# Tubular Filters

Reactel Tubular Filters are able to satisfy a variety of filter requirements. These versatile units cover the broad frequency range of 10 MHz to 18 GHz, range in diameters from 1/4" to 1 1/8" and can handle power up to 200 watts in our standard design. All standard tubular filters utilize a low ripple Chebyshev design which offers the best compromise of low loss, low VSWR, and high selectivity. Each filter situation is unique, and the data provided on the following pages offers only a small glimpse of our capabilities. Should a different design become necessary to meet your requirements, Bessel, Butterworth, Gaussian or Linear Phase responses are also available. Please contact the factory for filters designed to your unique requirement.

- 10 MHz to 18 GHz
- Bandwidths up to 50%
- Low Loss
- Flexible Design Options
- Lowpass and Bandpass Designs Available

## Part Numbering System

**8 B 2 — 1500 — 100 S 1 1**
1 2 3 4 5 6 7 8


**Part Number Definition:**
1 - Number of Sections
2 - Filter Type Designation
3 - Series Identification
4 - Center Frequency in MHz
5 - 3 dB Bandwidth in MHz
6 - Connector Definition (See Page 27)
7 - Input Connector Type
8 - Output Connector Type



## Tubular Filter Specifications

| | Series 0 | Series 1 | Series 2 | Series 3 | Series 4 |
|---|---|---|---|---|---|
| Frequency Range (MHz) | 100-18000 | 100-10000 | 40-6000 | 20-3500 | 10-1000 |
| 3 dB BW for Bandpass (% of CF) | 1 - 70% | 1 - 70% | 1 - 85% | 1 - 90% | 0.5 - 95% |
| Available Impedances | 50Ω & 75Ω | 50Ω & 75Ω | 50Ω & 75Ω | 50Ω & 75Ω | 50Ω & 75Ω |
| Maximum VSWR @ CF | 1.5:1 | 1.5:1 | 1.5:1 | 1.5:1 | 1.5:1 |
| Diameter (inches) | 0.25 | 0.375 | 0.50 | 0.75 | 1.125 |
| * Standard Input Power | 5 Watts | 10 Watts | 20 Watts | 50 Watts | 200 Watts |
| Shock | 30G @ 11mS | 30G @ 11mS | 30G @ 11mS | 15G @ 11mS | 15G @ 11mS |
| Vibration | 10G | 10G | 10G | 10G | 10G |
| Humidity | up to 95% | up to 95% | up to 95% | up to 95% | up to 95% |
| Altitude | Space Rated | Space Rated | Space Rated | Space Rated | Space Rated |
| Temperature | -55° to +125° C | -55° to +125° C | -55° to +125° C | -55° to +125° C | -55° to +125° C |

* Higher power is available, please consult the factory.

All Reactel standard tubular filters are designed to a low ripple Chebyshev configuration. Other configurations are available. Please call the factory to discuss your specific requirements.



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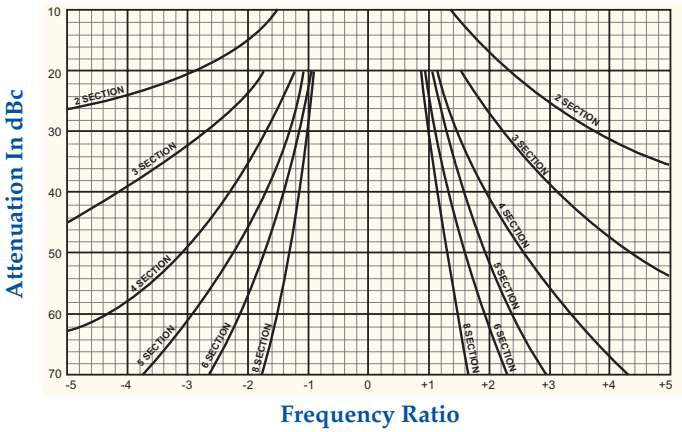
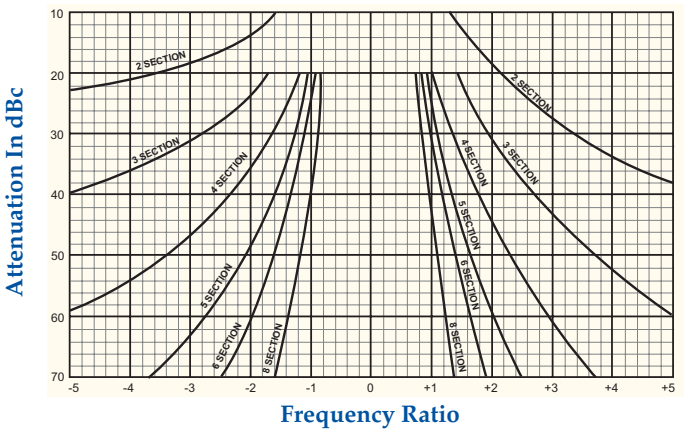
## Tubular Bandpass Filter Attenuation Curves

