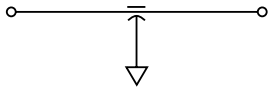
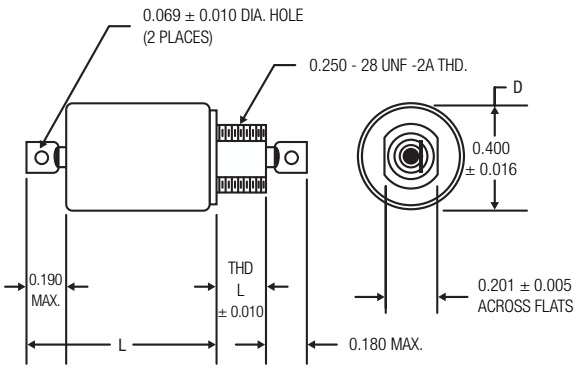
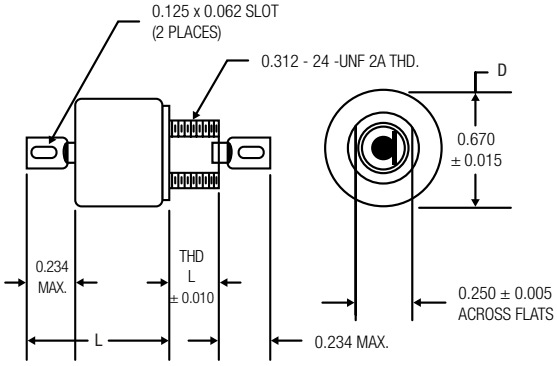
C (20 dB / DECADE)



