Tubular Filters

◆ Features - Lowpass

K&L has four different tubular lowpass filters ranging in size from .25 inch diameter to 1.25 inch diameter to cover the frequency range of 30MHz to 20GHz. K&L uses a .05dB Chebyshev design to yield low insertion loss in the passband and high attenuation levels in the stopband. The four basic sizes offer the user a choice in size and performance to best meet user needs. However, K&L recommends the use of the .50 inch diameter filter series for general application. This series has convenient size, broad frequency range, versatility of design, and is the most economical.

The two larger series, .75 inch diameter and 1.25 inch diameter, offer the user lower insertion loss, lower frequency operation, and higher power capabilities. The .25 inch diameter series offers the user miniature size and volume, higher frequency operation, and less weight.

◆ To Order

5 L121 - 350 / E3000 - O / OP
1 2 3 4 5 6 7 8 9

1. Number of sections
2. L-Lowpass
3. Model
   - 250 - .25"
   - 120 - .50"
   - 340 - .75"
   - 110 - 1.25"
4. Circuit structure
5. Cutoff frequency (MHz)
6. Supplemental codes (See page 17)
7. Upper frequency stopband limit (MHz)
8. Input connector
9. Output connector

◆ Mechanical

For sizes and connectors, see pages 69 and 70.

bular Filters

This series of curves defines the out-of-band attenuation, in dB, for K&L standard lowpass filters. The ratio is determined by dividing the out-of-band frequency by the 3dB frequency. Once the ratio is determined, the attenuation versus number of sections can be read directly from the curve.

EXAMPLE:
Reject frequency = 200MHz
3dB cutoff frequency = 125MHz
Number of sections = 4
The ratio equals

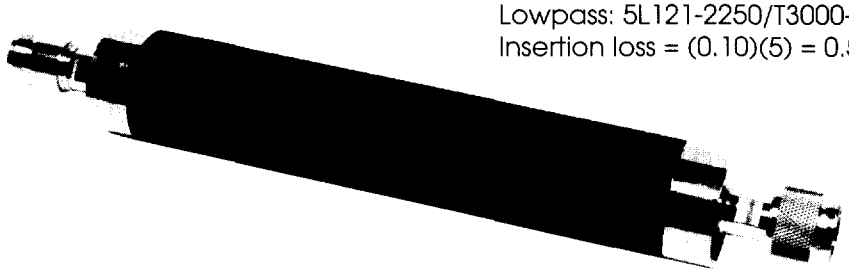
$$\frac{\text{Reject frequency}}{\text{3dB cutoff frequency}} = \frac{200}{125}$$

Ratio = 1.6
From the curve, a 4-section response equals 52dB.

◆ Insertion Loss

The insertion loss specification at 90% of the 3dB cutoff frequency is determined by the formula:
Loss = (Loss constant)(Number of sections)
For specification purposes, the result is always rounded up to the next tenth of a dB.

EXAMPLE:
Lowpass: 5L121-2250/T3000-O/O
Insertion loss = (0.10)(5) = 0.5dB

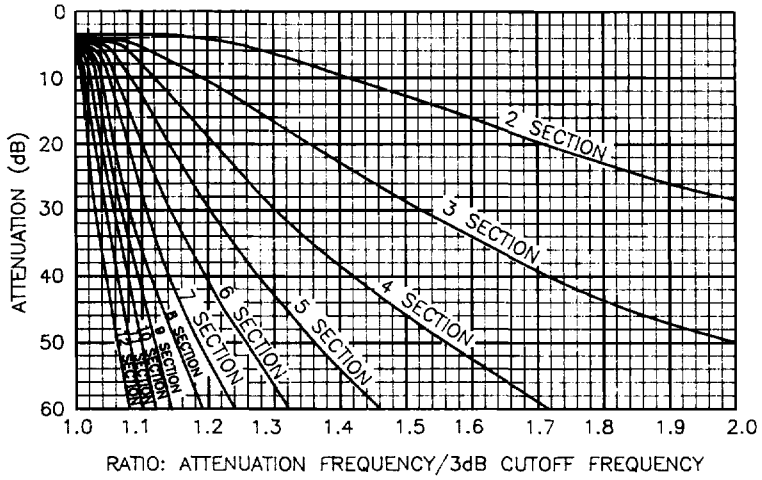


◆ Insertion Loss/Loss Constant

Loss Constant vs. Frequency vs. Model

	Frequency (MHz)						
Model	**30**	**51**	**101**	**401**	**1001**	**2001**	**4001**
	50	**100**	**400**	**1000**	**2000**	**4000**	**20000**
L250			.3	.25	.20	.18	.1
L120		.18	.16	.13	.11	.1	
L340	.18	.14	.13	.12	.11		
L110	.12	.09	.08	.07			