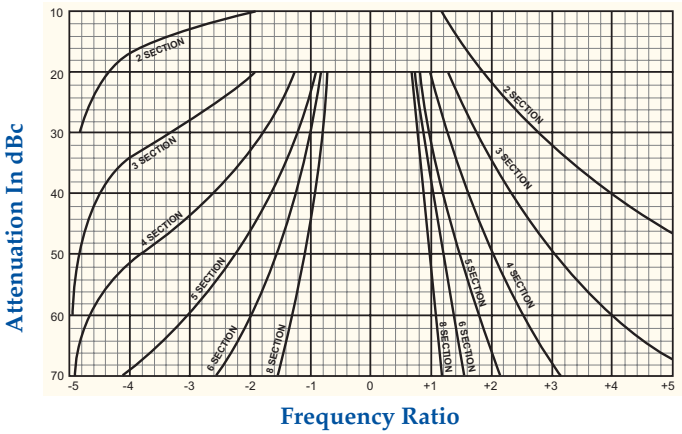
### 2 - 5% 3 dB Bandwidth



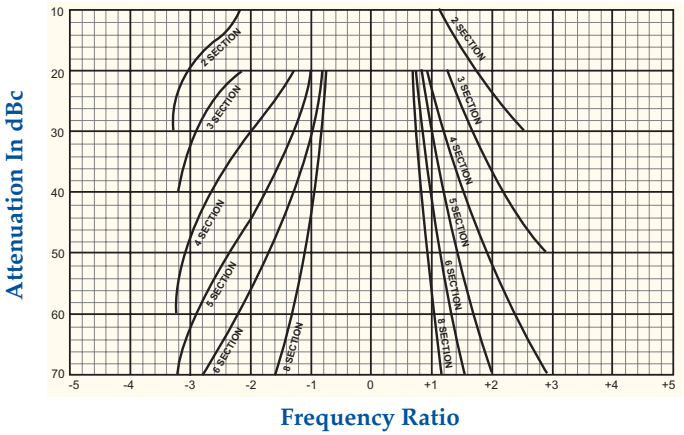

### 5 - 10% 3 dB Bandwidth




### 10 - 20% 3 dB Bandwidth




### 20 - 30% 3 dB Bandwidth




These attenuation curves are normalized to be reasonably representative of performance characteristics for filters with 3 dB bandwidths approximating the percentages shown. For more precise values at specific frequency points, please contact Reactel.

The rejection for bandpass filters can be determined from the curves. Calculate the frequency ratio as follows:

$$\text{Frequency Ratio} = \frac{\text{Rejection Frequency - Center Frequency}}{\text{3 dB Cutoff Frequency}}$$