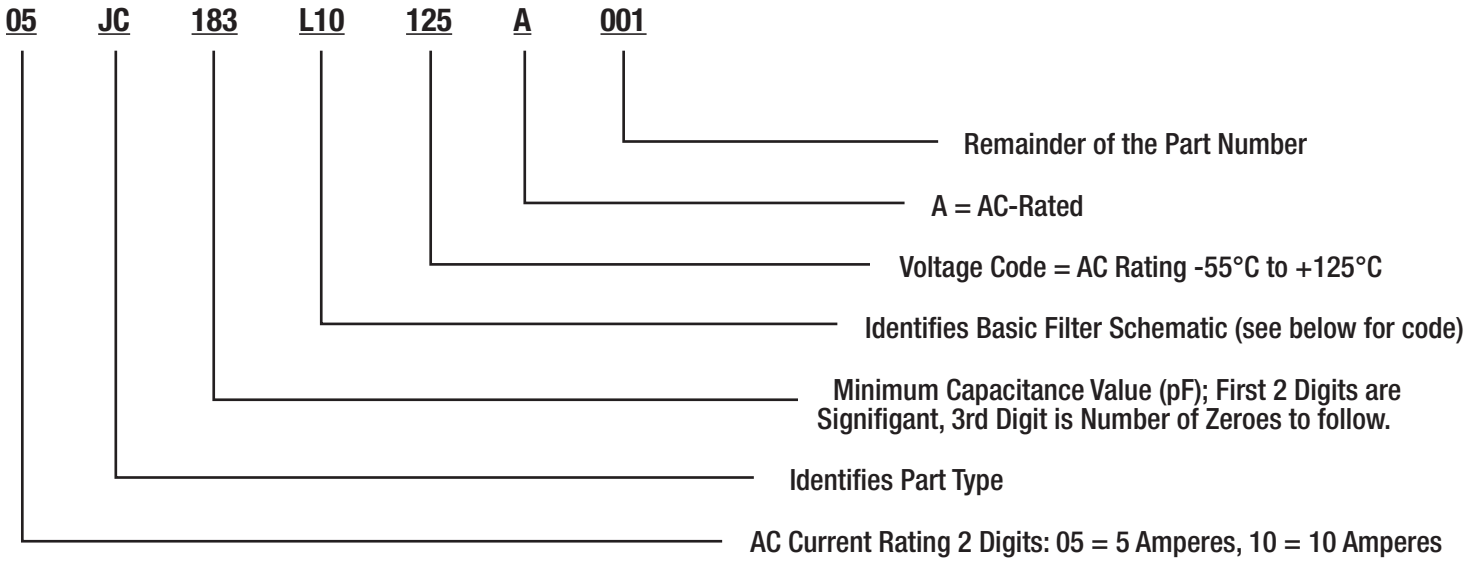




Current Rating (A)	DC Voltage Rating @85°C DC (V)	DC Voltage Rating @125°C DC (V)	DC Voltage Rating @125°C 400Hz (V)	D (in.)	Max. L (in.)	Thd. L (in.)	Min. Cap. (µF)	Max. R_{DC} (Ω)	Minimum Insertion Loss +25°C per MIL-STD-220 30kHz (dB)	75kHz (dB)	100kHz (dB)	150kHz (dB)	1MHz (dB)	10MHz (dB)	1GHz (dB)	Dearborn Part Number
5.0	250	150	125	0.400	0.440	0.187	0.25	0.01	-	11	14	17	32	50	70	5JX3502
5.0	250	150	125	0.400	0.440	0.312	0.25	0.01	-	9.0	11	15	30	50	70	5JX3102
5.0	300	150	125	0.400	0.440	0.187	0.15	0.01	-	-	5.0	7.0	22	44	60	5JX3501
5.0	300	150	125	0.400	0.440	0.312	0.1	0.01	-	-	4.0	7.0	22	42	70	5JX3101
10	300	200	125	0.400	0.440	0.312	0.1	0.004	-	-	4.0	8.0	24	42	70	10JX2141
15	250	150	125	0.400	0.440	0.187	0.25	0.004	-	8.0	12	15	30	60	70	15JX3503
15	250	150	125	0.400	0.545	0.187	0.25	0.004	-	10	13	16	31	50	60	15JX2585
15	300	150	125	0.400	0.390	0.312	0.15	0.005	-	-	5.0	7.0	24	44	70	15JX2137
15	400	300	230	0.400	0.440	0.187	0.04	0.004	-	-	-	-	16	36	70	15JX3508
15	450	300	230	0.670	0.690	0.312	0.3	0.005	-	12	14	18	34	44	70	15JX3103

AC-RATED
CERAMIC EMI-RFI FILTERS

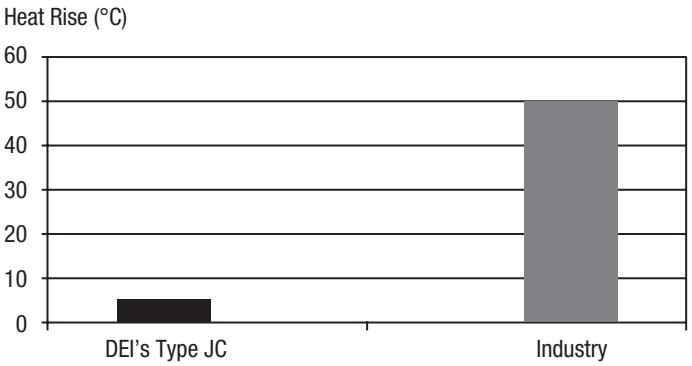
EXAMPLE:



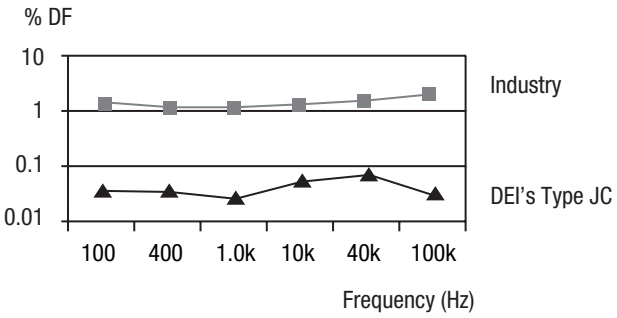
CODE FOR FILTER TYPES

Filter Type	P/N Code
C	C00
L1	L10
L2	L20
Pi	P00
T	T00
LL1	LL1
LL2	LL2

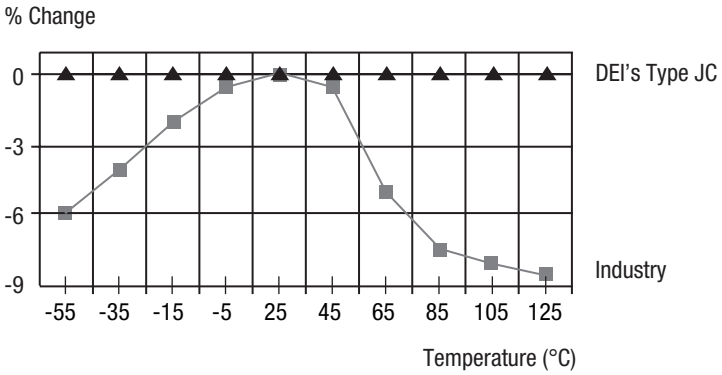
400Hz HEAT RISE 125 V AC @+125°C



DF @+125°C VS. FREQUENCY

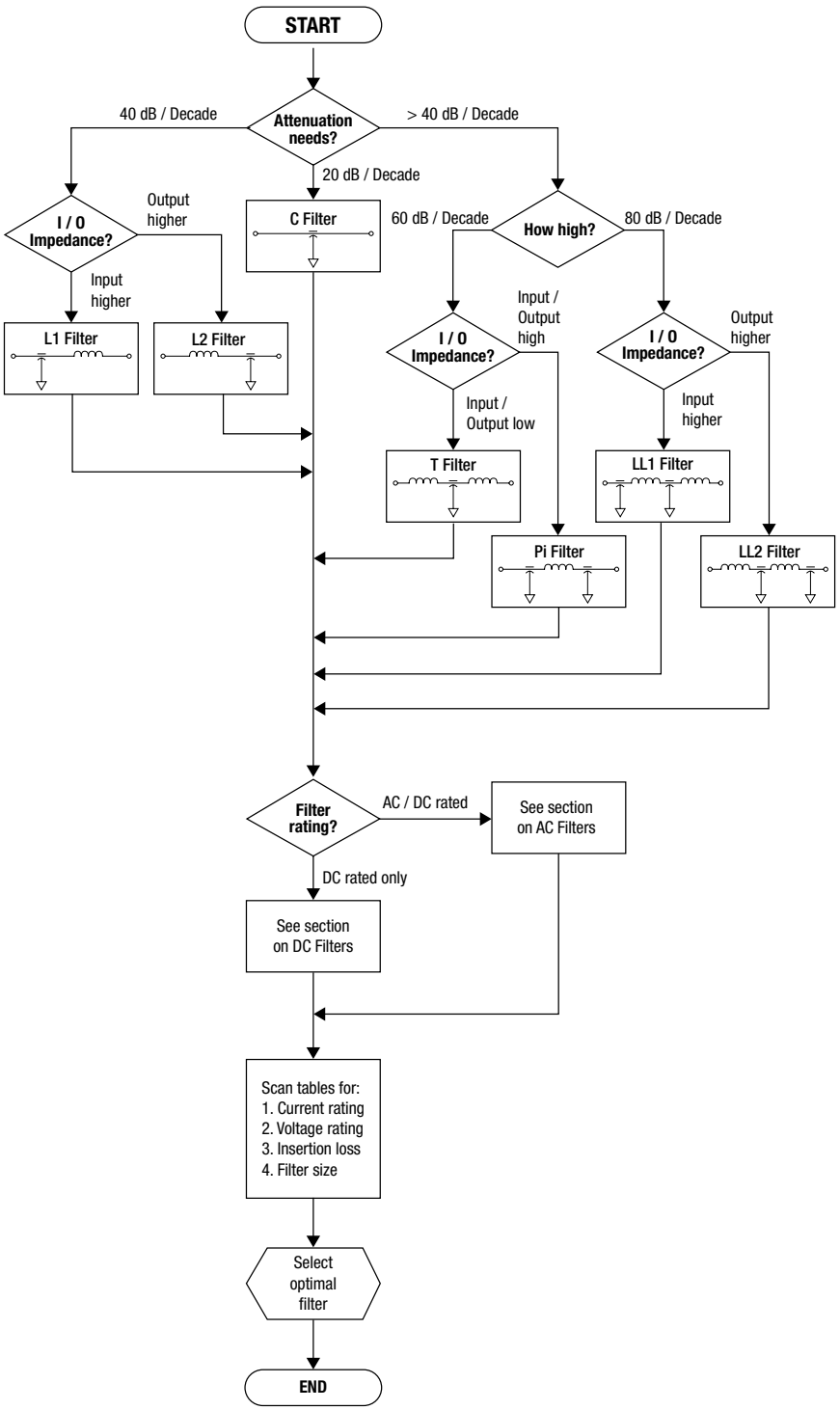


CAP CHANGE VS. TEMPERATURE



FILTER SELECTION

This catalog is designed to simplify filter selection, taking the user from basic needs of voltage, current, and circuit style through the process of specifying a filter part number. The flow chart below illustrates typical selection procedure.



CIRCUIT CONFIGURATIONS

Subminiature filters are passive devices, and their effects are bidirectional. They are all low-pass brute force devices, passing power line frequencies with very low losses while attenuating energy at higher frequencies. They do not differentiate between interference or other electrical energy generated inside or outside a device. They are equally effective in reducing electrical noise going to or coming from a device.

