 30 seconds.
    - 60/40 solder is recommended.
  - Avoid mechanical stress on the filter leads;
    - The stress is capable of cracking the glass and damaging the internal discoidal capacitor element.

Mechanical and Hardware Information







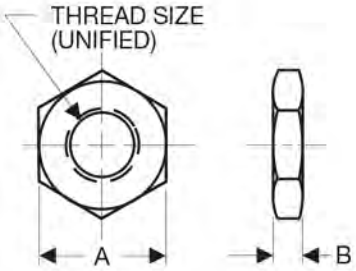
THREAD SIZE	TERMINAL AND HEADER DETAIL			
	A	B	C	T
1/4-28	.095 ±.005	.105 ±.005	.055 x .075	.190 ±.005
				.312 ±.005
5/16-24	.140 ±.005	.115 ±.005	.062 x .125	.190 ±.005
				.312 ±.005

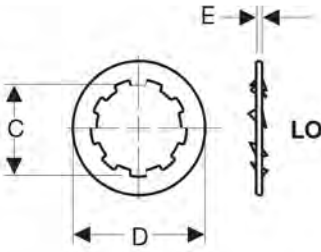
* LEAD AWG	
UP TO 5 AMPS	AWG 24
10 AMPS	AWG 22
15 AMPS	AWG 19

*Other lead gages available upon request.

THREAD SIZE	RECOMMENDED TORQUE
#4-40 UNC-2A	32 ± 4 oz-in
#8-32 UNC-2A	64 ± 4 oz-in
#12-32 UNEF-2A	64 ± 4 oz-in
1/4-28 UNF-2A	44 ± 4 oz-in
5/16-24 UNF-2A	64 ± 4 oz-in

HEX NUT





LOCKWASHER

THREAD SIZE	A	B	C	D	E
#4-40 UNC-2A	.185/.175	.067/.057	.123/.116	.225/.215	.020/.010
#8-32 UNC-2A	.260/.240	.073/.063	.169/.165	.288/.278	.023/.013
#12-32 UNEF-2A	.260/.240	.073/.063	.231/.221	.406/.394	.027/.017
1/4-28 UNF-2A	.332/.302	.098/.088	.267/.256	.408/.396	.022/.012
5/16-24 UNF-2A	.448/.428	.135/.115	.324/.314	.435/.425	.027/.017
5/8-24 UNEF-2A	.740/.760	.135/.115	.659/.640	1.07/1.05	.040/.050
3/4-20 UNEF-2A	1.05/1.07	.135/.115	.769/.795	1.22/1.25	.045/.055
1 1/8-18 UNEF-2A	1.68/1.63	.184/.190	1.17/1.14	1.83/1.80	.057/.067

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC, 100 VDC, 200 VDC

Rated Current:
5 Amperes maximum

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with rated DC voltage, 100 megohm-microfarad or 100,000 megohms minimum, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

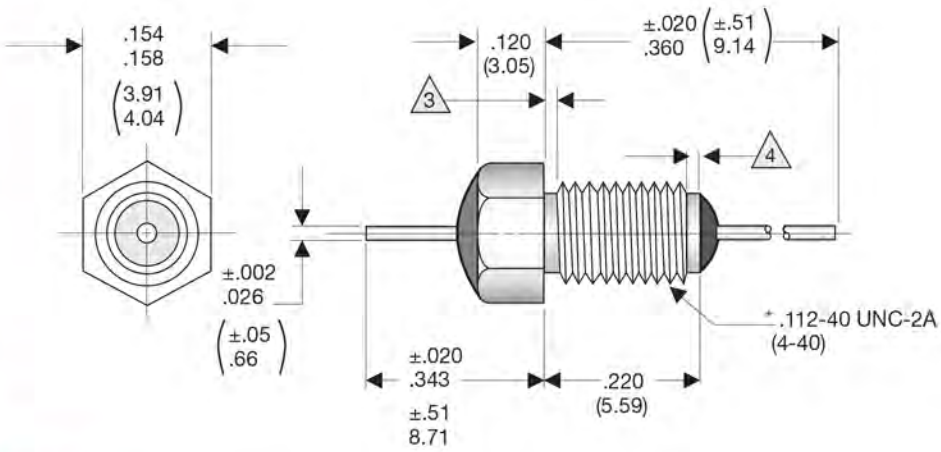
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Non Hermetically Sealed) and Hardware:
Electro-tin-lead plated or hot solder dipped, and can be supplied with silver or high purity gold plating.

Marking:

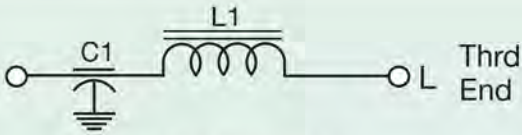
LOGO	PART NUMBER			DATE CODE	
W	CF	XX	XX	XX	XX

4-40 Thread Epoxy Sealed (DC Applications)

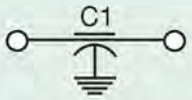


Notes:

1. Dimensions are inches (mm in parantheses).
2. *All units supplied with internal tooth lockwasher and hex nut, dimensions on page 6.
3. Imperfect thread or .030 inch maximum undercut optional.
4. One imperfect thread allowed, .030 inches maximum.
5. Recommended mounting torque 36 oz-in maximum.
6. Potting shall not extend beyond .030 inches from body.
7. Tolerance: ± .010 (±.254 mm) unless otherwise specified.
8. Alternate capacitance values and various mechanical configurations available upon request.



"L" Type Network



"C" Type Network

PART NUMBER	CAPACITANCE µF +100%, - 0%	CIRCUIT	WORKING VOLTAGE DC VOLTS	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]					
				1. MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
CF 6-001	0.075	L	50	18	37	52	64	70	70
CF 6-003	0.027	L	100	10	30	50	54	70	70
CF 6-004	0.050	L	100	15	38	54	60	70	70
CF 6-008	0.010	L	200	4	21	35	42	64	70
CF 6-002	0.027	C	100	10	30	39	45	65	70
CF 6-005	1,000 pF	C	200	–	4	20	25	50	55
CF 6-006	5,000 pF	C	200	–	15	34	41	50	55
CF 6-007	0.010	C	200	4	21	35	42	65	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC, 100 VDC, 200 VDC

Rated Current:
10 Amperes maximum

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with rated DC voltage, 100 megohm-microfarad or 100,000 megohms minimum, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

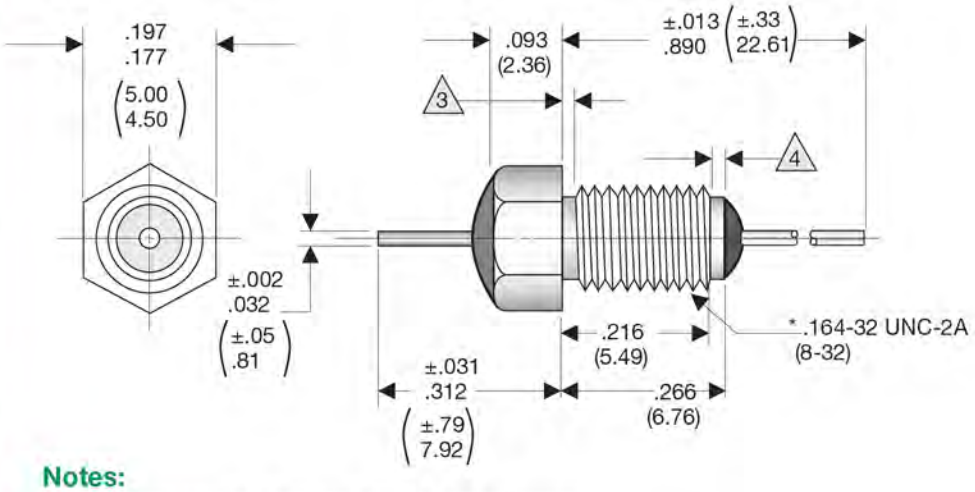
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Non Hermetically Sealed) and Hardware:
Electro-tin-lead plated or hot solder dipped, and can be supplied with silver or high purity gold plating.

Marking:

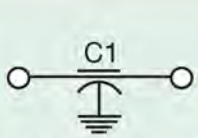
LOGO	PART NUMBER			DATE CODE	
W	CF	XX	XX	XX	XX

8-32 Thread Epoxy Sealed (DC Applications)

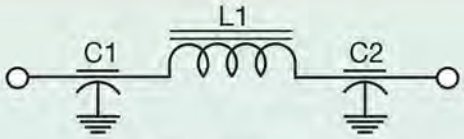


Notes:

1. Dimensions are inches (mm in parantheses).
2. *All units supplied with internal tooth lockwasher and hex nut, dimensions on page 6.
3. Imperfect thread or .040 inch maximum undercut optional.
4. One imperfect thread allowed, .040 inches maximum.
5. Recommended mounting torque 68 oz-in maximum.
6. Potting shall not extend beyond .030 inches from body.
7. Tolerance: ± .010 (±.254 mm) unless otherwise specified.
8. Alternate capacitance values and various mechanical configurations available upon request.



"C" Type Network



π Type Network

PART NUMBER	CAPACITANCE µF +100%, - 0%	CIRCUIT	WORKING VOLTAGE DC VOLTS	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]					
				1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
CF 7-001	0.050	C	50	15	35	42	50	70	70
CF 7-003	0.010	C	100	4	21	35	40	55	60
CF 7-005	0.027	C	100	10	30	39	45	65	70
CF 7-006	1000 pF	C	200	–	4	20	25	40	50
CF 7-008	5000 pF	C	200	–	15	34	41	45	50
CF 7-002	0.050	π	50	20	35	68	70	70	70
CF 7-004	0.015	π	100	–	12	60	70	70	70
CF 7-007	2000 pF	π	200	–	8	42	58	70	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC, 100 VDC, 200 VDC, 125 VAC, 400Hz

Rated Current:
10 Amperes maximum

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with rated DC voltage, 100 megohm-microfarad or 100,000 megohms minimum, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

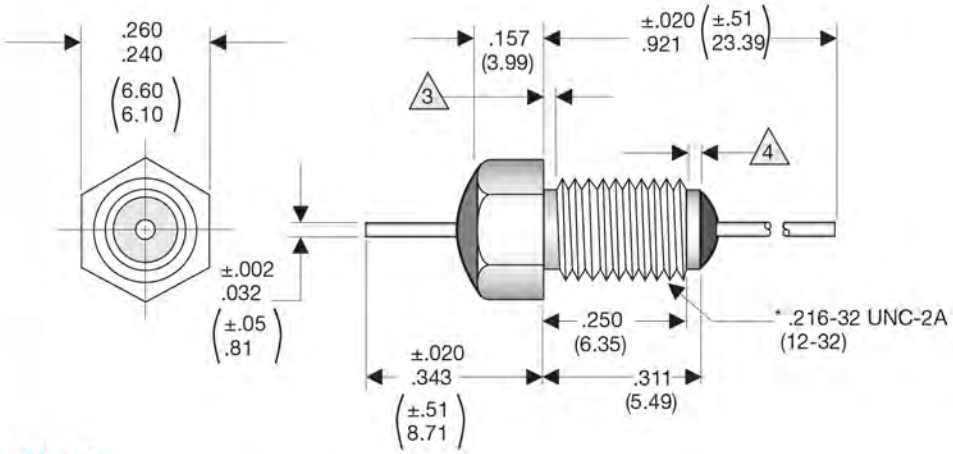
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Non Hermetically Sealed) and Hardware:
Electro-tin-lead plated or hot solder dipped, and can be supplied with silver or high purity gold plating.

Marking:

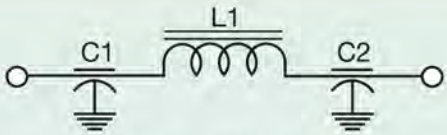
LOGO	PART NUMBER			DATE CODE	
W	CF	XX	XX	XX	XX

12-32 Thread Epoxy Sealed (AC/DC Applications)



Notes:

1. Dimensions are inches (mm in parantheses).
2. *All units supplied with internal tooth lockwasher and hex nut, dimensions on page 6.
3. Imperfect thread or .040 inch maximum undercut optional.
4. One imperfect thread allowed, .040 inches maximum.
5. Recommended mounting torque 68 oz-in maximum.
6. Potting shall not extend beyond .030 inches from body.
7. Tolerance: ± .010 (±.254 mm) unless otherwise specified.
8. Alternate capacitance values and various mechanical configurations available upon request.



π Type Network



"C" Type Network

PART NUMBER	CAPACITANCE µF +100%, - 0%	CIRCUIT	WORKING VOLTAGE		MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]					
			DC VOLTS	AC 400 HZ	1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
CF 9-001	0.015	π	50		23	40	60	70	70	70
CF 9-005	0.010	π	100		10	40	70	70	70	70
CF 9-010	0.012	π	200		–	16	65	65	70	70
CF 9-002	0.300	C	50		29	40	55	60	70	70
CF 9-003	0.050	C	100		15	35	42	50	70	70
CF 9-004	0.100	C	100		20	38	48	53	70	70
CF 9-006	0.150	C	100		23	39	50	55	70	70
CF 9-007	1000 pF	C	200	115	–	4	20	25	40	50
CF 9-008	5000 pF	C	200	115	–	15	34	41	45	50
CF 9-009	0.010	C	200	115	4	21	35	42	55	60
CF 9-011	0.027	C	200	115	10	30	39	45	65	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Hermetically Sealed (DC Applications)

Operating Temperature:
-55ºC to +125ºC

Operating Voltage:
50 VDC, 100 VDC, 200 VDC

Rated Current:
10 Amperes maximum

Dielectric Strength:
Twice DC Operating Voltage @ +25ºC, 50 mA maximum charging current.