◆ Attenuation Curves



◆ Specifications - *Lowpass*

Model	Diameter Inches	Frequency Range (MHz)	VSWR	No. of Sections	Impedance (Ohms)	Average Power (Watts)	Shock	Vibration	Humidity	Temperature Range
L250	1/4	300-20000	1.5:1	2-10	50	2	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
L120*	1/2	60-3000	1.5:1	2-10	50 75	18	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
L340	3/4	40 2000	1.5:1	2-10	50 75	40	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
L110	1-1/4	30-1000	1.5:1	2-10	50 75	200	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C

* Most versatile, fits most applications

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Tubular Filters

◆ Features - *Bandpass*

K&L tubular bandpass filters are available in four different series ranging in size from .25 inch diameter to 1.25 inch diameter to cover the frequency range of 40MHz to 6.0GHz. K&L uses a .05dB Chebyshev design to yield low insertion loss in the passband and high attenuation levels in the stopband. The tubular filter design is made up of small resonating sections. These sections are capacitively coupled to provide the specified passband response and selectivity required. This coupling structure provides a DC block.

In choosing the best tubular filter to meet the user's needs, K&L recommends the use of the .50 inch diameter; Model 120. This series has convenient size, broad frequency range, versatility of design, and is the most economical.

The two larger series, .75 inch diameter and 1.25 inch diameter, offer the user lower insertion loss, lower frequency operation, and higher power capabilities. The .25 inch diameter offers the user miniature size and volume, higher frequency operations and less weight.

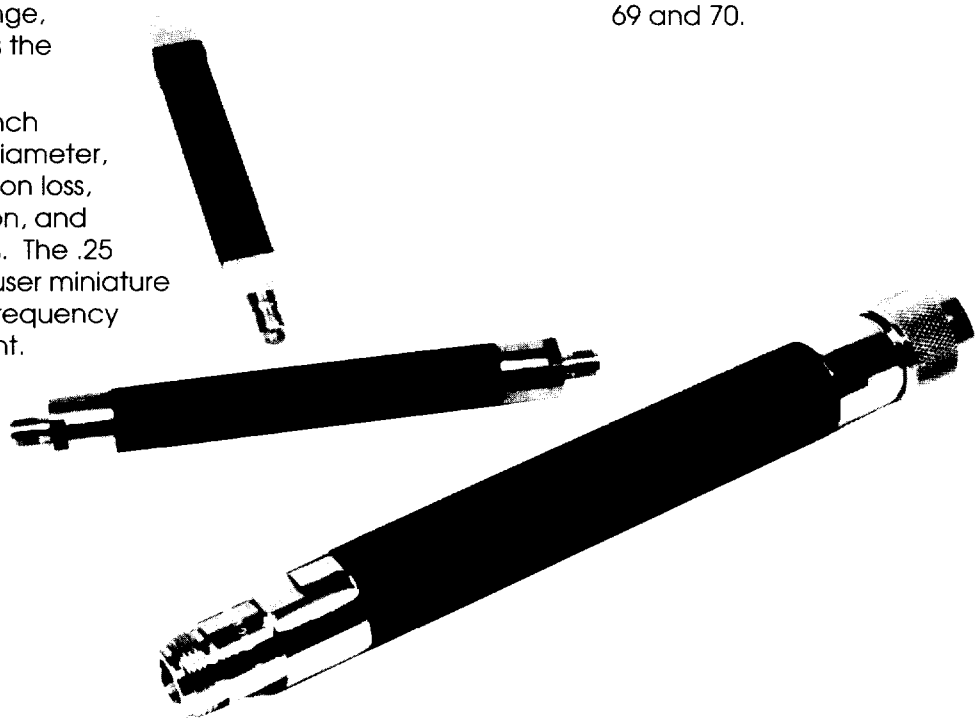
◆ To Order

5 B121 - 500 / T80 - O / O
1 2 3 4 5 6 7 8 9

1. Number of sections
2. B - Bandpass
3. Model
   - 250 - .25"
   - 120 - .50"
   - 340 - .75"
   - 110 - 1.25"
4. Circuit structure
5. Center frequency (MHz)
6. Supplemental codes (see page 17)
7. Bandwidth (MHz)
8. Input connector
9. Output connector

◆ Mechanical

For sizes and connectors, see pages 69 and 70.