The table below gives operating current and voltage ranges for each of the standard filter configurations shown in this catalog.

Filter Type	AC/DC-Rated Filters				DC-Rated Filters		
	Current Range (A)	+85°C	+125°C		Current Range (A)	+85°C	+125°C
		(VDC)	(VDC)	(VAC)		(VDC)	(VDC)
C	5.0-15	175-600	100-600	50-230	5.0-15	100-500	50-250
L	0.05-20	100-450	50-300	26-230	0.001-20	100-600	50-300
Pi	0.01-15	150-600	150-300	125-240	0.001-10	100-300	50-200
T	0.06-10	250-500	150-300	125-230	0.06-15	100-300	50-250
LL	0.1-3.0	250	150	125	0.1-3.0	100	50

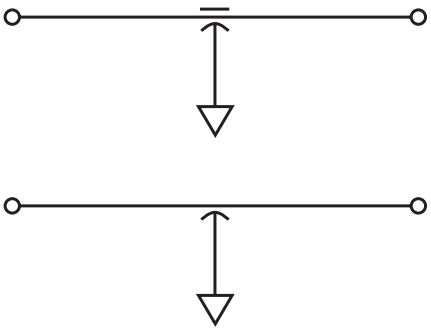
C-CIRCUIT

A single element, a capacitor from line to ground, with a through wire connecting the input to output. It has attenuation characteristics that increase at 20 dB per decade from its cutoff frequency to at least that frequency where it exhibits a minimum attenuation of 60 dB. It maintains this attenuation at higher frequencies.

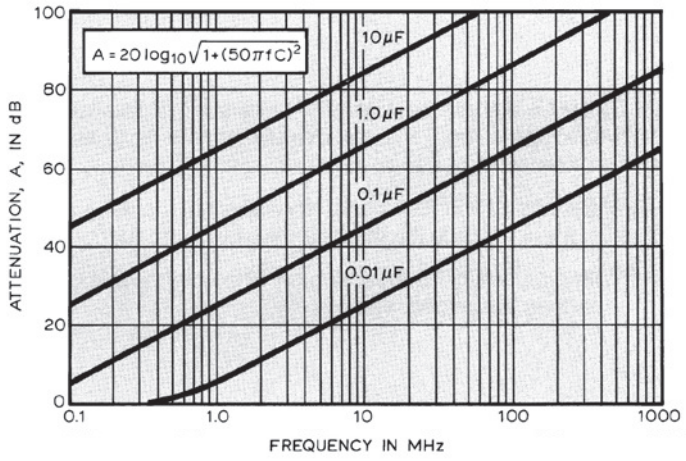
A feedthrough capacitor filter is usually the best choice for filtering lines that exhibit very high impedance. Its schematic symbol and its attenuation characteristics are shown below. A feedthrough capacitor, in this catalog, will be referred to as a **C** filter.

C-Only Filters are the choice for very high impedance lines.

C FILTERS



ATTENUATION CHARACTERISTICS FOR IDEAL CAPACITORS AT 50 Ω IMPEDANCE, PER MIL-STD-220



L CIRCUIT

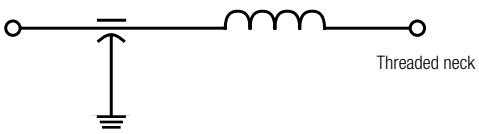
Two elements: a feedthrough capacitor from line to ground, and an inductor connected in series with it between the input and output terminals. The capacitive element can be placed on either the line or load side of the filter, making it either a capacitive or inductive input. Its attenuation increases at 40 dB per decade from its cutoff frequency to at least that frequency where it exhibits a minimum attenuation of 70 dB. It maintains this level at higher frequencies.

Schematic symbols and typical attenuation characteristics are shown below. They are commonly referred to as **L** filters. **L1** indicates that the inductive element is on the end with the threaded mounting neck. **L2** indicates that the capacitive element is on the end with the threaded mounting neck.

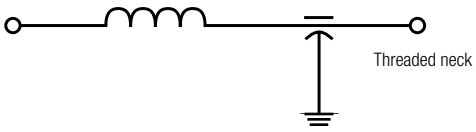
L-Only Filters or LL are used when the difference between line and load impedance is large. The inductive element is best placed so that it faces the lower impedance.