Insulation Resistance:
Measured with rated DC voltage, 1000 megohm-microfarad or 100,000 megohms minimum, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55ºC to +125ºC, the insertion loss will decrease a maximum of 3 dB from the +25ºC value.

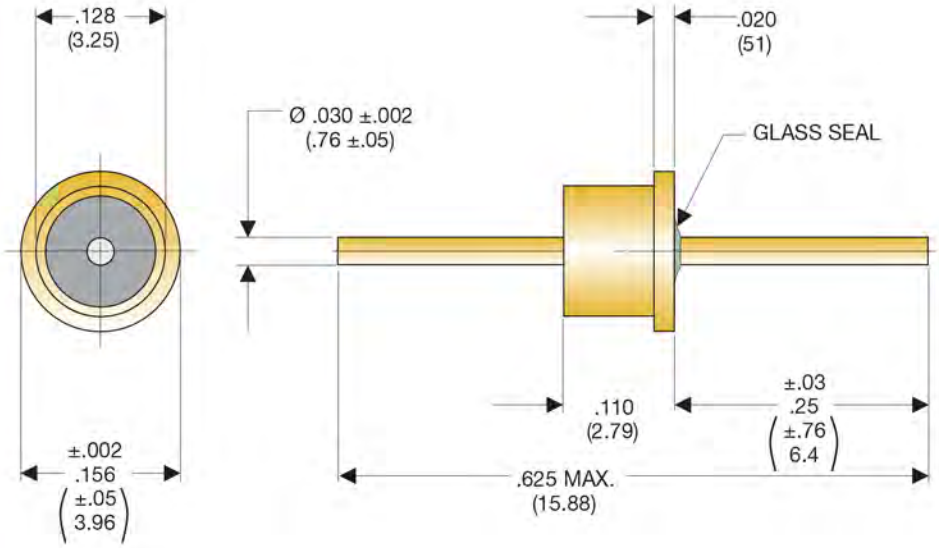
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-28861.

Housing (Hermetically Sealed):
High purity gold plating is standard, Electro-tin-lead plating or silver is available upon request.

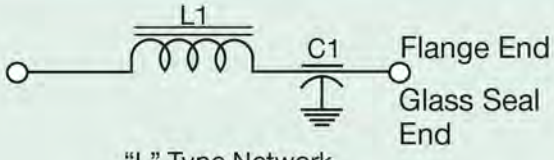
DC Resistance:
.010 ohms maximum.

Material:
Case: Cold Rolled Steel
Lead: Alloy 52

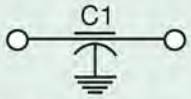
Marking:
None



Part numbers listed on following page.



"L" Type Network



"C" Type Network

PART NUMBER	CAPACITANCE pF +100%, - 0%	CIRCUIT	WORKING VOLTAGE DC VOLTS	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]					
				1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
CF 12-001	15,000	L	50	7	25	45	50	60	60
CF 12-003	2,700	L	100	–	10	28	32	50	60
CF 12-005	5,000	L	100	–	15	30	38	55	60
CF 12-007	10	L	200	–	–	–	–	15	20
CF 12-009	25	L	200	–	–	–	–	20	25
CF 12-011	100	L	200	–	–	5	10	30	40
CF 12-013	500	L	200	–	–	20	25	40	55
CF 12-015	1,000	L	200	–	4	25	30	45	55
CF 12-002	15,000	C	50	7	25	40	45	60	60
CF 12-004	2,700	C	100	–	10	25	30	50	60
CF 12-006	5,000	C	100	–	15	30	35	50	60
CF 12-008	10	C	200	–	–	–	–	5	20
CF 12-010	25	C	200	–	–	–	–	10	25
CF 12-012	100	C	200	–	–	3	5	20	35
CF 12-014	500	C	200	–	–	15	20	34	50
CF 12-016	1,000	C	200	–	4	20	25	40	55

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Applications

The CF 12 filter series provides effective filtering over the frequency range of 1 MHz to 10 GHz, which makes it ideal for RF and microwave applications. Designed to be soldered into a housing or bulkhead, it is ideal for hign impedance circuits where large capacitance values are not practical. The "L" circuit incorporates an internal ferrite bead that provides both inductance and resistance (lossy characteristics) which improves insertion loss.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC, 100 VDC, 200 VDC,
125 VAC, 400 Hz

Rated Current:
15 Amperes maximum

Peak Transient Voltage:
(10µsec) @ +25°C.

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with 100 VDC or the operating voltage, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetic or Epoxy Seal):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
Per page 6.

Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

AC / DC Applications

FIG 1 Epoxy Seal

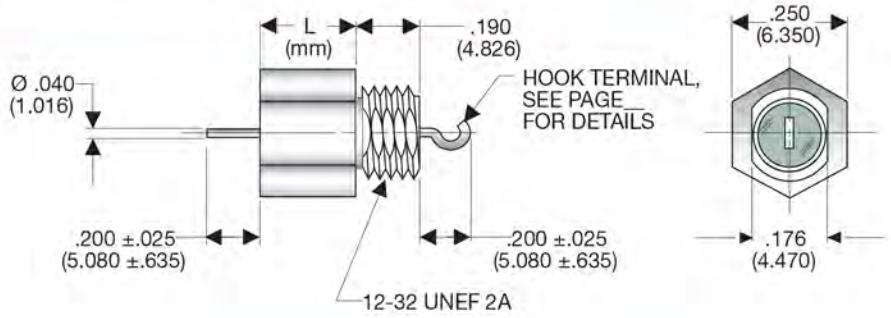


FIG 2 Hermetic Seal

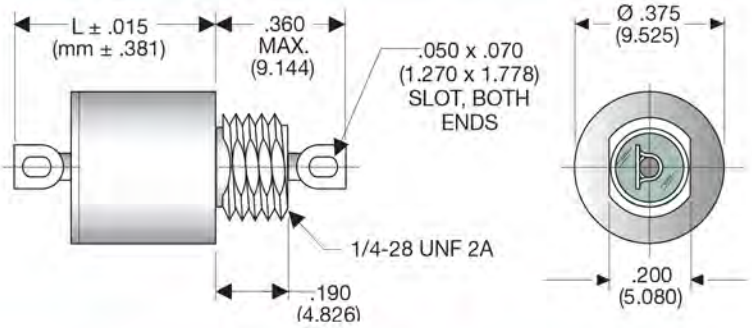
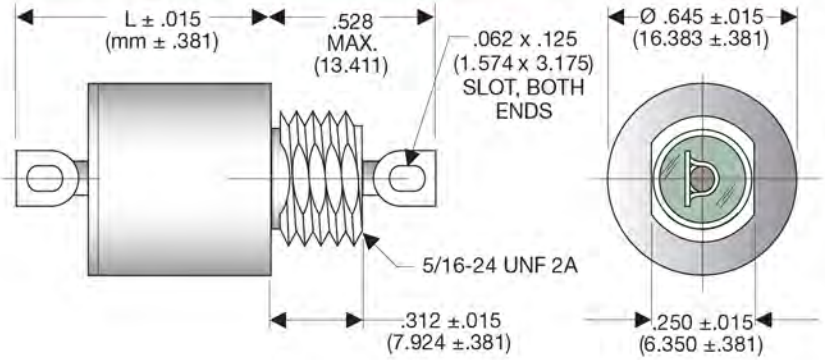


FIG 3 Hermetic Seal



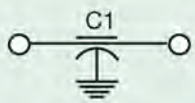
Tolerance: ± .010 (±.254 mm) unless otherwise specified.

*All units supplied with internal tooth lockwasher and hex nut. For further details see page 6.

Dimensions are inches (mm in parantheses).

Part numbers listed on following page.

"C" Type Network

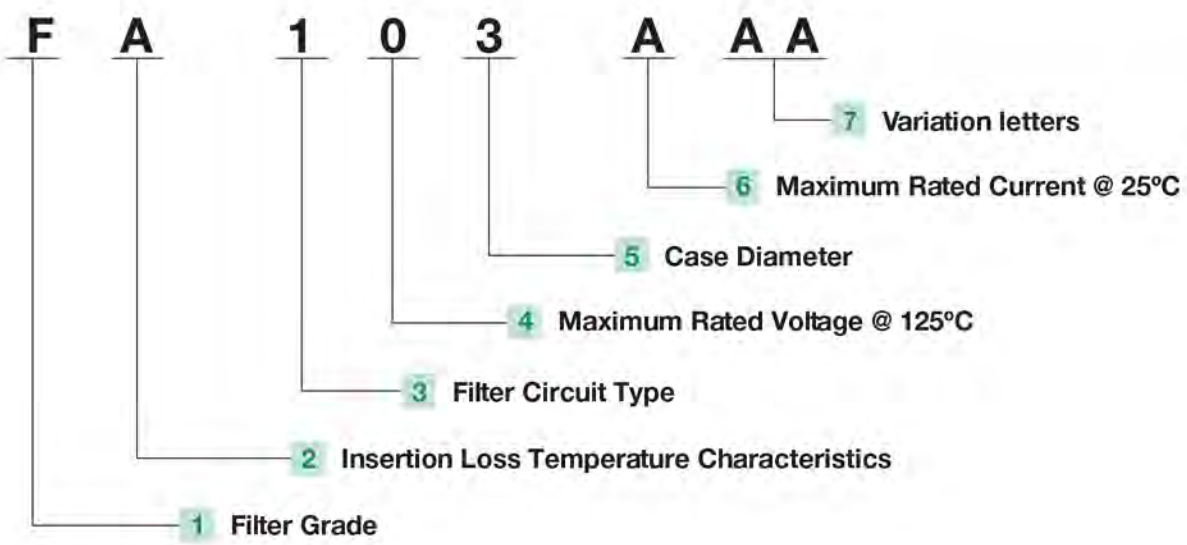


AC / DC Applications

PART NUMBER*	CAPACITANCE µF +100%, - 0%	WORKING VOLTAGE		INSULATION RESISTANCE MEGOHMS, MIN.	PEAK TRANSIENT VOLTAGE (10µSEC)	L DIMENSION INCHES (mm)	FIG	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
		DC VOLTS	AC 0-400Hz					50 kHz	100 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1.0 GHz
FA-502-MAA	0.35	50	–	1400	150	.345 (8.763)	1	7	10	16	22	32	50	65
FA-502-MAB	0.70	50	–	700	150	.345 (8.763)	1	15	20	24	30	40	57	65
FA-502-MAC	1.40	50	–	350	150	.345 (8.763)	1	19	25	28	35	45	60	65
FA-513-MAA	0.50	100	–	1000	300	.420 (10.668)	2	10	16	19	25	36	55	65
FA-513-MAB	1.00	100	–	500	300	.520 (13.208)	2	16	21	25	31	41	60	65
FA-523-MAA	0.125	200	125	1500	600	.420 (10.668)	2	–	–	8	12	21	43	65
FA-523-MAB	0.25	200	125	1500	600	.520 (13.208)	2	6	12	14	20	30	50	65
FA-523-MAC	0.375	200	125	1300	600	.590 (14.986)	2	8	13	17	23	34	52	65
FA-506-MAA	4.00	50	–	120	150	.590 (14.986)	3	28	35	37	43	54	60	65
FA-516-MAA	2.00	100	–	250	300	.590 (14.986)	3	21	27	31	37	48	60	65
FA-526-MAA	0.50	200	125	1000	600	.590 (14.986)	3	10	16	19	25	36	55	65

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers were previously specified as "FC 5XX-MXX" and have been amended to "FA" in lieu of "FC". FC part numbers were designated for Z5U dielectric material for the ceramic discoidal element and WEMS does not use this unstable material in any of our catalog filters or any custom filters.

Mini Filter Part Numering Information



1 Filter Grade

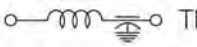
F = Standard catalog part number.
H = Hi-Rel catalog part number processed to high reliability specification.

2 Insertion Loss Temperature Characteristics

A = The filter capacitor element has a BX dielectric and insertion loss will decrease a maximum of 3 dB over the temperature range of -55°C to +125°C from the 25°C specified value.+

3 Filter Circuit Type

1 = L "in"  Thread end

2 = L "out"  Thread end

3 = π (pi) 

4 = T 

5 = C 

6 = 2π (pi)

7 = 2T

8 = 2L

4 Operating Voltage @ +125°C

0 = 28/50 VDC
1 = 100 VDC
2 = 200 VDC / 125 VAC, 400 Hz

5 Case Diameter

1 = .100 - .199 (2.540 - 5.055 mm)
2 = .200 - .299 (5.080 - 7.595 mm)
3 = .300 - .399 (7.620 - 10.135 mm)
4 = .400 - .499 (10.160 - 12.675 mm)
6 = .600 - .699 (15.240 - 17.755 mm)

6 Maximum Rated Current @ +125°C

A = .060 A
B = .150 A
C = .250 A
D = .300 A
E = .450 A
F = .500 A
G = 1.00 A
H = 2.00 A
J = 3.00 A
K = 5.00 A
L = 10.00 A
M = 15.00 A

7 Variation Letters

Allocated for custom designs, in house only.