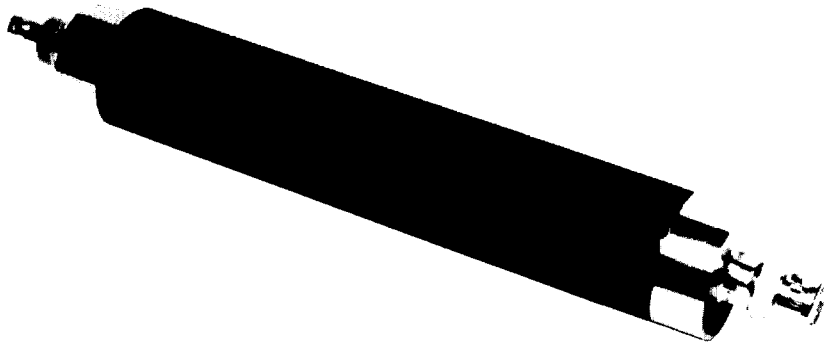


Tubular Filters

To determine the maximum insertion loss of the tubular filter at center frequency the follow formula is used:

Insertion loss at center frequency =

$$\frac{(\text{Loss constant})(\text{No. of sections} + 1/2)}{\%\ 3\text{dB BW}} + 0.2$$



EXAMPLE:
Center frequency = 500MHz
3dB bandwidth = 80MHz
Number of sections = 5
Filter model: B120
Find the insertion loss at center frequency
From the table the loss constant is shown to be 2.0

The percent 3dB bandwidth is:

$$\frac{3\text{dB BW}(100)}{\text{Center Frequency}} = \frac{(80)(100)}{500} = 16\%$$

By substituting in the formula we find the insertion loss =

$$\frac{(2)(5 + 1/2)}{16} + 0.2 = 0.9\text{dB}$$

◆ Insertion Loss/Loss Constant

Loss Constant vs. Frequency vs. Model

	Center Frequency (MHz)									
Model	**40**	**41 50**	**51 65**	**66 100**	**101 200**	**201 400**	**401 1000**	**1001 2000**	**2001 4000**	**4001 6000**
B250						5.0	4.0	3.5	3.0	2.5
B120				3.5	3.0	2.5	2.0	1.8	1.6	
B340		3.0	2.5	2.2	2.0	1.6	1.4	1.2		
B110	2.5	2.4	2.2	1.8	1.6	1.3	1.2			

◆ Specifications - Bandpass

Model	Diameter Inches	Frequency Range (MHz)	3dB % of Center	VSWR (1)	No. of Sections	Impedance (Ohms) (Watts)	Average Power	Shock	Vibration	Humidity	Temperature Range
B250	1/4	200-6000(2)	4-40%	1.5:1 or Less	2-8	50 75	2	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
B120*	1/2	100-2500	4-40%	1.5:1 or Less	2-10	50 75	18	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
B340	3/4	50-1700	4-40%	1.5:1 or Less	2-10	50 75	40	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C
B110	1-1/4	40-600	4-40%	1.5:1 or Less	2-10	50 75	200	30G, 11ms	10G 5-2000Hz	0-95%	-55°C +85°C

*Most versatile, fits most applications
1. 50 Ohms standard
2. For frequency above 6,000MHz, combline and interdigital filters are better suited

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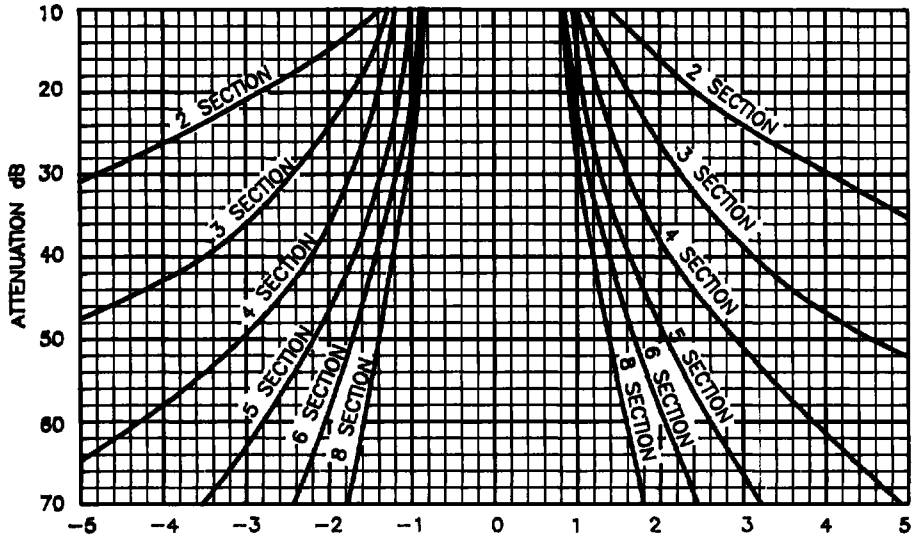
Tubular Filters