L CIRCUIT FILTERS

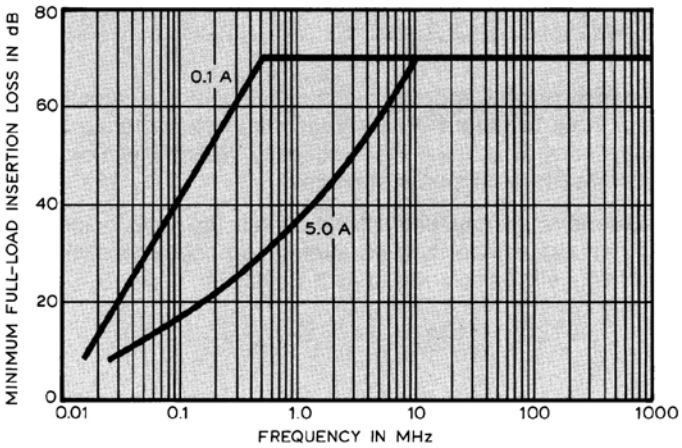
L1



L2



TYPICAL ATTENUATION CHARACTERISTICS



Pi CIRCUIT

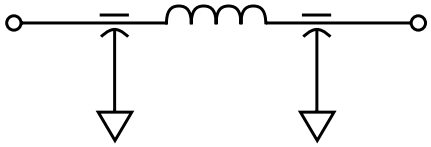
A three-section filter consisting of two feedthrough capacitors to ground with a series inductor between them. The Pi filter is usually symmetrical, as are all the Pi filters in this catalog, but circumstances sometimes warrant use of asymmetrical Pi circuits.

A Pi filter has attenuation characteristics that increase at 60 dB per decade from its cutoff frequency to at least that frequency where it exhibits a minimum attenuation of 80 dB. It maintains this level at higher frequencies.

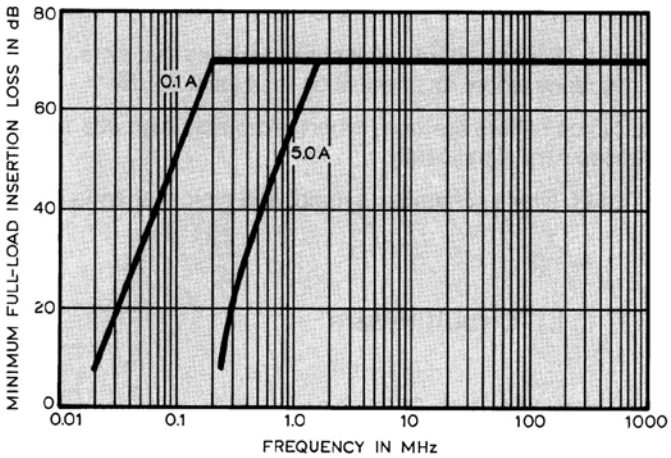
Pi-Only Filters are the choice when high levels of attenuation are required and both the input & output impedances are similar.

The Pi filter's schematic symbol and typical attenuation characteristics are shown below:

Pi CIRCUIT FILTERS



TYPICAL ATTENUATION CHARACTERISTICS



CIRCUIT CONFIGURATIONS

T CIRCUIT

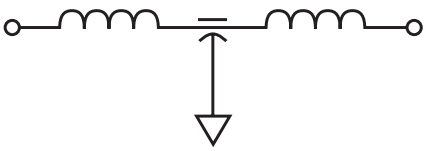
A three-section filter consisting of two series-connected inductors between the input and output terminals, with a feedthrough capacitor between them from line to ground. The T filter is usually symmetrical (identical inductive elements), but circumstances sometimes warrant use of asymmetrical circuits.

A T filter has attenuation characteristics that increase at 60 dB from its cutoff frequency to at least that frequency where it exhibits a minimum attenuation of 60 dB.

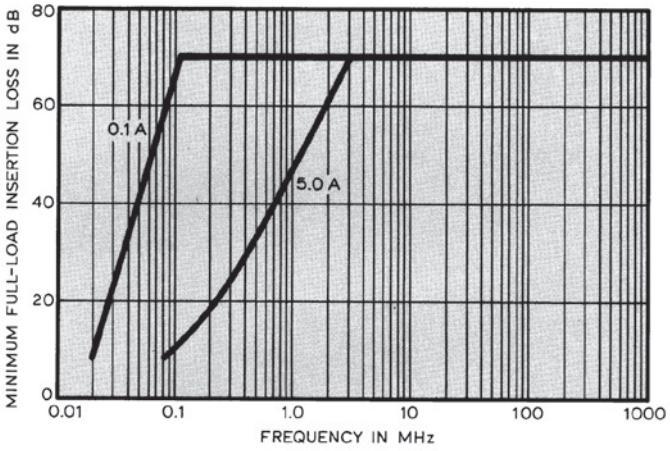
The schematic symbol and typical attenuation characteristics are shown below:

T-Only Filters are the choice when both the input and output impedances are low.