Standard plating is electro-tin-lead or hot solder dip. Gold and silver plating is available upon request.

Variations to terminal styles, thread lengths available upon request.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC

Peak Transient Voltage:
150 VDC (10µsec) @ +25°C.

Dielectric Strength:
100 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
170 megohms minimum with 50 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

INSERTION LOSS:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

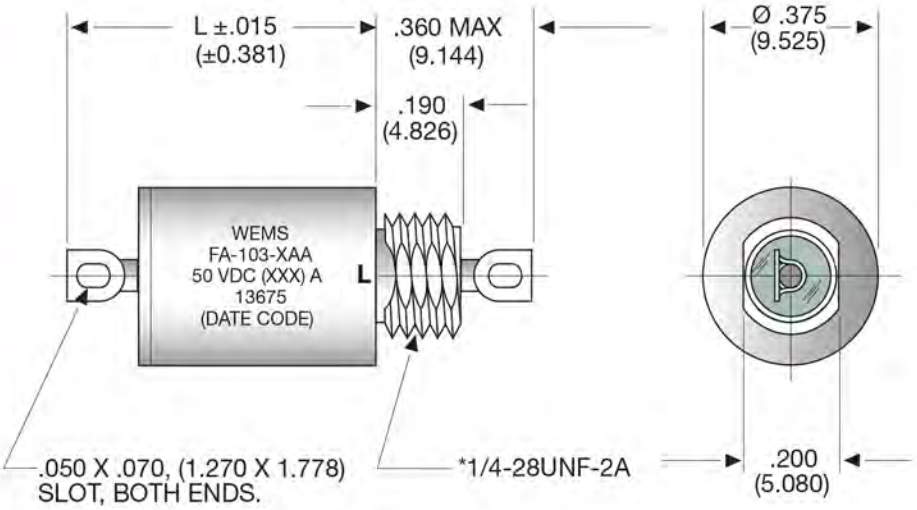
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

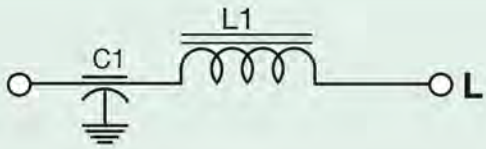
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (50 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"L" Type Network
50 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (mm)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-103-AAA	0.06	7.00	.721 (18.313)	46	70	70	70	70	70	70
FA-103-BAA	0.15	3.00	.721 (18.313)	33	63	70	70	70	70	70
FA-103-CAA	0.25	2.90	.721 (18.313)	30	58	70	70	70	70	70
FA-103-FAA	0.50	0.65	.721 (18.313)	22	45	58	70	70	70	70
FA-103-GAA	1.00	0.36	.721 (18.313)	21	36	45	65	70	70	70
FA-103-HAA	2.00	0.12	.721 (18.313)	21	34	41	58	70	70	70
FA-103-JAA	3.00	0.04	.721 (18.313)	21	34	40	52	69	70	70
FA-103-KAA	5.00	0.007	.721 (18.313)	21	34	40	50	69	70	70
FA-103-LAA	10.00	0.005	.721 (18.313)	21	34	40	50	55	70	70
FA-103-MAA	15.00	0.0025	.721 (18.313)	21	34	40	50	55	70	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers are specified for the thread on the inductor end. For a reverse type network, capacitor at threaded end, the filter numerical part number should be specified as 2, eg FA-203-XAA, (see page 14 for part numbering systems).

Operating Temperature:
-55°C to +125°C

Operating Voltage:
100 VDC

Peak Transient Voltage:
300 VDC (10µsec) @ +25°C.

Dielectric Strength:
200 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
100 megohms minimum with 100 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

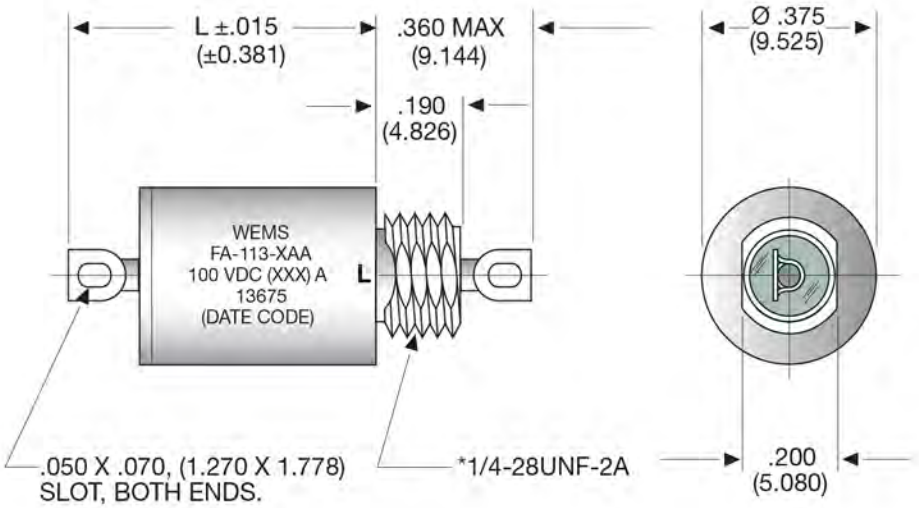
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

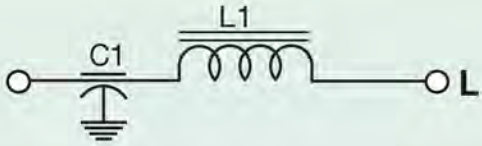
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (100 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"L" Type Network
100 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (mm)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-113-AAA	0.06	7.00	.721 (18.313)	38	66	70	70	70	70	70
FA-113-BAA	0.15	3.00	.721 (18.313)	28	53	58	70	70	70	70
FA-113-CAA	0.25	2.90	.721 (18.313)	23	47	64	70	70	70	70
FA-113-FAA	0.50	0.65	.721 (18.313)	15	38	45	61	70	70	70
FA-113-GAA	1.00	0.36	.721 (18.313)	13	29	38	57	70	70	70
FA-113-HAA	2.00	0.12	.721 (18.313)	13	27	33	51	70	70	70
FA-113-JAA	3.00	0.04	.721 (18.313)	13	27	33	45	70	70	70
FA-113-KAA	5.00	0.007	.721 (18.313)	13	27	33	43	67	70	70
FA-113-LAA	10.00	0.005	.721 (18.313)	13	27	33	43	63	70	70
FA-113-MAA	15.00	0.0025	.721 (18.313)	13	27	33	43	63	70	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers are specified for the thread on the inductor end. For a reverse type network, capacitor at threaded end, the filter numerical part number should be specified as 2, eg FA-213-XAA, (see page 14 for part numbering systems).

Operating Temperature:
-55°C to +125°C

Operating Voltage:
200 VDC, 125 VAC, 400 Hz

Peak Transient Voltage:
600 VDC (10µsec) @ +25°C.

Dielectric Strength:
400 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
100 megohms minimum with 200 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

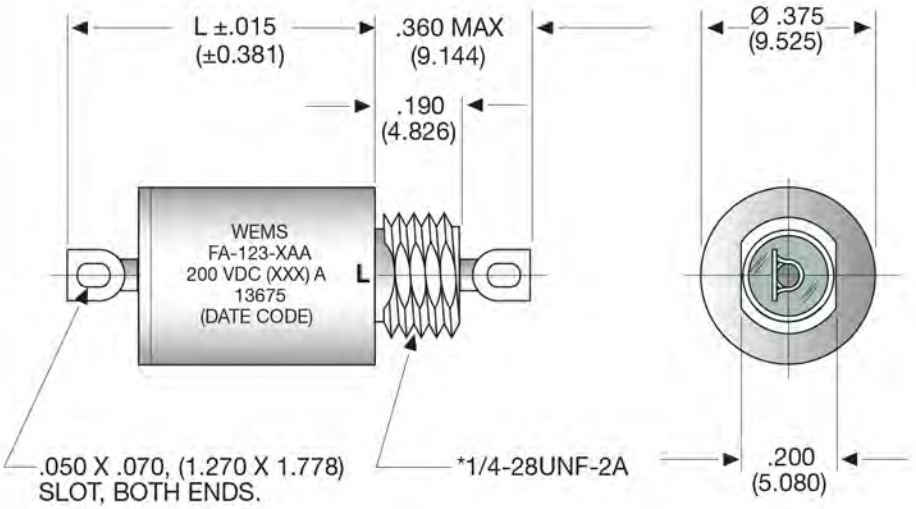
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

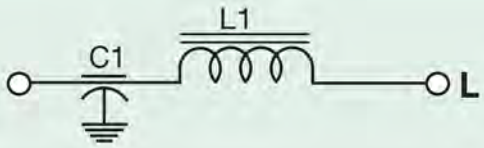
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (200 VDC, 125 VAC, 400 Hz Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"L" Type Network
200 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (mm)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-123-AAA	0.06	7.00	.721 (18.313)	31	59	70	70	70	70	70
FA-123-BAA	0.15	3.00	.721 (18.313)	22	50	62	70	70	70	70
FA-123-CAA	0.25	2.90	.721 (18.313)	15	43	55	70	70	70	70
FA-123-FAA	0.5	0.65	.721 (18.313)	8	30	38	53	70	70	70
FA-123-GAA	1.00	0.36	.721 (18.313)	7	23	31	50	70	70	70
FA-123-HAA	2.00	0.12	.721 (18.313)	7	20	27	43	70	70	70
FA-123-JAA	3.00	0.04	.721 (18.313)	7	20	26	39	70	70	70
FA-123-KAA	5.00	0.007	.721 (18.313)	7	20	26	37	63	70	70
FA-123-LAA	10.00	0.005	.721 (18.313)	7	20	26	37	50	70	70
FA-123-MAA	15.00	0.0025	.721 (18.313)	7	20	26	37	50	70	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers are specified for the thread on the inductor end. For a reverse type network, capacitor at threaded end, the filter numerical part number should be specified as 2, eg FA-223-XAA, (see page 6 for part numbering systems).

Operating Temperature:
-55°C to +125°C

Operating Voltage:
100 VDC, 200 VDC, 125 VAC, 400 Hz

Peak Transient Voltage:
(10µsec) @ +25°C.

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with 100 VDC, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

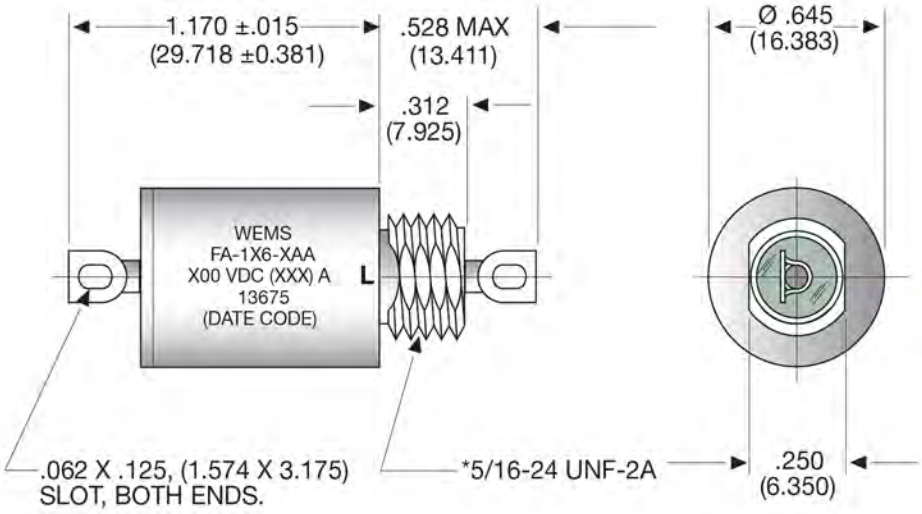
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
64 inch/oz. maximum.

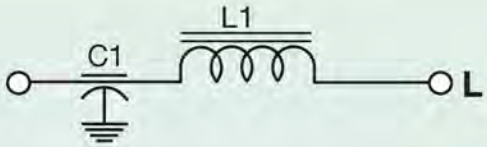
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (AC/DC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"L" Type Network



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	WORKING VOLTAGE		INSULATION RESISTANCE (MΩ MIN)	PEAK TRANSIENT VOLTAGE (10µSEC)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
			DC	AC 400Hz			30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-116-AAA	0.5	0.30	100		1000	300	24	51	63	70	70	70	70
FA-116-GAA	1.0	0.21	100		1000	300	19	43	55	70	70	70	70
FA-116-JAA	3.0	0.03	100		1000	300	17	32	40	58	70	70	70
FA-116-KAA	5.0	0.02	100		1000	300	17	32	37	50	70	70	70
FA-126-FAA	0.5	0.30	200	125	700	500	12	41	53	70	70	70	70
FA-126-GAA	1.0	0.21	200	125	700	500	7	33	44	63	70	70	70
FA-126-JAA	3.0	0.03	200	125	700	500	–	22	30	48	70	70	70
FA-126-KAA	5.0	0.02	200	125	700	500	–	22	28	40	70	70	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers are specified for the thread on the inductor end. For a reverse type network, capacitor at threaded end, the filter numerical part number should be specified as 2, eg FA-216-XAA, (see page 14 for part numbering systems).