◆ Attenuation

The following curves are used in determining the out-of-band attenuation for K&L's four series of tubular filters. The curves show minimum stopband in dB, as multiples of 3dB bandwidth for filters with 2 through 8 sections. For more than 8 sections please contact the factory.

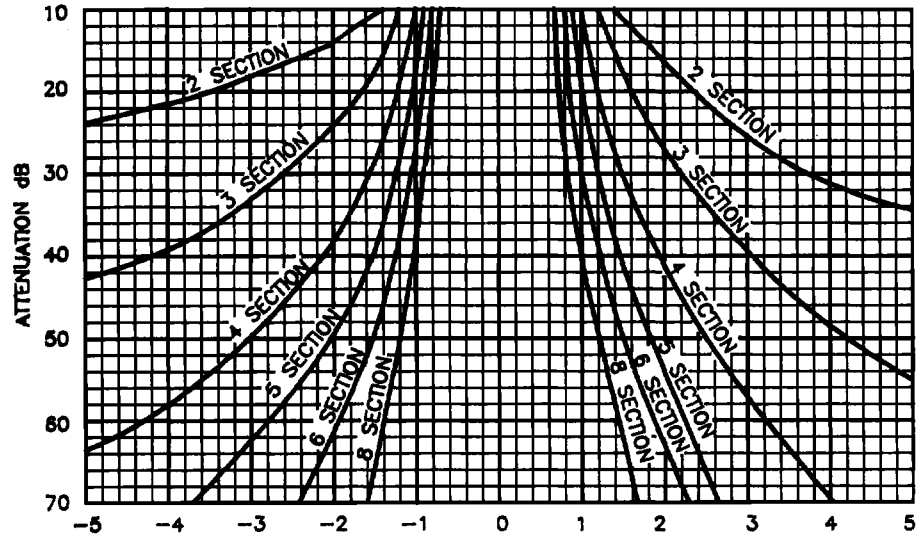
For the most part, tubular filters are free of spurious responses. However due to case moding or when resonance develops, spurious responses can occur. It is therefore advisable that the user specify the frequency which is to be spurious-free. By doing so, K&L can incorporate compensating networks to eliminate the spurious responses at no degradation in the passband frequencies.

◆ For Bandwidths 4 to 5%



NUMBER OF 3dB BANDWIDTHS

◆ For Bandwidths 5 to 15%



NUMBER OF 3dB BANDWIDTHS

ubular Filters

◆ Attenuation

To determine which series of curves to use, first calculate the percentage 3dB bandwidth from the formula:

$$\% \text{ BW} = \frac{\text{3dB BW}}{\text{Center frequency}} \times 100$$

To determine the number of bandwidths (3dB) from center frequency, use the following formula:

$$\text{No. 3dB BW} = \frac{\text{Reject freq. - Center freq.}}{\text{3dB BW}}$$

EXAMPLE:
Center frequency = 300MHz
3dB bandwidth = 50MHz
Number of sections = 6
Determine attenuation at 200MHz and 400MHz:

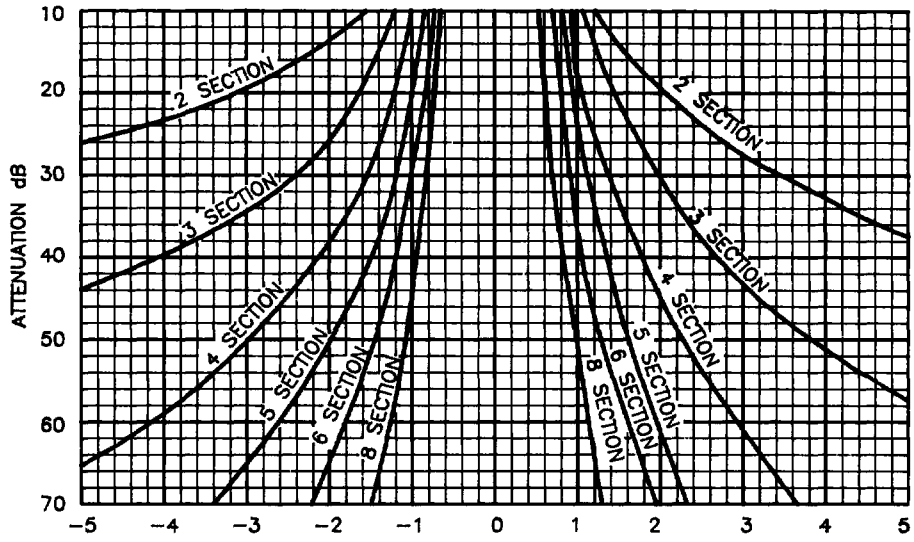
1. Calculate % BW $= \frac{50 \times 100}{300} = 17\%$

2. -3dB BW $= \frac{200-300}{50} = -2$ BW

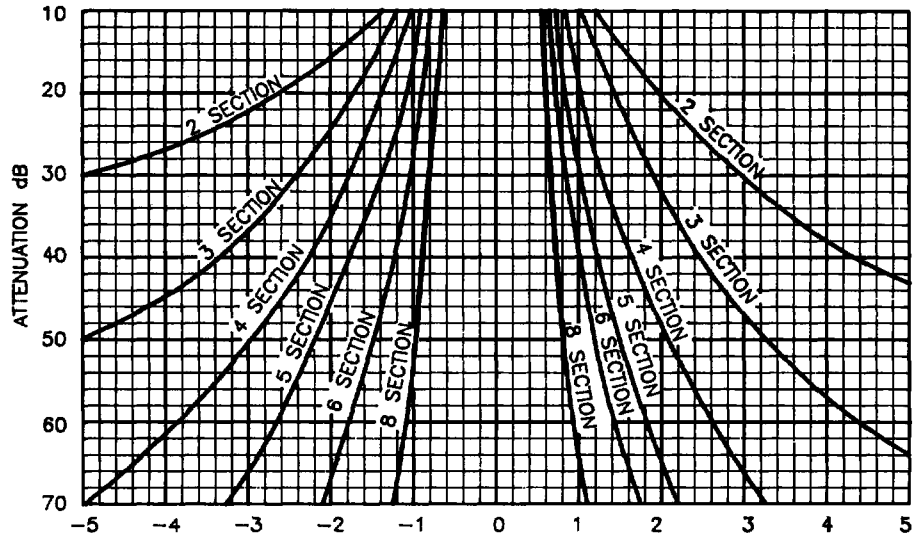
3. +3dB BW$= \frac{400-300}{50} = +2$ BW

Referring to the curve for 15%-30%, a 6 section response -2 BW yields 64dB, and +2 BW yields greater than 70dB.

◆ For Bandwidths 15 to 30%



◆ For Bandwidths 30 to 40%



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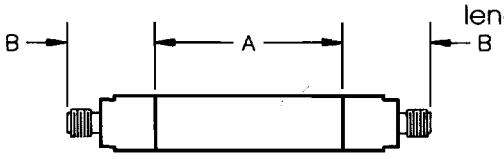
Tubular Filters

◆ Features

The length of a tubular filter is determined by adding the "A" and "B" dimensions. The "B' dimension is obtained from the table below and the " A" dimension is obtained from Length vs. Frequency tables on the following page.

EXAMPLE:
A 3-section bandpass filter Model B120 with a center frequency of 300MHz and with SMA connectors has an "A" dimension of 2 inches and a "B" dimension of 0.8 inches. The total length is 3.6".