T CIRCUIT FILTERS



TYPICAL ATTENUATION CHARACTERISTICS



LL CIRCUIT

Four-section filter consisting of two feedthrough capacitors connected between line and ground with two interspersed inductors connected in series with them between the input and output terminals. The **LL** filter is usually made with identical capacitor and inductor elements.

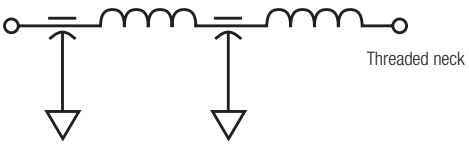
LL1 filters have an inductive element closest to the end with the threaded mounting neck. **LL2** filters have a capacitive element adjacent to the end with the threaded mounting neck. An **LL** filter has attenuation characteristics that increase at 80 dB per decade from its cutoff frequency to that frequency where its attenuation is at least 80 dB.

The **LL** filter's schematic symbol and typical attenuation characteristics are shown below:

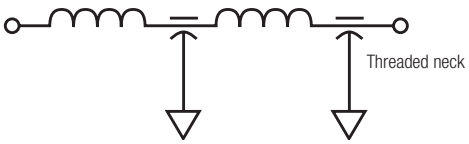
LL-Only Filters should only be selected when extremely high attenuation is required and when the input & output impedances vary significantly.

LL CIRCUIT FILTERS

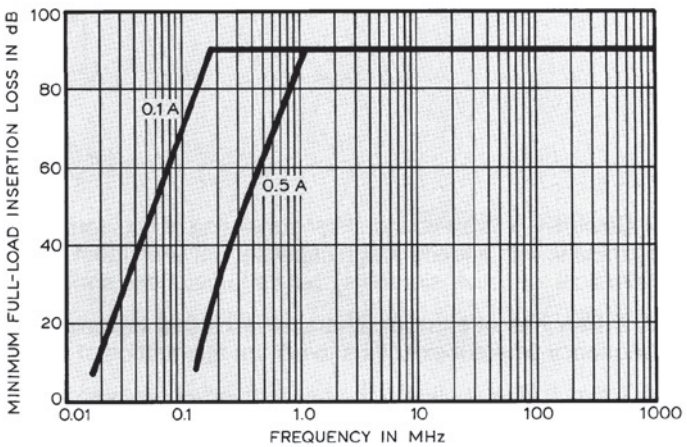
LL1



LL2



TYPICAL ATTENUATION CHARACTERISTICS



INSTALLATION GUIDELINES

WHEN INSTALLING AN EMI FILTER FOR ANY PURPOSE, OBSERVE THESE BASIC RULES:

- The filter's metal case must make direct, low-resistance contact with the metal chassis, cabinet, or groundplane.
- Ground connections should be physically short and should exhibit the lowest possible rf impedance. Never use wires for rf grounds.
- The filter's input and output leads should be physically separated to provide the greatest amount of electrical isolation possible.
- Mount the filter as close as possible to the point power lines egress from the device being filtered. At any point of penetration through the device's electrical shield, make sure the shield's continuity is maintained. In every instance, the preferred installation technique is "bulkhead" mount.
- Maximum installation torque is as follows:

Thread Size	Maximum Torque
1/4 - 28	48 in/ounces
5/16 - 24	64 in/ounces

ABBREVIATIONS & TERMS

ATTENUATION

The decrease in amplitude of electricity (voltage, current, or power) in the stop-band of a filter, referenced to the amplitude without the filter. It is generally measured at a standard 50 Ω impedance and expressed in decibels (dB).

CONDUCTED INTERFERENCE

Undesirable electrical energy emitted by a device. The interference appears on power, signal, or control leads of the device and disrupts or degrades its performance or that of another device. Limits of conducted interference levels are generally defined by law or regulation.

CONDUCTED SUSCEPTIBILITY

A measure of the interference signal level (voltage or current) on power, signal or control leads required to cause an undesirable response or to degrade performance of a device.

DECADE

A frequency ratio of 10 to 1.

EMI

Electromagnetic interference or unwanted electrical energy in any form.

FILTER

To restrict or control electrical energy over a frequency range, or a device for doing so.