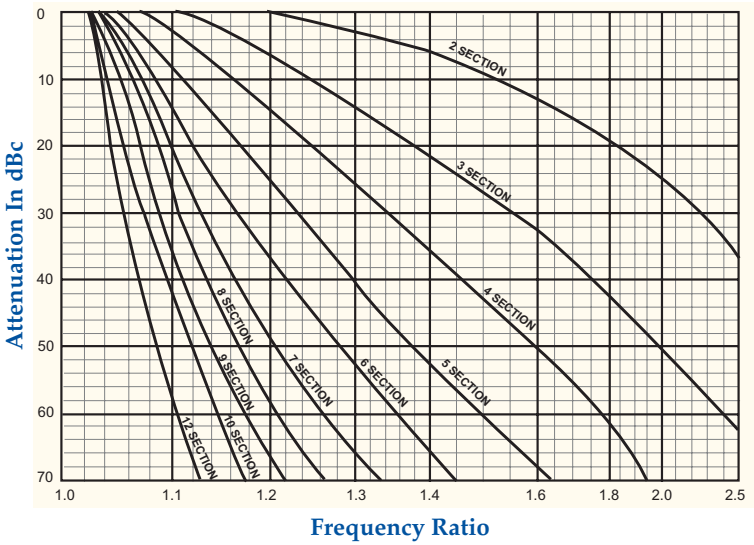
Example:

Center Frequency = 1000 MHz
3 dB Bandwidth = 150 MHz
Number of Sections = 6
Reject Frequencies = 800 & 1200 MHz
% Bandwidth = 15%

$$\text{Frequency Ratio} = \frac{800 - 1000}{150} = -1.33$$

Rejection from Curve = 42.8 dB

## Tubular Lowpass Filter Attenuation Curves




The rejection of lowpass filters can be determined from the attenuation curves. For frequencies above the 3 dB cutoff, calculate the frequency ratio as follows:

$$\text{Frequency Ratio} = \frac{\text{Rejection Frequency}}{\text{3 dB Cutoff Frequency}}$$

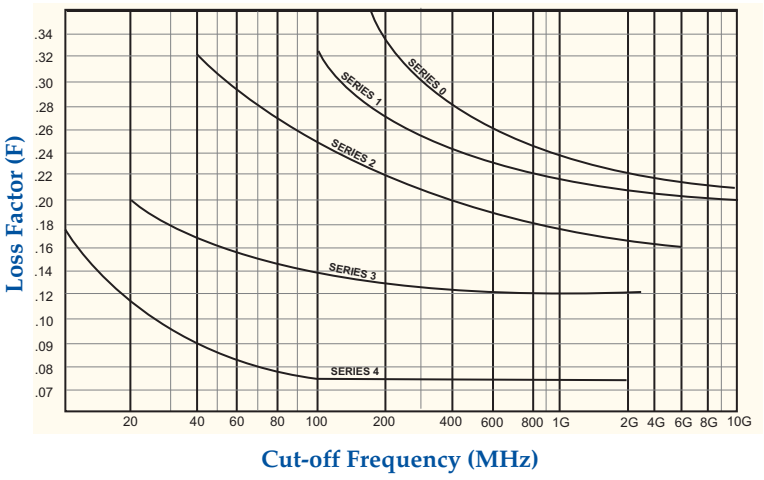
Example:

Rejection Frequency = 196 MHz
3 dB Cutoff Frequency = 150 MHz
No. of Sections = 6

$$\text{Frequency Ratio} = \frac{196}{150} = 1.3$$

Rejection from Curve = 53.5 dB

## Tubular Bandpass Filter Insertion Loss Curves




Insertion Loss = F x N + .05
Where F = Loss Factor
And N = Number of Sections

Example:

Number of Sections = 5
Series = 2
Cut-off Frequency = 1500 MHz
Insertion Loss = FN + .05
Insertion Loss = .17 x 5 + .05
Insertion Loss = .9 dB max up to 90% of 3 dB cutoff

The curves on this page are theoretical values only. For more precise values at specific frequency points, please contact the factory.