Connector Style	Connector Code	"B" Dimension (Inches) .25 Diameter	.50 Diameter	.75 Diameter	1.25 Diameter	Figure
"N" Female	N	NR*	1.28	1.4	1.7	
"N" Male	NP	NR*	1.23	1.31	1.65	
BNC Female	B	NR*	1.0	1.35	1.42	
BNC Male	BP	NR*	.93	1.45	1.35	
TNC Female	T	NR*	1.0	1.35	1.42	
TNC Male	TP	NR*	.93	1.45	1.35	
SMC Female (Screw On)	S	.6	.73	.73	.73	
SMC Male (Screw On)	SP	NR*	.81	.81	.81	
SMB Female (Snap On)	A	.6	.73	.73	.73	
SMB Male (Snap On)	AP	NR*	.81	.81	.81	
"F" Female	F	NR*	1.05	1.05	1.05	
SMA Female (Standard)	O	.6	.8	.8	.8	
SMA Female (Right Angle)	DO	NR*	.6	.6	.6	2
SMA Female (Right Angle Square)	EO	.55	.65	.65	.65	5
SMA Male (Standard)	OP	.73	.85	.85	.85	
SMA Male (Right Angle)	DP	NR*	.6	.6	.6	2
SMA Male (Right Angle Square)	EP	.55	.65	.65	.65	5
Cable, RG 188 (Right Angle Stand.)	C	.45	.5	.5	.5	1
Cable, RG 188 (Straight)	CS	.45	.55	.55	.55	4
Solder Lug	L	.40	.45	.45	.45	3
PC Mount (Right Angle)	P	*	*	*	*	*

NR*- Not recommended
*- For PC mount, contact factory

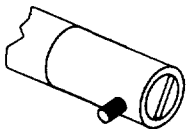


Figure 1

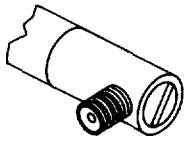


Figure 2

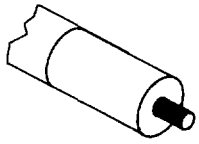


Figure 3

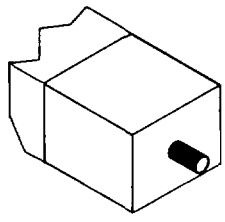


Figure 4

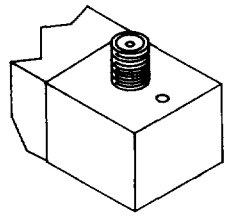


Figure 5

◆ Tubular Filters

◆ Approximate* Dimension "A" - Length vs. Frequency

◆ B250

No. of Sections	Frequency (MHz)					
	200-300	300-400	400-1000	1000-3000	3000-4000	4000-6000
2	1.10	1.00	.90	.80	.70	.50
3	2.00	1.90	1.40	1.20	1.00	.70
4	2.90	2.80	1.90	1.70	1.30	.90
5	3.80	3.60	2.40	2.10	1.60	1.10
6	4.70	4.40	2.90	2.5	1.90	1.30
7	5.60	5.20	3.40	2.90	2.20	1.60
8	6.50	6.00	3.90	3.30	2.50	1.90

◆ L250

No. of Sections	Frequency (MHz)							
	300-600	600-1000	1000-1300	1300-1700	1700-2300	2300-3000	3000-5000	5000-20000
2	.65	.55	.40	.50	.45	.40	.40	
3	1.00	.90	.70	.85	.75	.70	75	
4	1.45	1.25	1.00	1.20	1.10	1.00	1.50	Contact factory for exact size at higher frequencies.
5	1.90	1.65	1.30	1.55	1.40	1.30	1.40	
6	2.30	2.00	1.60	1.95	1.70	1.55	1.75	
7	2.75	2.40	1.90	2.30	2.00	1.85	2.10	
8	3.20	2.75	2.20	2.65	2.35	2.15	2.45	
9	3.65	3.10	2.50	3.00	2.70	2.45	2.80	
10	4.10	3.50	2.80	3.35	3.00	2.75	3.10	

◆ B120

No. of Sections	Frequency (MHz)				
	100-130	130-180	180-350	350-700	700-2500
2	2.00	1.60	1.30	1.10	.90
3	3.15	2.60	2.00	1.65	1.40
4	4.30	3.60	2.70	2.20	1.95
5	5.45	4.55	3.40	2.70	2.45
6	6.60	5.55	4.10	3.25	3.00
7	7.75	6.55	4.80	3.80	3.50
8	8.90	7.55	5.50	4.35	4.00
9	-	8.55	6.20	4.90	4.55
10	-	9.50	6.90	5.40	5.00

◆ L120

No. of Sections	Frequency (MHz)						
	60-70	70-90	90-150	150-200	200-400	400-800	800-3000
2	2.45	2.10	1.80	1.55	1.10	.75	.65
3	3.85	3.15	2.80	2.45	1.80	1.20	1.10
4	5.20	4.20	3.85	3.40	2.55	1.70	1.50
5	6.60	5.25	4.85	4.30	3.25	2.15	1.95
6	8.00	6.30	5.90	5.20	3.95	2.60	2.40
7	9.40	7.30	6.95	6.15	4.70	3.00	2.80
8	-	8.35	7.95	7.00	5.40	3.50	3.25
9	-	9.40	8.95	8.00	6.10	3.95	3.70
10	-	-	-	8.90	6.80	4.40	4.10