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC

Rated Current:
15 Amperes maximum.

Peak Transient Voltage:
150 VDC (10µsec) @ +25°C.

Dielectric Strength:
100 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
170 megohms minimum with 50 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (50 VDC Applications)

FIG 1 Epoxy Seal

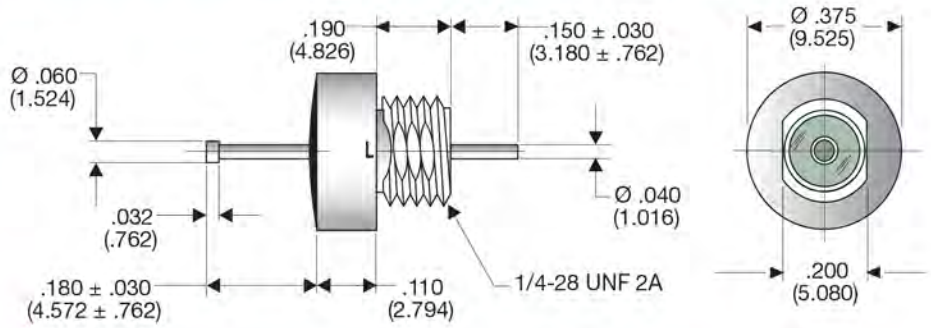
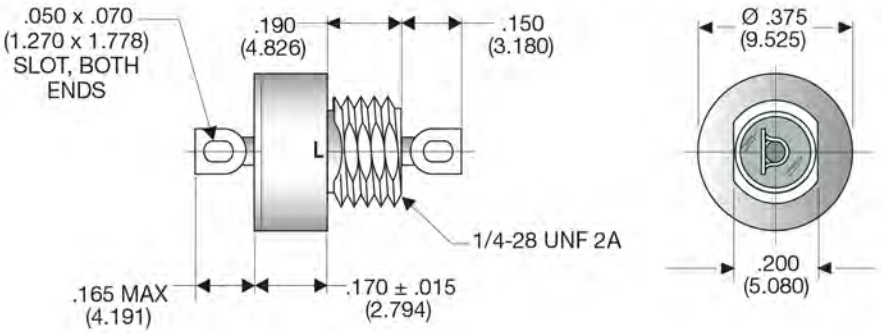
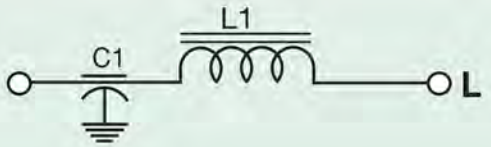


FIG 2 Hermetic Seal



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"L" Type Network
50 VDC



PART NUMBER	CAPACITANCE µF +100%, -0%	RESISTANCE DC MAX. (Ω)	FIG	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
				30 kHz	150 kHz	300 kHz	1 MHz	10 MHz	100 MHz	1.0 GHz
FA-103-MAC	1.4	0.0025	1	15	28	33	44	60	60	70
FA-103-MAB	1.4	0.0025	2	15	28	33	44	60	60	70

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.
* Part numbers were previously specified as "FC 103-MAX" and have been amended to "FA" in lieu of "FC". FC part numbers were designated for Z5U dielectric material for the ceramic discoidal element and WEMS does not use this unstable material in any of our catalog filters or any custom filters.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC

Peak Transient Voltage:
150 VDC (10µsec) @ +25°C.

Dielectric Strength:
100 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
170 megohms minimum with 50 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

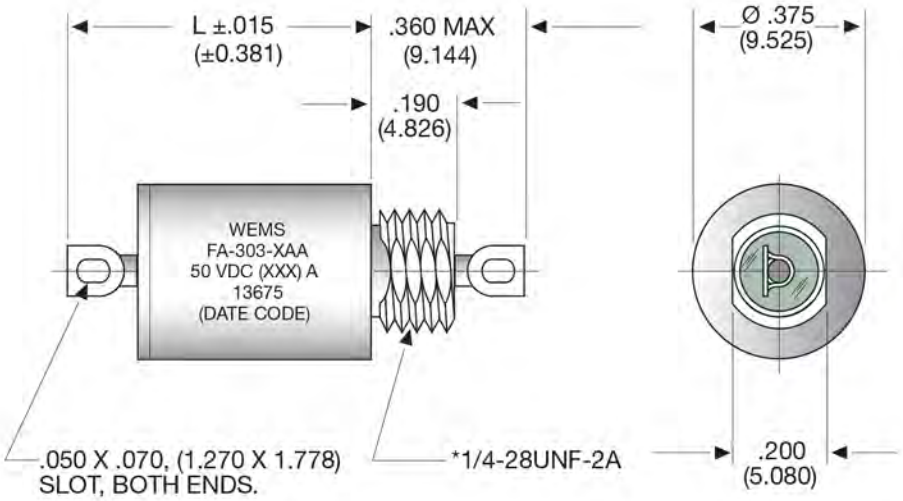
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

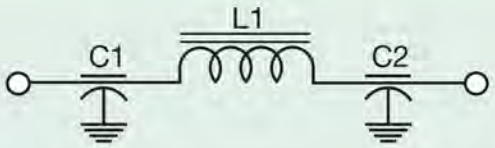
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (50 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

π Type Network
50 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-303-AAA	0.06	7.00	.721 (18.313)	57	80	80	80	80	80	80
FA-303-BAA	0.15	3.00	.721 (18.313)	47	80	80	80	80	80	80
FA-303-CAA	0.25	2.90	.721 (18.313)	42	80	80	80	80	80	80
FA-303-FAA	0.50	0.65	.721 (18.313)	27	69	80	80	80	80	80
FA-303-GAA	1.00	0.36	.721 (18.313)	–	57	75	80	80	80	80
FA-303-HAA	2.00	0.12	.721 (18.313)	–	47	65	80	80	80	80
FA-303-JAA	3.00	0.04	.721 (18.313)	–	35	56	80	80	80	80
FA-303-KAA	5.00	0.007	.721 (18.313)	–	–	45	75	80	80	80
FA-303-LAA	10.00	0.005	.721 (18.313)	–	–	29	53	80	80	80
FA-303-MAA	15.00	0.0025	.721 (18.313)	–	–	29	53	80	80	80

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
100 VDC

Peak Transient Voltage:
300 VDC (10µsec) @ +25°C.

Dielectric Strength:
200 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
500 megohms minimum with 50 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

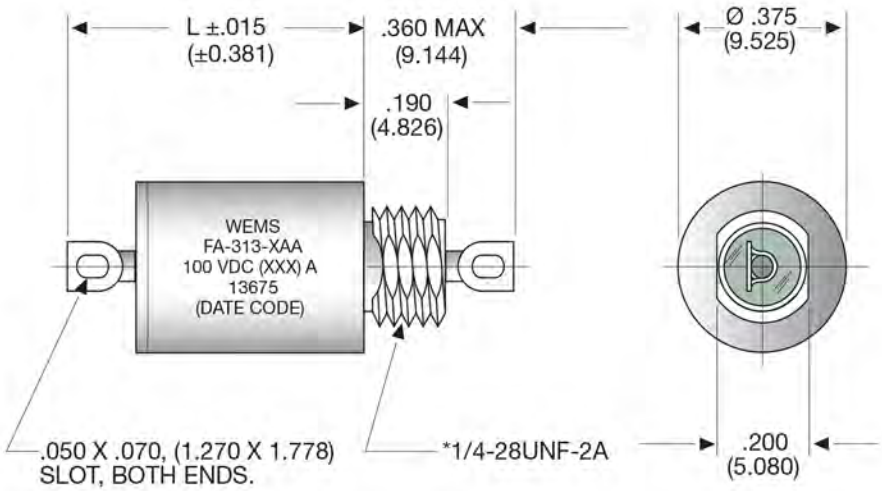
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

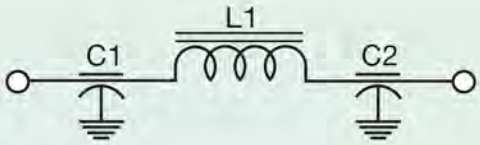
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (100 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

π Type Network
100 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-313-AAA	0.06	7.00	.721 (18.313)	43	80	80	80	80	80	80
FA-313-BAA	0.15	3.00	.721 (18.313)	31	73	80	80	80	80	80
FA-313-CAA	0.25	2.90	.721 (18.313)	26	67	80	80	80	80	80
FA-313-FAA	0.50	0.65	.721 (18.313)	9	54	70	80	80	80	80
FA-313-GAA	1.00	0.36	.721 (18.313)	–	41	60	80	80	80	80
FA-313-HAA	2.00	0.12	.721 (18.313)	–	32	52	80	80	80	80
FA-313-JAA	3.00	0.04	.721 (18.313)	–	8	40	73	80	80	80
FA-313-KAA	5.00	0.007	.721 (18.313)	–	–	23	63	80	80	80
FA-313-LAA	10.00	0.005	.721 (18.313)	–	–	–	23	80	80	80
FA-313-MAA	15.00	0.0025	.721 (18.313)	–	–	–	23	80	80	80

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
200 VDC, 125 VAC 400Hz

Peak Transient Voltage:
600 VDC (10µsec) @ +25°C.

Dielectric Strength:
400 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
1000 megohms minimum with 200 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

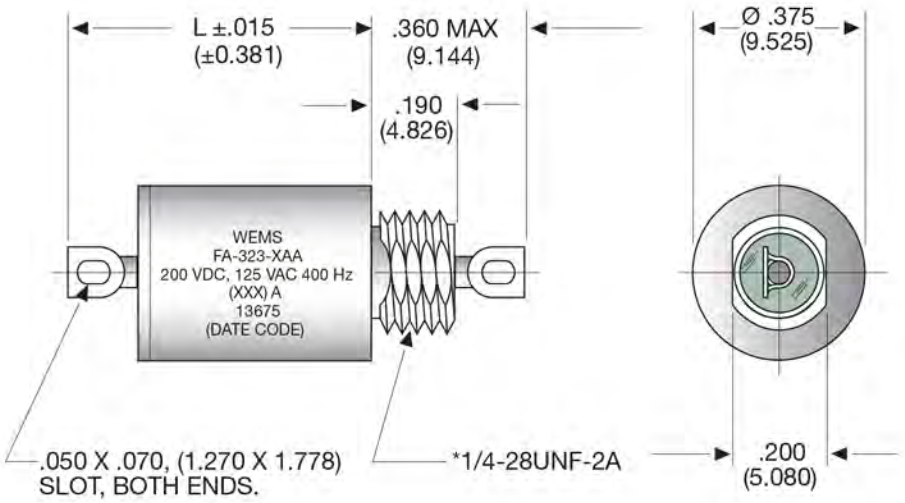
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

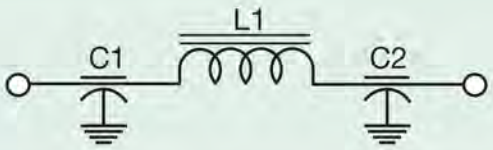
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (200 VDC, 125 VAC 400 Hz Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

π Type Network
200 VDC,
125 VAC 400 Hz



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-323-AAA	0.06	7.00	.721 (18.313)	30	70	80	80	80	80	80
FA-323-BAA	0.15	3.00	.721 (18.313)	18	59	77	80	80	80	80
FA-323-CAA	0.25	2.90	.721 (18.313)	11	54	72	80	80	80	80
FA-323-FAA	0.50	0.65	.721 (18.313)	–	40	59	80	80	80	80
FA-323-GAA	1.00	0.36	.721 (18.313)	–	28	48	80	80	80	80
FA-323-HAA	2.00	0.12	.721 (18.313)	–	14	39	72	80	80	80
FA-323-JAA	3.00	0.04	.721 (18.313)	–	–	27	61	80	80	80
FA-323-KAA	5.00	0.007	.721 (18.313)	–	–	–	50	80	80	80
FA-323-LAA	10.00	0.005	.721 (18.313)	–	–	–	19	80	80	80
FA-323-MAA	15.00	0.0025	.721 (18.313)	–	–	–	19	80	80	80

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
100 VDC, 200 VDC, 125 VAC, 400 Hz

Peak Transient Voltage:
10µsec) @ +25°C.

Dielectric Strength:
Twice DC Operating Voltage @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
Measured with 100 VDC or the operating voltage, whichever is less, 50 mA maximum charging current, @ +25 after two minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of -3 dB from the +25°C value.