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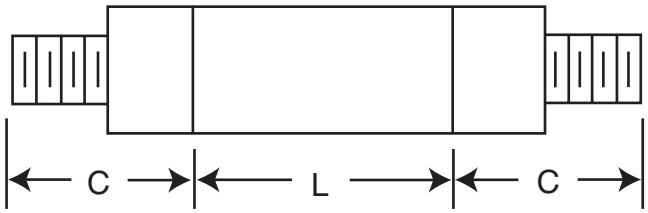
# Tubular Filter Data

## Length Definition




**L = Filter Length** (see tables on pages 28 & 29)
**C = Connector Length** (see table below)

## * Tubular Filter Connector Length "C" (inches)

| Connector Type | Connector Code | Type M/F | Filter Series 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| SMA | S | 2/1 | 0.72/0.60 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 | 0.90/0.75 |
| SMA Right Angle | SR | 2/1 | N/A | 0.60/0.60 | 0.60/0.60 | 0.60/0.60 | 0.60/0.60 |
| SMA Flush | SF | 2/1 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 | 0.90/0.75 |
| SMB (Snap On) | M | 2/1 | 0.60/0.60 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 |
| SMC (Screw On) | O | 2/1 | 0.60/0.60 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 | 0.75/0.75 |
| BNC | B | 2/1 | N/A | 1.10/1.10 | 1.00/1.00 | 1.42/1.42 | 1.42/1.42 |
| TNC | T | 2/1 | N/A | 1.10/1.10 | 1.00/1.00 | 1.42/1.42 | 1.42/1.42 |
| Type N | N | 2/1 | N/A | 1.35/1.37 | 1.25/1.27 | 1.67/1.70 | 1.67/1.70 |
| PC Pin | P | --- | 0.50 | 0.60 | 0.60 | 0.60 | 0.75 |
| Cable | G | --- | TBD | TBD | TBD | TBD | TBD |

* Dimensions are approximate and are subject to change.

## 3 dB BW Tolerance
**(Unless Otherwise Specified)**

| 3 dB BW % of $f_0$ | Tolerance on % BW |
|---|---|
| 1 - 5% | +0.5 to -0% |
| 5.1 - 25% | +2.5 to -0% |
| 25.1 - 55% | +4.5 to -0% |
| 55.1% - and up | +5.5 to -0% |

## Insertion Loss v. 1.5:1 VSWR BW And Number of Sections

| I.L. dB | Number of Sections 2 | 3 | 4 | 5 | 6 & up |
|---|---|---|---|---|---|
| 0 - 3 | 50 - 55% | 65 - 75% | 75 - 80% | 80 - 90% | 95% & up |
| 3 - 4 | 55 - 65% | 75 - 82% | 83 - 90% | 89 - 95% | 95% & up |
| 4 - 5 | 60 - 70% | 80 - 95% | 90% & up | 95% & up | 95% & up |

# Tubular Bandpass Filter Lengths

## Series B0 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 160-200 | 2.75 | 3.75 | 4.75 | 5.25 | 6.75 | 7.75 | 8.75 | 9.75 | 1025 |
| 201-300 | 2.75 | 3.5 | 4.25 | 5.0 | 5.75 | 6.5 | 7.25 | 8.0 | 8.75 |
| 301-800 | 2.5 | 3.25 | 3.75 | 4.25 | 4.75 | 5.25 | 6.5 | 7.25 | 8.0 |
| 801-2000 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 |
| 2001-4000 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 |
| 4001-6000 | 0.5 | 0.75 | 1.0 | 1.25 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 |

## Series B1 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 100-200 | 3.0 | 4.0 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 8.5 | 9.0 |
| 201-300 | 2.75 | 3.0 | 3.75 | 3.75 | 4.0 | 5.0 | 5.5 | 6.5 | 6.75 |
| 301-500 | 2.5 | 2.75 | 3.5 | 3.5 | 3.75 | 4.75 | 5.0 | 6.25 | 6.5 |
| 501-700 | 2.0 | 2.5 | 3.0 | 3.25 | 3.75 | 4.5 | 5.0 | 6.0 | 6.5 |
| 701-1000 | 1.75 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.25 |
| 1001-2000 | 1.5 | 1.75 | 2.0 | 2.5 | 3.0 | 3.5 | 3.75 | 4.0 | 4.5 |
| 2001-3000 | 1.25 | 1.5 | 1.75 | 2.25 | 2.5 | 3.0 | 3.5 | 3.75 | 4.25 |
| 3001-5000 | 1.0 | 1.25 | 1.5 | 2 | 2.25 | 2.5 | 3.0 | 3.5 | 4.0 |