◆ B340

No. of Sections	Frequency (MHz)				
	50-80	80-140	140-230	230-500	500-1700
2	3.00	2.00	1.50	1.30	1.10
3	4.50	3.00	2.25	1.85	1.60
4	6.00	3.95	3.00	2.40	2.10
5	7.50	4.90	3.75	2.95	2.60
6	9.00	5.90	4.50	3.50	3.10
7	-	6.85	5.25	4.10	3.60
8	-	7.80	6.00	4.60	4.10
9	-	8.80	6.75	5.15	4.60
10	-	-	7.50	5.70	5.10

◆ L340

No. of Sections	Frequency (MHz)							
	40-60	60-80	80-100	100-200	200-400	400-600	600-1000	1000-2000
2	3.90	3.10	2.20	2.00	1.20	1.00	.90	.80
3	5.90	4.80	3.50	3.15	2.00	1.60	1.35	1.25
4	8.00	6.45	4.75	4.30	2.70	2.15	1.80	1.65
5	-	8.10	6.00	5.40	3.40	2.70	2.25	2.00
6	-	-	7.30	6.50	4.10	3.25	2.70	2.45
7	-	-	8.60	7.65	4.90	3.85	3.15	2.85
8	-	-	-	8.75	5.55	4.40	3.60	3.30
9	-	-	-	-	6.40	5.00	4.00	3.70
10	-	-	-	-	7.00	5.50	4.50	4.10

◆ B110

No. of Sections	Frequency (MHz)				
	40-55	55-80	80-200	200-400	400-600
2	3.00	2.80	2.40	2.00	1.60
3	4.00	3.80	3.20	2.80	2.30
4	5.00	4.80	4.00	3.60	3.00
5	6.50	6.00	5.20	4.40	3.80
6	8.00	7.20	5.60	5.20	4.60
7	9.50	8.40	6.40	6.00	5.40
8	-	9.60	7.20	6.80	6.20
9	-	-	8.60	7.60	7.00
10	-	-	-	8.50	7.80

◆ L110

No. of Sections	Frequency (MHz)				
	30-40	40-80	80-200	200-600	600-1000
2	3.65	2.40	2.00	1.30	1.00
3	5.45	3.55	2.85	2.00	1.55
4	7.25	4.75	3.70	2.60	2.00
5	9.10	6.00	4.55	3.25	2.60
6	-	7.15	5.40	3.90	3.10
7	-	8.35	6.25	4.55	3.65
8	-	9.50	7.10	5.20	4.20
9	-	-	7.95	5.85	4.70
10	-	-	8.80	6.50	5.20

* Length shown at left is less connectors. Dimensions and weight are approximate.

◆ Weight (Ounces)

B250	B120	B340	B110
1/4 oz. per inch	3/4 oz. per inch	3/4 oz. per inch	1 1/2 oz. per inch

◆ Weight (Ounces)

L250	L120	L340	L110
1/4 oz. per inch	3/4 oz. per inch	3/4 oz. per inch	1 1/2 oz. per inch

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K&L

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Tubular Filters

◆ Folded Tubular Filters

To reduce the length of a tubular filter, folding or bending is often used. Most tubular filters below 1GHz can be folded. To determine the approximate size of the folded filter, the following formula is used.

1. "E" equal .625 "A" dimension shown in tables on page 70.
2. "B" dimension is obtained from table on page 69 .
3. "D" dimension is shown in table below.
4. "X" and "Y" dimensions obtained from table below.
5. "L" equals "D" + "E" + "B".

Example:

Bandpass filter, CF = 70MHz
3dB BW = 10MHz
5 sections
SMA Female connectors
Model B340.