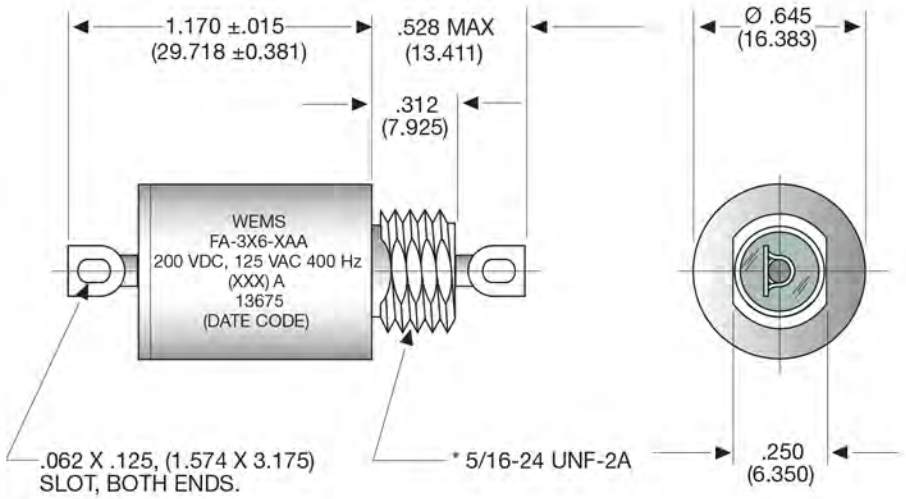
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
64 inch/oz. maximum.

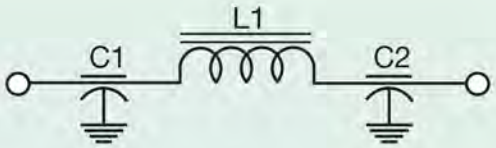
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (AC/DC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

π Type Network



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	WORKING VOLTAGE		INSULATION RESISTANCE (MΩ MIN)	PEAK TRANSIENT VOLTAGE (10µSEC)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
			DC	AC 400Hz			30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-316-AAA	0.5	0.30	100		100	300	37	78	80	80	80	80	80
FA-316-GAA	1.0	0.21	100		100	300	27	72	80	80	80	80	80
FA-316-JAA	3.0	0.03	100		100	300	–	51	69	80	80	80	80
FA-316-KAA	5.0	0.02	100		100	300	–	41	61	80	80	80	80
FA-326-FAA	0.5	0.30	200	125	300	500	19	64	80	80	80	80	80
FA-326-GAA	1.0	0.21	200	125	300	500	8	57	73	80	80	80	80
FA-326-JAA	3.0	0.03	200	125	300	500	–	34	54	80	80	80	80
FA-326-KAA	5.0	0.02	200	125	300	500	–	20	43	78	80	80	80

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
50 VDC

Peak Transient Voltage:
150 VDC (10µsec) @ +25°C.

Dielectric Strength:
100 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
350 megohms minimum with 50 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

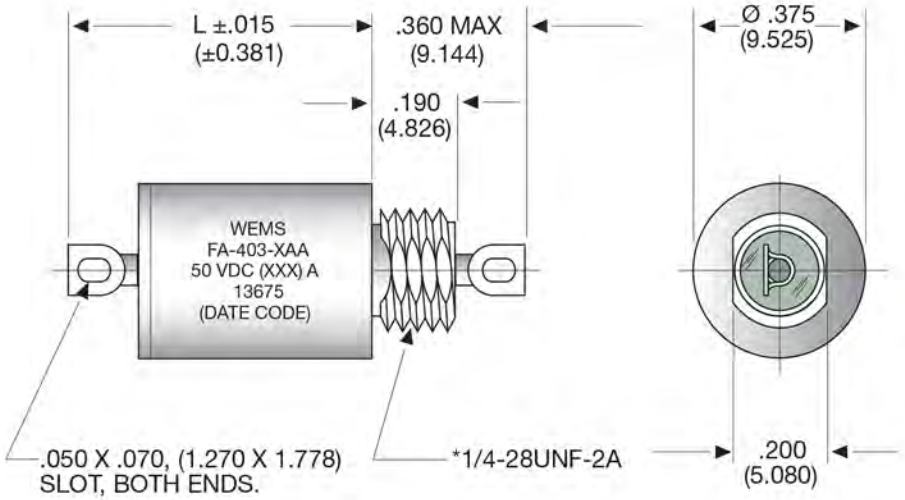
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

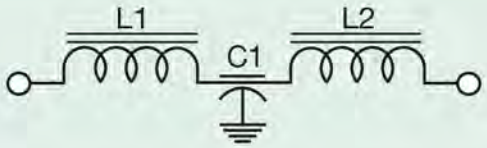
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (50 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"T" Type Network
50 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-403-AAA	0.06	14.00	.872 (22.148)	66	80	80	80	80	80	73
FA-403-BAA	0.15	6.00	.872 (22.148)	45	80	80	80	80	80	73
FA-403-CAA	0.25	5.80	.872 (22.148)	33	68	80	80	80	80	73
FA-403-FAA	0.50	1.30	.872 (22.148)	18	49	65	80	80	80	73
FA-403-GAA	1.00	0.72	.872 (22.148)	15	33	44	73	80	80	73
FA-403-HAA	2.00	0.24	.872 (22.148)	14	29	37	56	80	80	73
FA-403-JAA	3.00	0.08	.872 (22.148)	14	28	35	48	73	80	73
FA-403-KAA	5.00	0.014	.872 (22.148)	14	28	34	45	72	80	73
FA-403-LAA	10.00	0.005	.872 (22.148)	14	28	34	45	63	63	63
FA-403-MAA	15.00	0.0025	.872 (22.148)	14	28	34	45	63	63	63

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
100 VDC

Peak Transient Voltage:
300 VDC (10µsec) @ +25°C.

Dielectric Strength:
200 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
1000 megohms minimum with 100 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

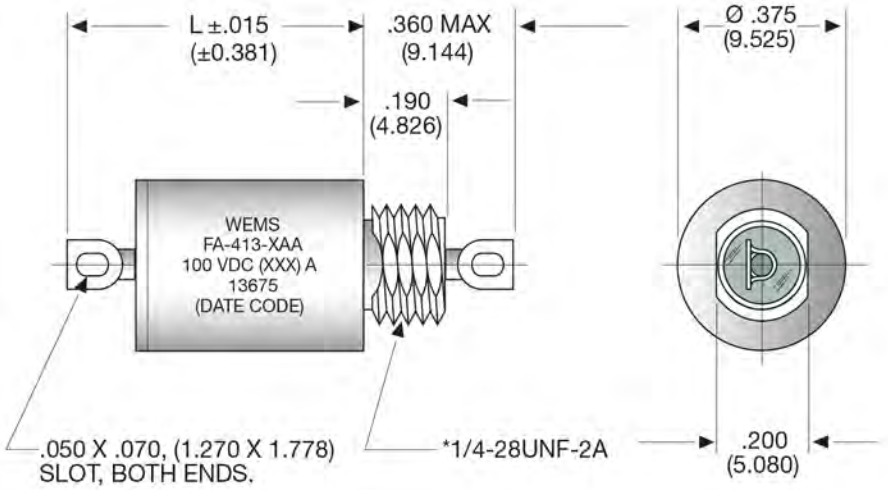
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

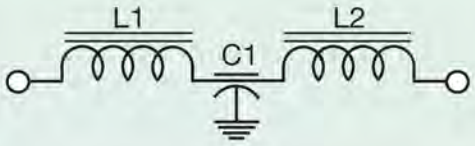
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (100 VDC Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"T" Type Network
100 VDC



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220[1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-413-AAA	0.06	14.00	.872 (22.148)	41	80	80	80	80	80	73
FA-413-BAA	0.15	6.00	.872 (22.148)	35	76	80	80	80	80	73
FA-413-CAA	0.25	5.80	.872 (22.148)	23	60	75	80	80	80	73
FA-413-FAA	0.50	1.30	.872 (22.148)	10	39	54	80	80	80	73
FA-413-GAA	1.00	0.72	.872 (22.148)	7	24	37	65	80	80	73
FA-413-HAA	2.00	0.24	.872 (22.148)	7	21	30	48	78	80	73
FA-413-JAA	3.00	0.08	.872 (22.148)	7	20	27	40	72	80	73
FA-413-KAA	5.00	0.014	.872 (22.148)	7	20	27	37	68	80	73
FA-413-LAA	10.00	0.005	.872 (22.148)	7	20	27	37	57	68	63
FA-413-MAA	15.00	0.0025	.872 (22.148)	7	20	27	37	57	68	63

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
200 VDC. 125 VAC 400 Hz

Peak Transient Voltage:
600 VDC (10µsec) @ +25°C.

Dielectric Strength:
400 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
1500 megohms minimum with 200 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
At -55°C to +125°C, the insertion loss will decrease a maximum of 3 dB from the +25°C value.

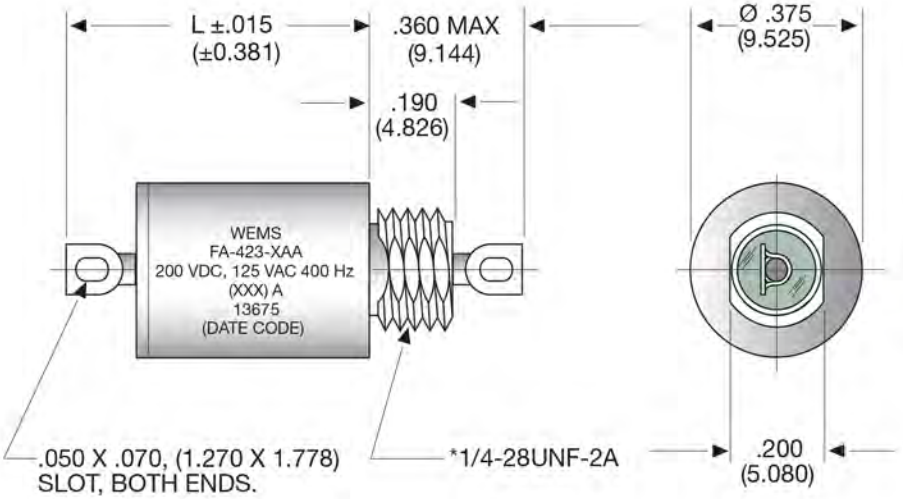
Military Specifications:
Meets or exceeds the applicable parameters of MIL-PRF-15733 and MIL-PRF-28861.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Recommended Torque:
48 inch/oz. maximum.

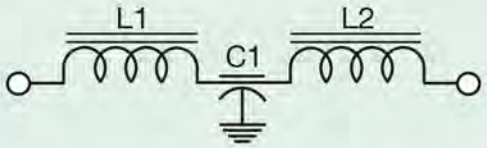
Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (200 VDC, 125 VAC 400 Hz Applications)



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

"T" Type Network
200 VDC
125 VAC 400 Hz



PART NUMBER	CURRENT DC MAX. (AMPERES)	RESISTANCE DC MAX. (Ω)	DIMENSION L INCHES (MM)	MINIMUM INSERTION LOSS (Db) At +25°C IN ACCORDANCE WITH MIL-STD-220 [1,2]						
				30 kHz	150 kHz	300 kHz	1.0 MHz	10 MHz	100 MHz	1.0 GHz
FA-423-AAA	0.06	14.00	.872 (22.148)	48	80	80	80	80	80	73
FA-423-BAA	0.15	6.00	.872 (22.148)	27	70	80	80	80	80	73
FA-423-CAA	0.25	5.80	.872 (22.148)	15	54	69	80	80	80	73
FA-423-FAA	0.50	1.30	.872 (22.148)	–	34	48	74	80	80	73
FA-423-GAA	1.00	0.72	.872 (22.148)	–	18	31	57	80	80	73
FA-423-HAA	2.00	0.24	.872 (22.148)	–	14	24	42	78	80	73
FA-423-JAA	3.00	0.08	.872 (22.148)	–	14	20	33	70	80	73
FA-423-KAA	5.00	0.014	.872 (22.148)	–	14	20	31	65	80	73
FA-423-LAA	10.00	0.005	.872 (22.148)	–	14	20	31	51	68	63
FA-423-MAA	15.00	0.0025	.872 (22.148)	–	14	20	31	51	68	63

1 Insertion loss measurements shall be made under full load over the frequency range of 1.0 MHz to 10 MHz. Insertion loss measurements above this frequency range under no load.
2 The insertion loss requirements between any two adjacent specified frequencies shall be that of the lower of the two frequencies in order to accommodate resonant dips.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
250/440 VAC 50/60 Hz

Dielectric Strength:
For 240 VAC; 800 VDC @ +25°C, 50 mA maximum charging current.

Insulation Resistance:
100 megohms minimum with 100 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

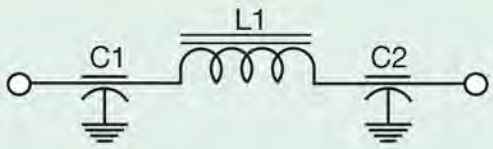
Insertion Loss:
A minimum insertion loss of 60 dB at 150 kHz and 80 dB over the frequency range from 0.50 MHz through 1.0 GHz.

Housing (Hermetically Sealed):
Electro-tin-lead plated, hot solder dipped, or as specified.

Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance (250/440 VAC 50/60 Hz Applications)

π Type Network
250 VAC
440 VAC
50/60 Hz



Tolerance: ± .010 (±.254 mm) unless otherwise specified.
*All units supplied with internal tooth lockwasher and hex nut.
For further details see page 6.
Dimensions are inches (mm in parantheses).

FIG 1

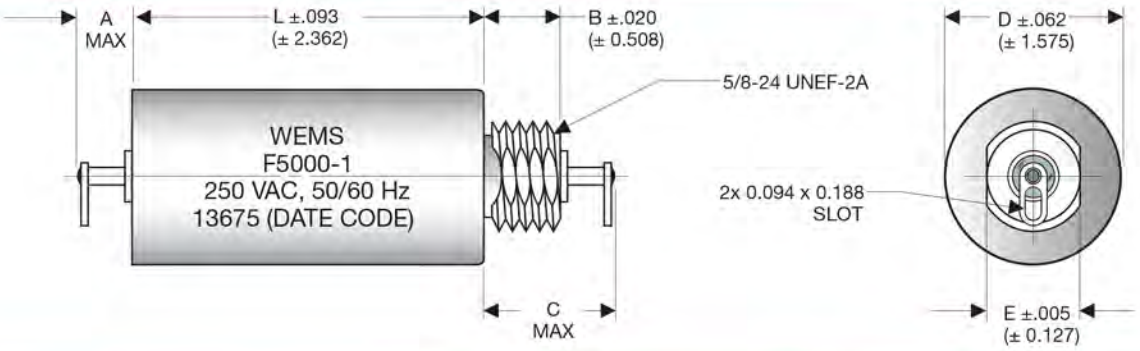
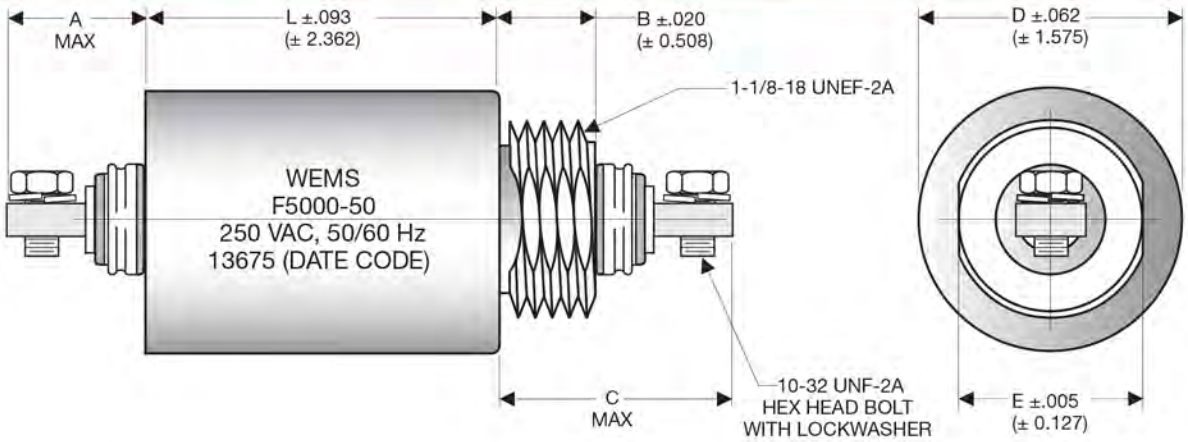


FIG 2



High Performance
(250/440 VAC 50/60 Hz Applications)

PART NUMBER	WORKING VOLTAGE VAC 50/60 HZ	CURRENT (AMPERES) MAX.	FIG	A		B		C		D		E		L	
				INCH	(MM)	INCH	(MM)	INCH	(MM)	INCH	(MM)	INCH	(MM)	INCH	(MM)
F5000-1	250	1	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.000	(25.40)	0.531	(13.49)	2.688	(68.28)
F5000-3	250	3	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.125	(28.58)	0.531	(13.49)	3.500	(88.90)
F5000-5	250	5	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.250	(31.75)	0.531	(13.49)	3.500	(88.90)
F5000-10	250	10	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.500	(38.10)	0.531	(13.49)	3.750	(95.25)
F5000-20	250	20	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	1.750	(44.45)	1.046	(26.57)	4.000	(101.60)
F5000-30	250	30	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	2.188	(55.58)	1.046	(26.57)	4.500	(114.30)
F5000-50	250	50	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	2.250	(57.15)	1.046	(26.57)	4.875	(123.83)
F5500-5	440	5	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.500	(38.10)	0.531	(13.49)	4.500	(114.30)
F5500-10	440	10	1	0.312	(7.92)	0.438	(11.13)	1.250	(31.75)	1.500	(38.10)	0.531	(13.49)	5.250	(133.35)
F5500-20	440	20	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	2.188	(55.58)	1.046	(26.57)	5.500	(139.70)
F5500-30	440	30	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	2.188	(55.58)	1.046	(26.57)	6.000	(152.40)
F5500-50	440	50	2	0.780	(19.81)	0.531	(13.49)	1.350	(34.29)	2.250	(57.15)	1.046	(26.57)	6.000	(152.40)

Applications

WEMS High Current Cylindrical style filters are designed to attenuate conducted interference on power lines for military, industrial and commercial electronic / electrical equipment. Small and compact, this style filter has a threaded header for mounting on panels, bulkheads, and enclosures.

Alternate terminal configurations, custom applications or special case sizes are available upon request.

Operating Temperature:
-55°C to +125°C

Operating Voltage:
250 VAC, 0-60 Hz, 600 VDC

Dielectric Strength:
1200 VDC @ +25°C, 50 mA 500 maximum charging current.

Insulation Resistance:
500 megohms minimum with 200 VDC, 50 mA maximum charging current, @ +25 after 2 minutes.

Insertion Loss:
In accordance with typical insertion loss curves on page 30.

Housing (Hermetically Sealed):
Electro-tin-lead plated.

Marking:
WEMS, part number, Federal Code identification, voltage, current and date code.

High Performance
(250 VAC 0-60 Hz, 600 VDC Applications)

Typical Part Number

WCF	20	2	A
1	2	3	4

UNAVAILABLE

Order

1 Filter Type Designation

2 Current Capacity in Amperes

20 = 20 A
30 = 30 A
50 = 50 A
75 = 75 A
100 = 100 A

3 Case Terminal Shielding

Filter cases are designed with terminals shielded against radiated RFI. Filters are offered with one or both ends shielded and are designated as follows:

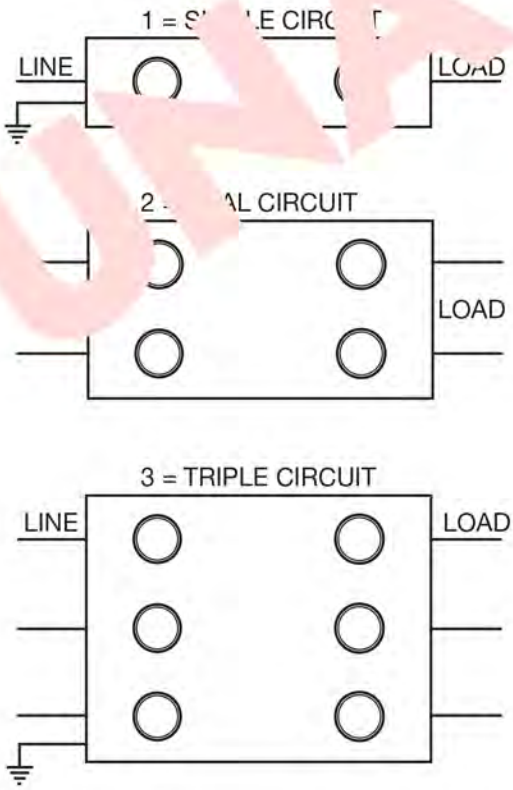
1 = one shielded end
2 = two shielded ends

4 Attenuation Curve and Case Size

WCF filters are offered at three noise rejection levels to supply the desired attenuation. Attenuation and circuit requirements control physical size and weight.

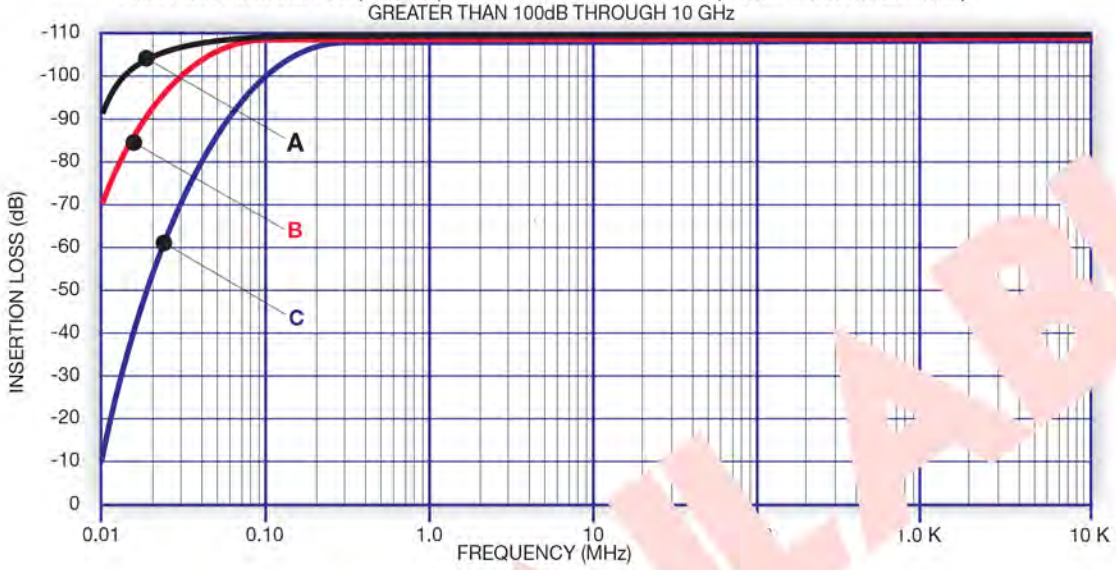
5 Single, Dual or Triple Circuits

1 = Single
2 = Dual
3 = Triple



High Performance
(250 VAC 0-60 Hz, 600 VDC Applications)

INSERTION LOSS CURVES (TYPICAL) MEASURED IAW MIL-STD-220 (UNDER LOAD CONDITIONS)
GREATER THAN 100dB THROUGH 10 GHz



SINGLE CIRCUIT

SINGLE PHASE, 2 WIRE, ONE LINE GROUNDED
250 VAC / 600 VDC —0-60 HZ

H = 4.0"
W = 3.75"
L = SEE CHART

MAXIMUM CURRENT (AMPERES)	CURVE A (100 Db @ 14 KhZ)			CURVE B (100 Db @ 30 KhZ)			CURVE C (100 Db @ 100 KhZ)		
	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS
20	WCF202A1	2	19	WCF202B1	16	14	WCF202C1	16	9
30	WCF302A1	2	21	WCF302B1	16	16	WCF302C1	16	11
50	WCF502A1	25	25	WCF502B1	20	20	WCF502C1	20	15
75	WCF752A1	25	28	WCF752B1	20	21	WCF752C1	20	16
100	WCF1002A1	28	35	WCF1002B1	25	30	WCF1002C1	20	25

DUAL CIRCUIT

SINGLE PHASE, 2 WIRE, ONE LINE GROUNDED
250 VAC / 600 VDC —0-60 HZ

H = 4.0"
W = 7.5"
L = SEE CHART

MAXIMUM CURRENT (AMPERES)	CURVE A (100 Db @ 14 KhZ)			CURVE B (100 Db @ 30 KhZ)			CURVE C (100 Db @ 100 KhZ)		
	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS
2 x 20	WCF202A2	20	34	WCF202B2	16	24	WCF202C2	16	12
2 x 30	WCF302A2	20	39	WCF302B2	16	29	WCF302C2	16	19
2 x 50	WCF502A2	25	44	WCF502B2	20	34	WCF502C2	20	24
2 x 75	WCF752A2	25	49	WCF752B2	20	39	WCF752C2	20	29
2 x 100	WCF1002A2	28	59	WCF1002B2	25	49	WCF1002C2	20	39