## Series B2 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 50-70 | 5.5 | 8.0 | 10.0 | 12.0 | 14.5 | 17.0 | 17.5 | 18.5 | 19.5 |
| 71-100 | 3.5 | 4.5 | 6.0 | 8.0 | 9.75 | 11.5 | 13.5 | 15.5 | 17.0 |
| 101-140 | 3.0 | 3.5 | 5.0 | 6.5 | 7.5 | 8.5 | 9.5 | 11.0 | 12.5 |
| 141-200 | 2.5 | 3.0 | 4.25 | 5.25 | 6.25 | 7.0 | 8.0 | 9.0 | 10.0 |
| 201-300 | 2.25 | 2.75 | 3.5 | 4.25 | 5.0 | 5.5 | 6.25 | 7.0 | 8.0 |
| 301-400 | 2.0 | 2.5 | 3.0 | 3.5 | 4.25 | 5.0 | 5.5 | 6.5 | 7.5 |
| 401-700 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.5 | 5.0 | 6.0 | 7.0 |
| 701-3000 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |

## Series B3 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40-50 | 5.0 | 7.0 | 9.0 | 11.5 | 14.0 | 17.0 | 19.0 | 21.5 | 24.0 |
| 51-75 | 4.5 | 6.5 | 8.0 | 9.5 | 11.5 | 13.0 | 15.0 | 16.0 | 17.0 |
| 76-150 | 3.0 | 3.5 | 4.0 | 5.5 | 6.5 | 8.0 | 9.0 | 10.0 | 11.0 |
| 151-300 | 2.5 | 3.0 | 3.5 | 4.0 | 5.0 | 5.5 | 6.5 | 7.0 | 8.0 |
| 301-700 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 6.0 | 7.0 |
| 701-2000 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 6.0 |

## Series B4 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 20-40 | 4.5 | 6.5 | 9.0 | 10.5 | 13.0 | 16.0 | 19.0 | 22.0 | 25.0 |
| 41-60 | 4.0 | 5.0 | 6.5 | 8.5 | 10.0 | 13.0 | 15.0 | 17.0 | 19.0 |
| 61-80 | 3.5 | 4.0 | 5.5 | 7.0 | 8.5 | 9.5 | 11.0 | 13.0 | 14.5 |
| 81-200 | 3.0 | 4.0 | 4.5 | 6.0 | 7.0 | 8.0 | 9.5 | 11.0 | 12.0 |
| 201-500 | 3.0 | 3.5 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 |
| 501-1000 | 2.5 | 3.0 | 3.5 | 4.5 | 5.0 | 5.5 | 6.5 | 7.0 | 8.0 |

## Tubular Bandpass Weight per Section (oz.)

| Series | B0 | B1 | B2 | B3 | B4 |
|---|---|---|---|---|---|
| Weight | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 |

The lengths and weights shown in these tables are approximate and should only be used as a guide. Reactel reserves the right to alter these dimensions to meet a particular specification.



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# Tubular Lowpass Filter Lengths

## Series L0 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 100-200 | 1.75 | 2.5 | 3.25 | 4.0 | 4.75 | 5.5 | 7.25 | 8.0 | 8.75 |
| 201-300 | 1.25 | 1.75 | 2.25 | 2.75 | 3.25 | 3.75 | 4.25 | 4.75 | 5.25 |
| 301-800 | 1.0 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 | 3.0 | 3.5 | 4.0 |
| 801-2000 | 1.0 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 | 2.75 | 3.5 | 3.75 |
| 2001-4000 | 1.0 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 | 2.5 | 3.0 | 3.5 |
| 4001-7000 | 0.75 | 1.0 | 1.75 | 1.5 | 1.75 | 2.0 | 2.25 | 2.5 | 3.0 |
| 7001-10000 | 0.5 | 0.75 | 1.0 | 1.25 | 1.5 | 2.0 | 2.25 | 2.5 | 2.75 |
| 10001-18000 | 0.5 | 0.65 | 0.75 | 0.9 | 1.0 | 2.0 | 2.25 | 2.5 | 2.75 |