FREQUENCY SUBDIVISIONS

VLF (Very Low) ..... 3kHz to 30kHz
LF (Low) ..... 30kHz to 300kHz
MF (Medium) ..... 300kHz to 3MHz
HF (High) ..... 3MHz to 30MHz
VHF (Very High) ..... 30MHz to 300MHz
UHF (Ultra High) ..... 300MHz to 3GHz
SHF (Super High) ..... 3GHz to 30GHz
EHF (Extremely High) ..... 30GHz to 300GHz

INSERTION LOSS

The decrease in amplitude of electricity (voltage, current, or power) in the pass-band of a filter, referenced to the amplitude without the filter. It is generally measured at a standard 50Ω impedance and expressed in decibels (dB).

INSULATION RESISTANCE

Or IR, usually the value of the DC resistance from a conducting element to the case of a filter, extrapolated from measurement of DC current flow driven by a pure and precise DC voltage applied between the filter's terminals and its case.

LEAKAGE CURRENT

Or leakage, usually the algebraic sum of reactive currents flowing through the filter's capacitors to ground.

MIL-B-5087

U.S. Government document that specifies bonding, electrical and lightning protection for aerospace systems.

MIL-E-6051

U.S. Government document that specifies electromagnetic compatibility requirements for systems.

MIL-PRF-15733

U.S. Government document for general specification of filters and capacitors for control of radio-frequency interference.

MIL-PRF-28861

U.S. Government document for general specification of filters and capacitors for suppression of radio-frequency and electromagnetic interference.

MIL-HDBK-235 (NAVY)

U.S. Government document that specifies electromagnetic (radiated) environment considerations for design and procurement of electrical and electronic equipment.

MIL-HDBK-237

U.S. Government document that specifies electromagnetic compatibility program requirements.

MIL-STD-202

U.S. Government document that specifies test methods for electronic and electrical components.

MIL-STD-220

U.S. Government document that specifies methods of insertion loss measurement for radio-frequency filters.

MIL-STD-461

U.S. Government document that specifies electromagnetic interference requirements for equipment.

MIL-STD-462

U.S. Government document that specifies measurement of electromagnetic interference characteristics.

MIL-STD-469

U.S. Government document that specifies radar engineering design requirements for electromagnetic compatibility.

NOISE

Generic term for undesirable electrical energy.

OCTAVE

A frequency ratio of 2 to 1.

RADHAZ

Hazard presented by electromagnetic radiation to fuels, electronic hardware, ordnance, or personnel.

RADIATED INTERFERENCE

Undesirable electrical energy that radiates from a device or its leads, coupled for measurement purposes to a standard test antenna and receiver. Limits of radiated interference levels are generally defined by law or regulation.

RADIATED SUSCEPTIBILITY

A measure of radiated interference level required to cause an undesirable response or to degrade the performance of a device.

RADIATION

The emission of energy in the form of electromagnetic waves.

RFI

Radio-frequency interference, an older, somewhat restrictive term generally used interchangeably with “EMI.”

RI

Radio interference, an even older and more restrictive term for “EMI.”

TEST PROCEDURES

All filters in this catalog are capable of passing the following tests in tables I & II without physical damage or electrical degradation, except as noted. The following documents are applicable to this specification: MIL-STD-202, MIL-STD-220, MIL-PRF-15733, and MIL-PRF-28861.

TABLE I

TEST PROCEDURES

Test	Quality Level/Sample Requirement			Test Method (MIL-STD-202 unless otherwise specified)
	MIL-PRF-15733	MIL-PRF-28861		
		Class B	Class S	
Thermal Shock	100% (Note 1)	100%	100%	Method 107, Condition A (-55°C to +125°C, 5 cycles)
Voltage Conditioning	100% (Note 2)	100%	100%	Per MIL-PRF-28861, or 168 hours at 1.2 x AC voltage rating or 2 x DC rating (Note 3)
Dielectric Withstanding Voltage	1% AQL	100%	100%	Method 301 (2.5 x DC voltage rating)
Insulation Resistance at +25°C	1% AQL	100%	100%	Method 302 (At rated DC voltage)
Capacitance to Ground	1% AQL	100%	100%	Method 305 (1.2 Vrms, maximum, at f=1kHz)
Insertion Loss	1% AQL	100%	100%	MIL-STD-220
DC Resistance	1% AQL	100%	100%	Method 303
DC Voltage Drop	1% AQL	None	None	MIL-PRF-15733, Para. 4.6.8
X-Ray	(Note 4)	100%	100%	Method 209
Case Seal	1% AQL	100%	100%	Method 112 MIL-PRF-15733, Condition A, or MIL-PRF-28861, Conditions A and C
Visual and Mechanical	1% AQL	1% AQL	1% AQL	Per detailed specification
Temperature Rise	4% AQL	None	None	MIL-PRF-15733, Para. 4.6.4
Current Overload	4% AQL	None	None	MIL-PRF-15733, Para. 4.6.10