TRIPLE CIRCUIT

SINGLE PHASE, 2 WIRE, ONE LINE GROUNDED
250 VAC / 600 VDC —0-60 HZ

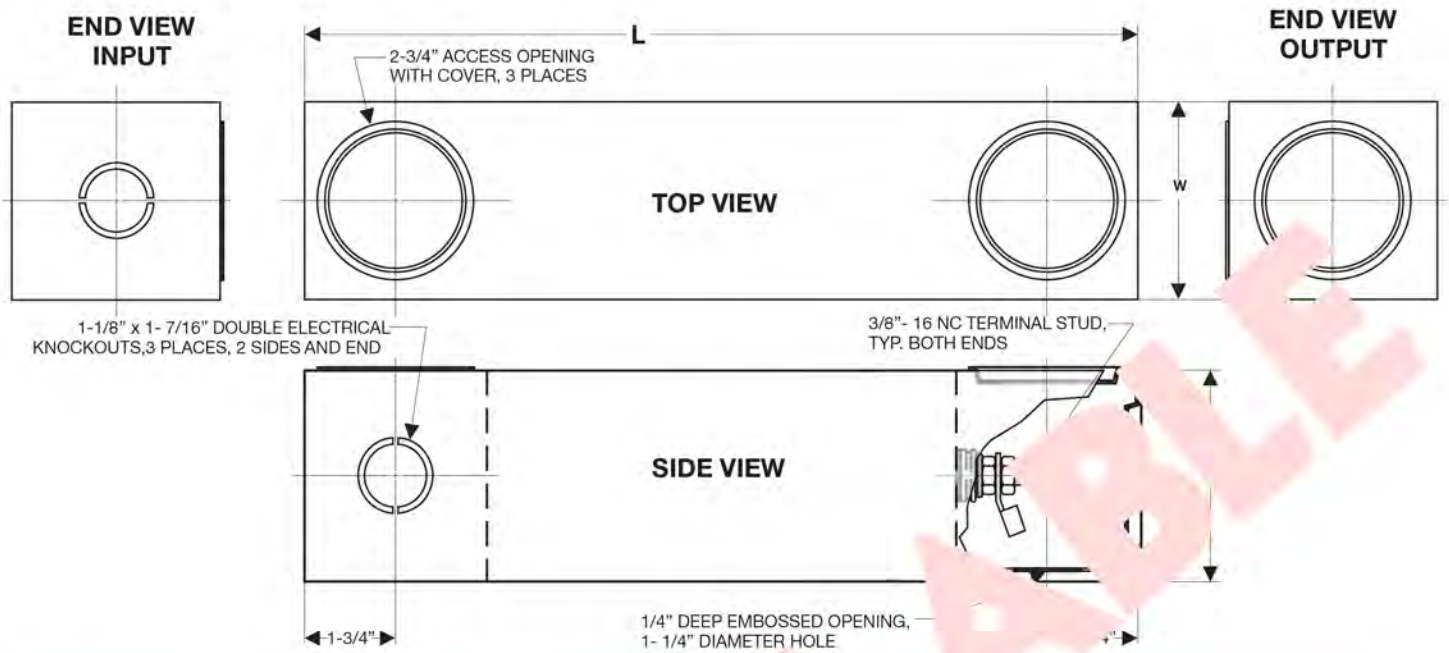
H = 4.0"
W = 11.25"
L = SEE CHART

MAXIMUM CURRENT (AMPERES)	CURVE A (100 Db @ 14 KhZ)			CURVE B (100 Db @ 30 KhZ)			CURVE C (100 Db @ 100 KhZ)		
	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS	PART NUMBER	L"	APPROXIMATE WEIGHT, LBS
3 x 20	WCF202A3	20	57	WCF202B3	16	42	WCF202C3	16	27
3 x 30	WCF302A3	20	63	WCF302B3	16	48	WCF302C3	16	33
3 x 50	WCF502A3	25	75	WCF502B3	20	60	WCF502C3	20	45
3 x 75	WCF752A3	25	78	WCF752B3	20	63	WCF752C3	20	48
3 x 100	WCF1002A3	28	105	WCF1002B3	25	90	WCF1002C3	20	75

UNAVAILABLE

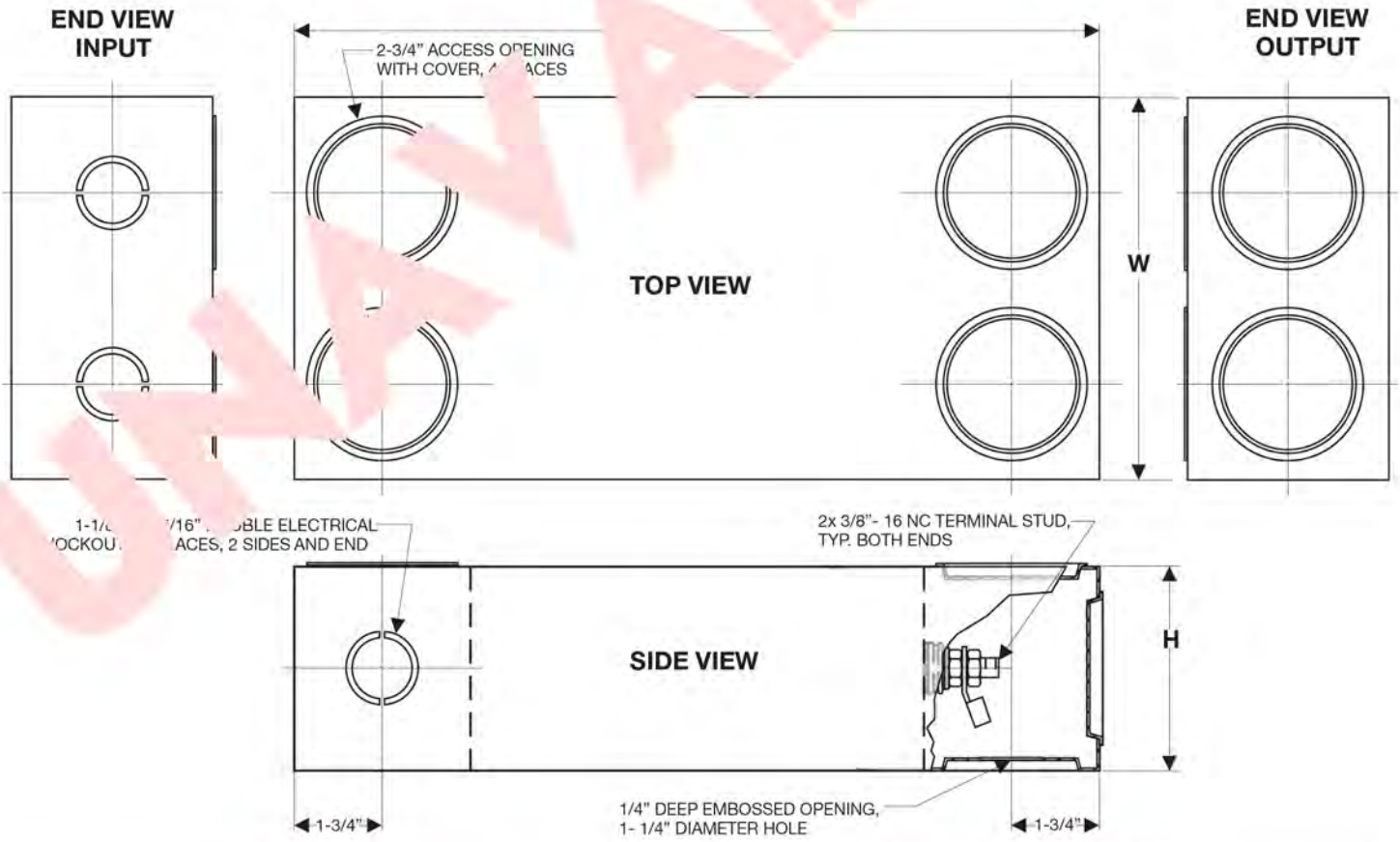
Single Circuit

Detailed dimensions are listed in table on page 30.



Dual Circuit

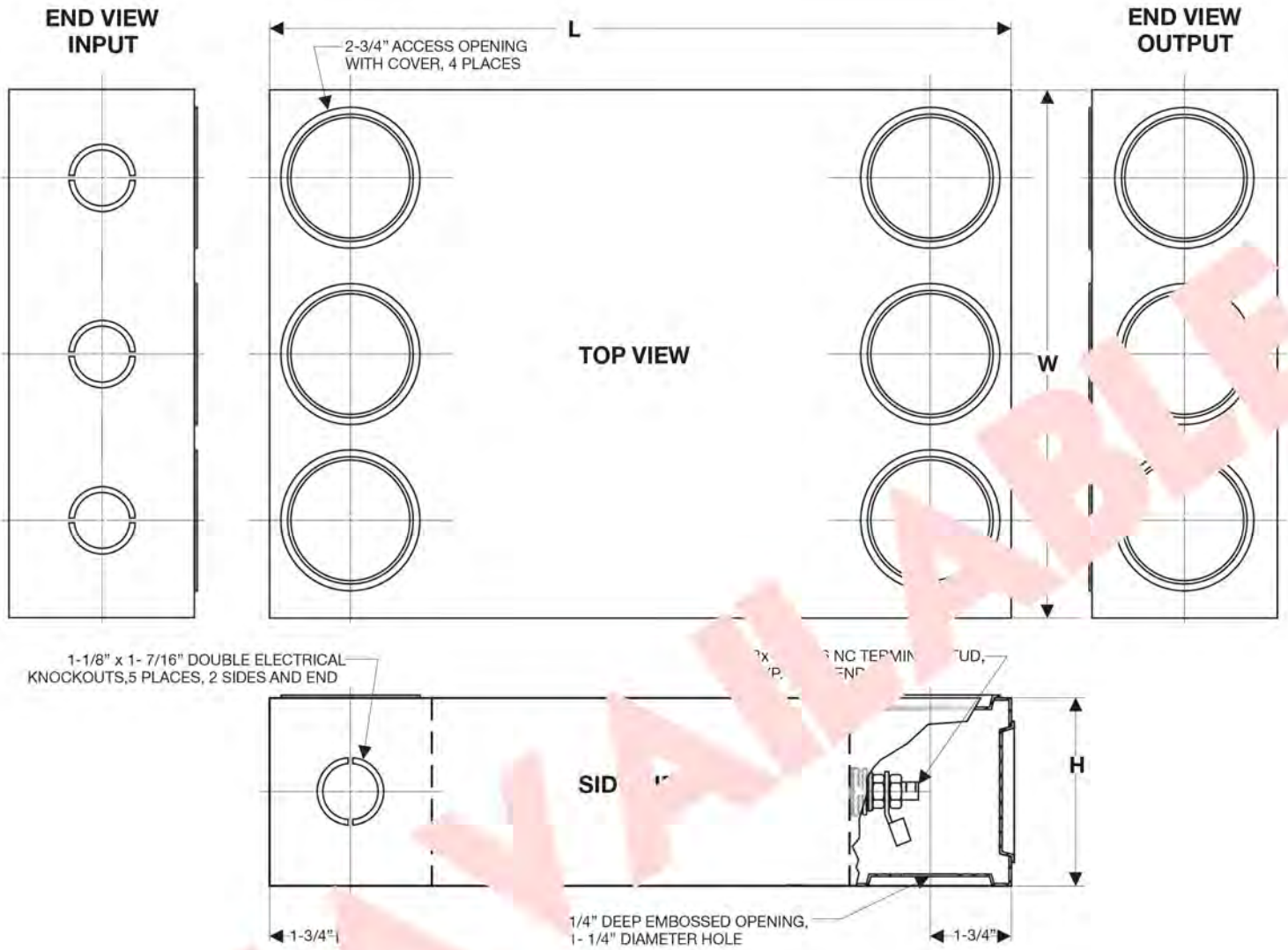
Detailed dimensions are listed in table on page 30.



UNAVAILABLE

Triple Circuit

Detailed dimensions are listed in table on page 30.



Applications

WEMS ... Filters are offered in 45 standard models. These proven power line filters are rated from 20 ... amperes. Filters are available for use on single, dual and triple circuits offering a substantial savings in ... ces wh... total ... wer requirements reach this circuit level. Special coil designs within each filter offer maximum heat dissi... on wh... operating requirements are constant and load conditions are at full rating.

Covers to terminal compartments are easily removed for installation, maintenance or inspection purposes. Covers reseat tightly to maintain proper shielding. Convenient knockouts are placed at readily accessible locations for required access to the terminal areas. Hermetically sealed cases are fabricated from 16 gauge cold rolled steel and electro tin-lead plated. Terminal hardware is provided with each filter.

UNAVAILABLE

Why do you need an EMI Filter?

Electromagnetic compatibility (EMC) engineers use the concept of "noise" to describe the unwanted signals that degrade the performance of electronic equipment. In avionic applications, both external and internal sources of EMI noise can jam sensitive navigation and tactical equipment, possibly even disrupting control of the aircraft. An aircraft carrier's massive electronics bay might cause interference that scuttles a take-off or landing. EMI affecting satellite transmissions can cause communication failures on the battleground. For these reasons, EMI is considered a serious problem, and numerous technologies and techniques have been developed to insure electromagnetic compatibility (EMC) in data transmission systems—from shipboard to undersea, from avionics to space, from aircraft carriers to micro unmanned aerial vehicles.

Sources of EMI

Sources of EMI "noise" can be grouped into three categories: 1) Intrinsic noise that arises from random fluctuations within physical systems, such as thermal and shot noise, 2) Man-made noise from motors, switches, power supplies, digital electronics and radio transmitters, and 3) Noise from natural disturbances such as electro-static discharge (ESD), lightning and sunspots.

Intrinsic

Intrinsic noise sources can be very subtle and often go unrecognized. All electrical systems are potential sources of intrinsic noise, including such common devices as portable radios, MP3 players, cell phones and so on. These devices can cause interference simply by being on. This is because electrons within a conducting media or a semiconductor device create current flow when excited by external voltages. When the externally applied voltage stops, electrons continue to move, randomly interacting with other electrons and with the surrounding material. This random electron motion can create noise in conducting media even without current flow.