## Series L1 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 100-200 | 2.5 | 3.5 | 4.5 | 5.5 | 6.5 | 7.5 | 8.5 | 9.5 | 10.0 |
| 201-400 | 1.5 | 2.0 | 3.0 | 3.5 | 4.0 | 4.5 | 5.5 | 6.5 | 7.0 |
| 401-600 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.5 | 4.75 | 5.0 | 5.5 |
| 601-1000 | 1.5 | 2.0 | 2.25 | 2.5 | 3.0 | 4.0 | 4.25 | 4.5 | 5.0 |
| 1001-2000 | 1.0 | 1.5 | 1.75 | 2.5 | 2.75 | 3.25 | 3.5 | 4.0 | 4.5 |
| 2001-3000 | 1.0 | 1.5 | 1.75 | 2.0 | 2.5 | 3.0 | 3.25 | 3.5 | 4.0 |
| 3001-4000 | 0.75 | 1.25 | 1.5 | 2.0 | 2.5 | 2.75 | 3.0 | 3.25 | 3.5 |
| 4001-10000 | 0.75 | 1.0 | 1.25 | 1.75 | 2.25 | 2.5 | 3.0 | 3.25 | 3.5 |

## Series L2 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40-50 | 4.0 | 6.0 | 8.5 | 10.5 | 12.5 | 15.0 | 17.5 | 18.0 | 19.5 |
| 51-70 | 3.0 | 5.0 | 6.5 | 8.5 | 10.5 | 12.5 | 15.0 | 16.0 | 19.0 |
| 71-100 | 2.5 | 4.0 | 5.5 | 6.5 | 8.0 | 10.0 | 11.5 | 13.0 | 14.5 |
| 101-250 | 2.0 | 3.5 | 4.5 | 5.5 | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 |
| 251-500 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 |
| 501-1000 | 1.25 | 1.5 | 2.25 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| 1001-2500 | 1.0 | 1.5 | 2.0 | 2.25 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 |
| 2501-6000 | 0.75 | 1.0 | 1.5 | 2.0 | 2.5 | 2.75 | 3.0 | 3.5 | 4.0 |

## Series L3 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 20-40 | 5.0 | 8.0 | 11.5 | 15.5 | 18.0 | 21.5 | 25.0 | 26.5 | 28.0 |
| 41-60 | 3.0 | 6.0 | 8.0 | 10.5 | 13.0 | 15.0 | 17.5 | 21.0 | 24.0 |
| 61-90 | 2.5 | 4.5 | 6.0 | 8.0 | 10.0 | 11.5 | 12.5 | 14.5 | 16.0 |
| 91-150 | 1.5 | 3.0 | 4.5 | 5.0 | 6.0 | 6.5 | 7.5 | 8.0 | 9.0 |
| 151-500 | 1.5 | 3.0 | 3.5 | 4.5 | 5.5 | 6.0 | 6.5 | 7.0 | 8.0 |
| 501-1000 | 1.5 | 2.5 | 3.5 | 4.5 | 5.0 | 5.25 | 6.0 | 6.5 | 7.5 |
| 1001-3500 | 1.0 | 2.5 | 3.0 | 3.5 | 4.5 | 4.75 | 5.0 | 6.0 | 6.5 |