NOTES:

1. Dearborn performs thermal shock test on all ceramic filters as part of the production process.
2. Dearborn conducts +125°C burn-in Tests on all Military QPL Filters for a minimum of 48 hours at 1.5 x DC voltage rating.
3. Includes +125°C test for insulation resistance during last 50 hours (for MIL-PRF-28861, at 0.2% PDA).
4. Except were selected specification sheets require 100% X-Ray.

TABLE II

Periodic Test	INSPECTION INTERVAL/ALLOWED FAILURES			Test Method (MIL-STD-202 unless otherwise specified)
	MIL-PRF-15733	MIL-PRF-28861		
		Class B	Class S	
AC Voltage Drop	Not required	90 days, 2 in 25	30 days, 0 in 5	MIL-PRF-28861, Para. 4.6.6
Voltage at Temperature, Capacitance Limits	Not required	90 days, 2 in 25	30 days, 0 in 5	MIL-PRF-28661, Para. 4.6.10
Insertion Loss at Temperature Extremes (Note1)	6 months, 1 in 4	90 days, 2 in 25	30 days, 0 in 5	MIL-PRF-15733, Para. 4.6.9 MIL-PRF-28861, Para. 4.6.5
Operation at Reduced Barometric Pressure (Note1)	6 months, 1 in 4	90 days, 2 in 25	30 days, 0 in 5	Method 105 MIL-PRF-15733,(50,000 ft. simulation) MIL-PRF-28861 (150,000 ft. simulation)
Salt Spray (Corrosion) (Note 1)	6 months, 1 in 4	90 days, 1 in 5	90 days, 0 in 5	Method 101 MIL-PRF-15733, Condition B MIL-PRF-28861, Condition A
Temperature Rise	Not required	90 days, 2 in 25	30 days, 0 in 5	MIL-PRF-28861, Para. 4.6.11
Current Overload	Not required	90 days, 2 in 25	30 days, 0 in 5	MIL-PRF-28861, Para. 4.6.14
Thermal Shock and Immersion (Note 2)	6 months, 1 in 4	90 days, 2 in 25	30 days, 0 in 5	Method 107, Condition A Method 104, Condition A
Resistance to Soldering Heat (Note 2)	6 months, 1 in 4	90 days, 1 in 5	90 days, 0 in 5	Method 210, Condition B
Resistance to Solvents (Note 2)	6 months, 1 in 4	90 days, 1 in 3	90 days, 0 in 3	Method 215
Terminal Strength (Note 2)	6 months, 1 in 4	90 days, 2 in 25	30 days, 0 in 5	Method 211, Condition A (5 lbs.)
Solderability	90 days, 1 in 0	90 days, 1 in 5	90 days, 0 in 5	Method 208
Life Test	90 days, 1 in 10	90 days, 1 in 10	90 days, 0 in 22	Method 108 MIL-PRF-15733, 250 hours MIL-PRF-28861, 1000 hours
Mechanical Shock	6 months, 1 in 4	6 months, 1 in 10	6 months, 0 in 5	Method 213 MIL-PRF-15733, condition K, 30 Gs MIL-PRF-28861, Class B, Condition I, 100 Gs MIL-PRF-28861, Class S, Condition F, 1500 Gs
High-Frequency Vibration	6 months, 1 in 4	6 months, 1 in 10	6 months, 0 in 5	Method 204 MIL-PRF-15733, Condition B, 15 Gs MIL-PRF-28861, Condition E, 50 Gs
Moisture Resistance	6 months, 1 in 4	6 months, 1 in 10	6 months, 0 in 5	Method 106
Destructive Physical Analysis	Not required	Not required	90 days	MIL-PRF-28861, Appendix B, 2 pieces

NOTES:

1. MIL-PRF-15733 allows one failure in four as a result of three tests: Insertion Loss, Barometric Pressure, Salt Spray.
2. MIL-PRF-15733 allows one failure in four as a result of four tests: Thermal Shock/Immersion, Resistance to Soldering Heat, Resistance to Solvents, Terminal Strength.