Man-made

To protect avionics systems from man-made noise, intentional radio frequency (RF) emitters like cell phones, Bluetooth accessories, CB radios, remote-controlled toys, and walkie-talkies are banned outright on commercial airline flights. Laptops, hand held scanners and game players, while not intentional emitters, can produce signals in the 1 MHz range that can affect performance of avionic equipment. Navigation cabling and other critical wiring runs along the fuselage with passengers sitting just a few feet away. Since the thin sheet of dielectric material that forms the interior of the passenger compartment— typically fiberglass—offers no shielding whatsoever; and since commercial passenger jets contain up to 150 miles of electrical wiring that can behave like a giant antenna, it is extremely important for passengers to heed regulations on the use of potentially disruptive electronic equipment.

Obviously, these internal sources of EMI are quite dangerous to aircraft because they are so close to the systems they might affect. But external sources, such as radio and radar transmitters on the ground, or radar from a passing military plane, cockpit avionics are susceptible to multiple sources of EMI including man-made interference from iPhones® and other PEDs can be even more disruptive due to the high power and frequency of such equipment. As if the many external and internal sources of EMI were not enough of a concern, the aluminum airframe itself, in certain circumstances, can act as a resonant cavity in the 1 to 10 MHz range. Behaving much like a satellite dish, the airframe can compound the effects of both internal and external EMI by concentrating man made and naturally-occurring transient signals and broadcasting the interference into nearby equipment. A recently released report from a major aircraft manufacturer illustrates the ongoing concern with passenger-carried portable electronic devices (PED). The number of these devices on commercial airplanes has mushroomed, particularly with the advents of new classes of laptop devices such as the Apple iPad.

The use of PEDs produces uncontrolled electromagnetic emissions that have the potential to interfere with avionic systems. While aircraft avionics gear is tested and qualified to rigorous electromagnetic standards PEDs are not subjected to even a fraction of the same testing and qualification regimens for electromagnetic compatibility. As system speeds have increased, the voltage levels of data signals have necessarily decreased, making them much more susceptible to performance degradation by unwanted electronic noise—particularly the combined noise of large numbers of PED's operating within a single aircraft.

The frequency bands used by avionic systems span the electromagnetic spectrum from a few kilohertz to several gigahertz. At the low end, Omega Navigation, which is used to fix aircraft position within a network of ground based transmitters, operates in the frequency range of 10 to 14 KHz. VHF Omnidirectional Range Finders (VOR) are radio beacons used in point to point navigation. They operate from 108 to 118 MHz. Glideslope Systems used during landings operate in the 328 to 335 MHz range. Distance-Measuring Equipment (DME), which gauges the space between the aircraft and ground-based transponders operate at just over 1 GHz. Also in the spectrum above 1 GHz are global positioning, collision avoidance, and cockpit weather radar systems. Personal Electronic Devices (PEDs) operate at frequencies from 10 to 15 KHz for AM radios and up to 400 MHz for laptop computers. When the higher harmonics of these signals are taken into account, the emitted frequencies cover almost the entire range of navigation and communication frequencies used on the aircraft, and PEDs, are just a single class of EMI emitters. When the full spectrum of other radiated and conducted EMI emitters are taken into account, it becomes clear that the entire system of electronic equipment aboard commercial and military aircraft are at risk to EMI.

Naturally

Naturally occurring noise sources such as ESD, lightning or other energy surges also present significant life safety and equipment damage potential. A poorly grounded device can transmit dangerous energy from a transient surge to a technician, user or any other passerby. Sensitive semiconductors and other components can be damaged or destroyed. Solutions to naturally occurring noise include:

- Eliminate static buildup at the source
- Insulate the device properly
- Provide an alternative path for the discharge or surge to bypass the circuit
- Use of EMI Filters with Transient Suppression

In conclusion, it is becoming more and more apparent that EMI/EMC is a growing concern for both the military and commercial industries for all forms of electronic equipment. In response to the increasing demand for low-cost and effective EMI/EMC solutions, WEMS Electronics is here to solve your most challenging requirements and would welcome any opportunity to demonstrate our expertise on your new & upgrade program requirements.

Multi-Circuit Filters

Applications

WEMS Electronics multi-circuit filters and filter assemblies are custom designed and engineered to specific customer requirements intended for system compliance to:

- MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.
- MIL-STD-704 - Aircraft Electric Power Transient Voltage Characteristics.
- MIL-STD-1275 - Transient Voltage Characteristics and Steady State Limit of the 28VDC Circuits of Military Vehicles.
- DO-160 - Environmental Conditio--ns and Test Procedures for Airborne Equipment is a standard for the environmental testing of avionics hardware. It is published by the Radio Technical Commission for Aeronautics (RTCA).

Multi-circuit filters utilize the same high reliability assembly processes and component construction developed by WEMS Electronics for their standard military and aerospace product lines. The internal components in the filter assemblies can be as specified in MIL-PRF-123, MILPRF- 15733, MIL-PRF-28861, QPL listed, or as dictated by the customer's source control drawings or specific application. The multi-circuit filter concept offers a unique means of combining power line and signal line components into a single package, thus reducing the number of discrete components and assembly processes.

Characteristics

Applications: Custom designed and engineered to specific customer requirements. Power entry modules containing up to 300 power and signal line circuits providing effective filtering from 10 kHz to 10 GHz.

Construction: Fabricated, drawn, or machined steel, brass, or aluminum housings. The physical size is determined by the quantity and type of circuits. Metallic and non-metallic assemblies intended for printed circuit board installations. Unique mounting schemes utilizing connectors, threads rods, blind inserts, fasteners, brackets, and flanges.

Finish Options: Electro-tin plated, gold plated, chem film, anodized or painted finishes.

Hermeticity: Hermetically sealed and non-hermetically sealed designs depending on input and output terminations.

Input/Output Terminations: Military and/or commercial connectors, ceramic or glass seal terminals, solder/screw terminals, PWB mounting, flying leads, flex cables, coaxial cables, fiber optic cables, wire harnesses, or any combination thereof.

Specifications

Circuits: C, L, T, PI, or any combination for both common mode and differential mode filtering. Capacitor dielectrics and inductor magnetics are selected based on application.

Voltages: Multiple ratings up to 1000 VDC, 125/250 VAC, 50 to 400 Hz. Higher voltages, including corona requirements, are evaluated on an individual basis.

Current: Continuous operating current for the individual circuits can be rated up to 100 amperes, AC or DC. Higher operating values are evaluated on an individual basis.

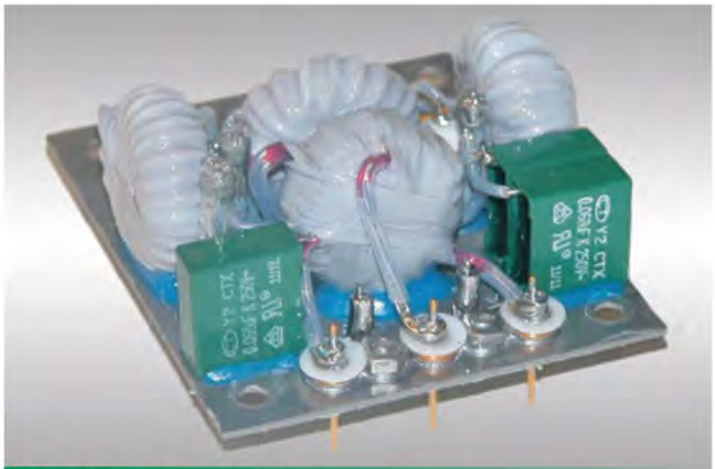
Circuit Protection: EDS, lightning, transient, HEMP, and EMP protection can be included as an integral part of the multi-circuit filter assembly.

Other Components: Additional non-filtering components such as flx cables, wiring harnesses, fused, circuit breakers, switches, relays, and receptacles can be incorporated into the multi-circuit assembly to create a complete power entry module.

Environmental: Capable of meeting the applicable portions of MIL-STD-202, MIL-STD-801, EIA-364, and similar environmental requirements.

EMI/EMC: Engineered and designed for system compliance to MIL-STD-461 or similar conducted emission and susceptibility specifications.

The following pages contain just a brief portion of our custom designed and manufactured filters.



PC Mount, 3 Ø AC Filter



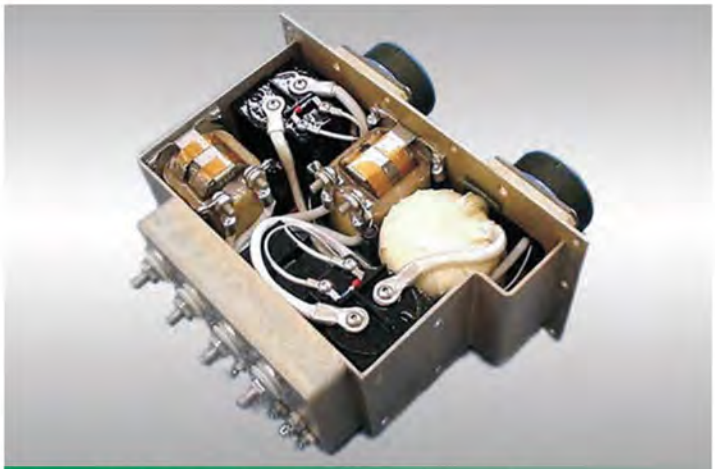
AC to DC Filter for Commercial Aircraft



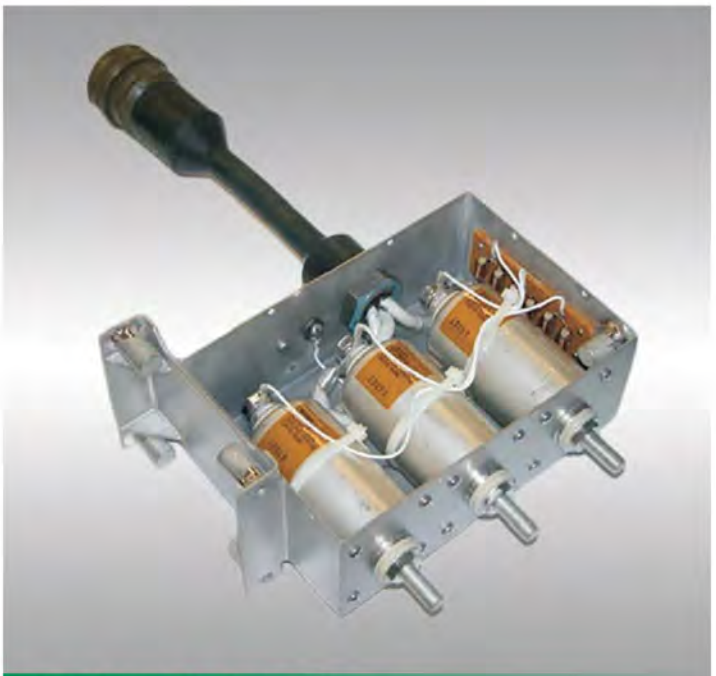
DC Filter for Classified Satellite Program



DC Filter with Connector Harness



Power Unit Filter for the Military Aircraft



3 Ø AC Filter for Radar System



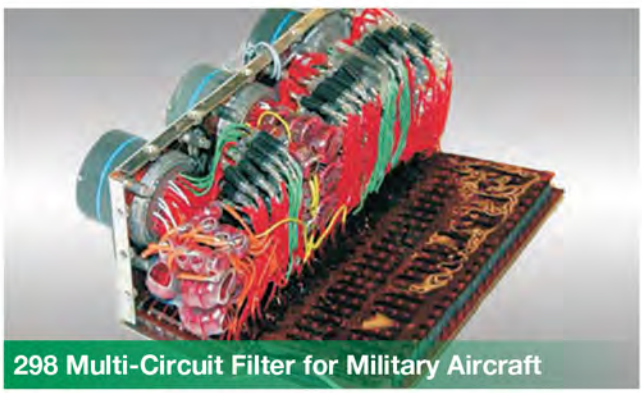
AC/DC Filter for Central Power Supply



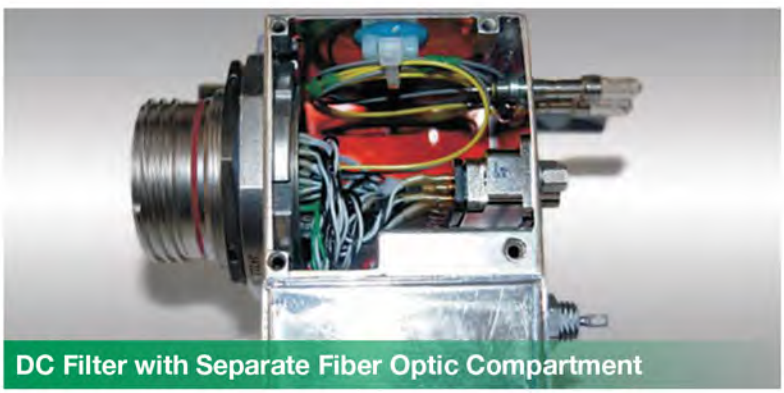
DC Filter for Classifed Program



EMI Filter Module for Space Launch Vehicle



298 Multi-Circuit Filter for Military Aircraft



DC Filter with Separate Fiber Optic Compartment



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