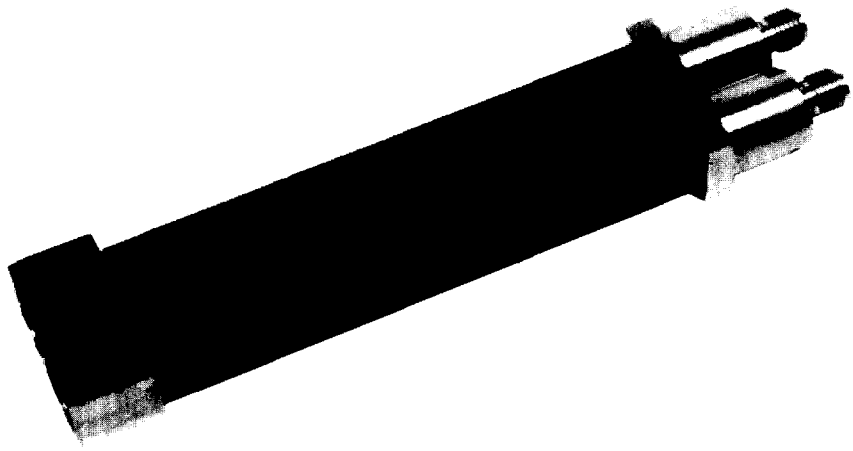
"L" = 0.5+(.625 x 7.5) + 0.8 = 6.0 inches
"X" = .75,"Y" = 1.50

The part number is preceded with the prefix "F" and becomes F5B340-70/T10-0/0

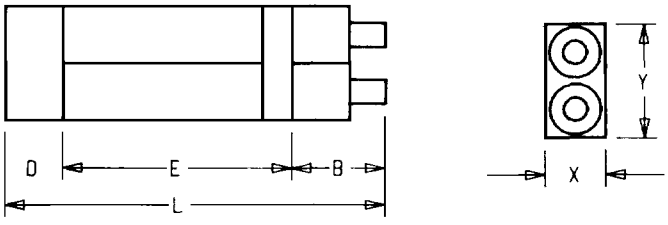
The standard straight tubular filter length is 9.1 inches.

"Y" dimensions given are for SMA and subminiature connectors. Consult factory for other configurations.

Series	X	Y	D
250	.31	.75	.25
120	.50	1.00	.50
340	.75	1.50	.50
110	1.25	2.50	.50



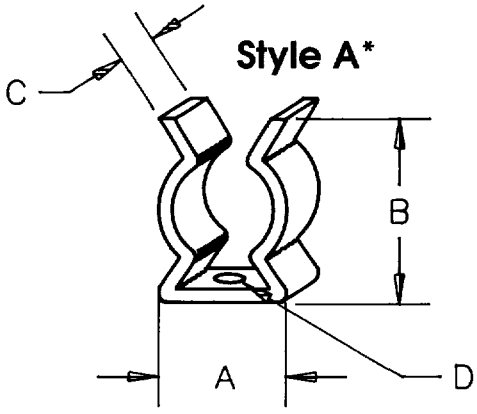
◆ Mechanical Drawing



bular Filters

◆ Mounting Hardware

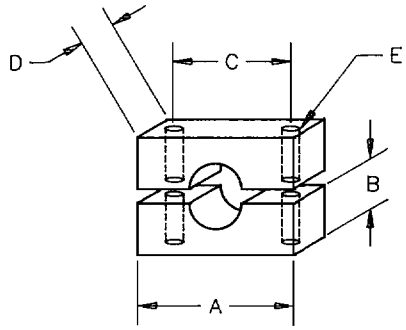
Style A*



Model	Diameter Filter	A	B	C	D
M25-A	.25	.34	.42	.25	.13
M12-A	.50	.45	.75	.39	.17
M34-A	.75	.88	1.13	.63	.27
M14-A	1.25	1.31	1.25	.63	.27

* Two clips normally utilized for secure mountings.

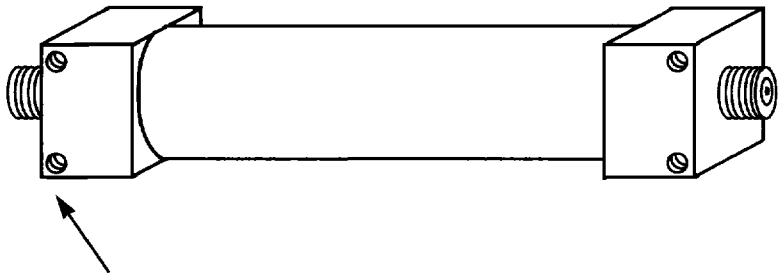
Style B*



Model	Diameter Filter	A	B	C	D	E
M25-B	.25	.50	.22	.36	.13	.10
M12-B	.50	1.00	.47	.75	.25	.13
M34-B	.75	1.5	.72	1.16	.38	.17
M14-B	1.25	2.00	.97	1.63	.38	.27

* Bracket consists of upper and lower yoke.
Two brackets normally utilized for secure mounting.

Style C*



Tapped holes for flush mounting optional - contact factory

Phone: 410-749-2424 FAX: 410-749-5725