## Series L4 Length (inches)

| CF (MHz) | Number of Sections | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10-20 | 7.0 | 10.5 | 13.5 | 17.5 | 20.5 | 23.0 | 26.0 | 28.5 | 30.0 |
| 21-35 | 5.0 | 7.0 | 9.5 | 13.0 | 15.0 | 17.0 | 21.0 | 22.0 | 24.5 |
| 36-60 | 4.0 | 5.5 | 6.5 | 7.5 | 10.0 | 11.5 | 13.0 | 14.5 | 16.0 |
| 61-150 | 3.5 | 4.0 | 4.5 | 5.5 | 7.0 | 8.0 | 9.0 | 10.0 | 11.0 |
| 151-400 | 3.0 | 3.5 | 4.0 | 5.0 | 5.5 | 6.5 | 7.5 | 8.0 | 8.5 |
| 401-1000 | 2.5 | 3.0 | 3.5 | 4.5 | 5.5 | 6.5 | 7.0 | 7.5 | 8.0 |

## Tubular Lowpass Weight per Section (oz.)

| Series | L0 | L1 | L2 | L3 | L4 |
|---|---|---|---|---|---|
| Weight | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 |

The lengths and weights shown in these tables are approximate and should only be used as a guide. Reactel reserves the right to alter these dimensions to meet a particular specification.

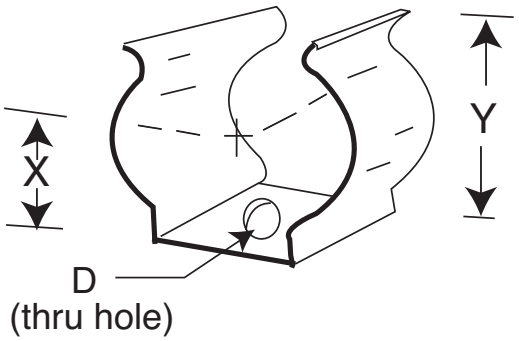
# Tubular Filter Mounting Options

The "Type S Spring Clip" is a light to medium duty fastening method, and is good for most applications.

For more rugged environments the "Type R High Shock Bracket" would be appropriate.

## Type S Spring Clip (dimensions in inches)

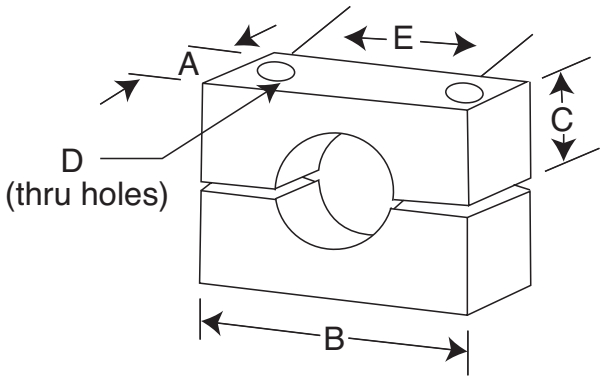
| Series | X | Y | D | Material |
|---|---|---|---|---|
| 0 | 0.30 | 0.50 | 0.130 | Phos-Bronze |
| 1 | 0.32 | 0.50 | 0.085 | Plastic |
| 2 | 0.45 | 0.75 | 0.200 | Phos-Bronze |
| 3 | 0.50 | 0.80 | 0.150 | Plastic |
| 4 | 0.62 | 1.15 | 0.130 | Phos-Bronze |
| 5 | 0.62 | 1.15 | 0.130 | Phos-Bronze |




All tubular filters ordered in quantities of 10 or fewer are supplied with Type S Spring Clips free of charge. For larger quantities, please consult the factory.

## Type R High Shock Bracket (dimensions in inches)

| Series | A | B | C | D | E |
|---|---|---|---|---|---|
| 0 | 0.12 | 0.50 | 0.22 | 0.093 | 0.375 |
| 1 | 0.25 | 0.87 | 0.35 | 0.113 | 0.620 |
| 2 | 0.25 | 1.00 | 0.47 | 0.144 | 0.750 |
| 3 | 0.37 | 1.50 | 0.70 | 0.169 | 1.125 |
| 4 | 0.37 | 2.00 | 1.00 | 0.193 | 1.575 |
| 5 | 0.50 | 2.00 | 1.00 | 0.193 | 1.575 |




Type R High Shock Brackets can be supplied with tubular filters for an additional charge. Please consult the factory for a price quote.



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