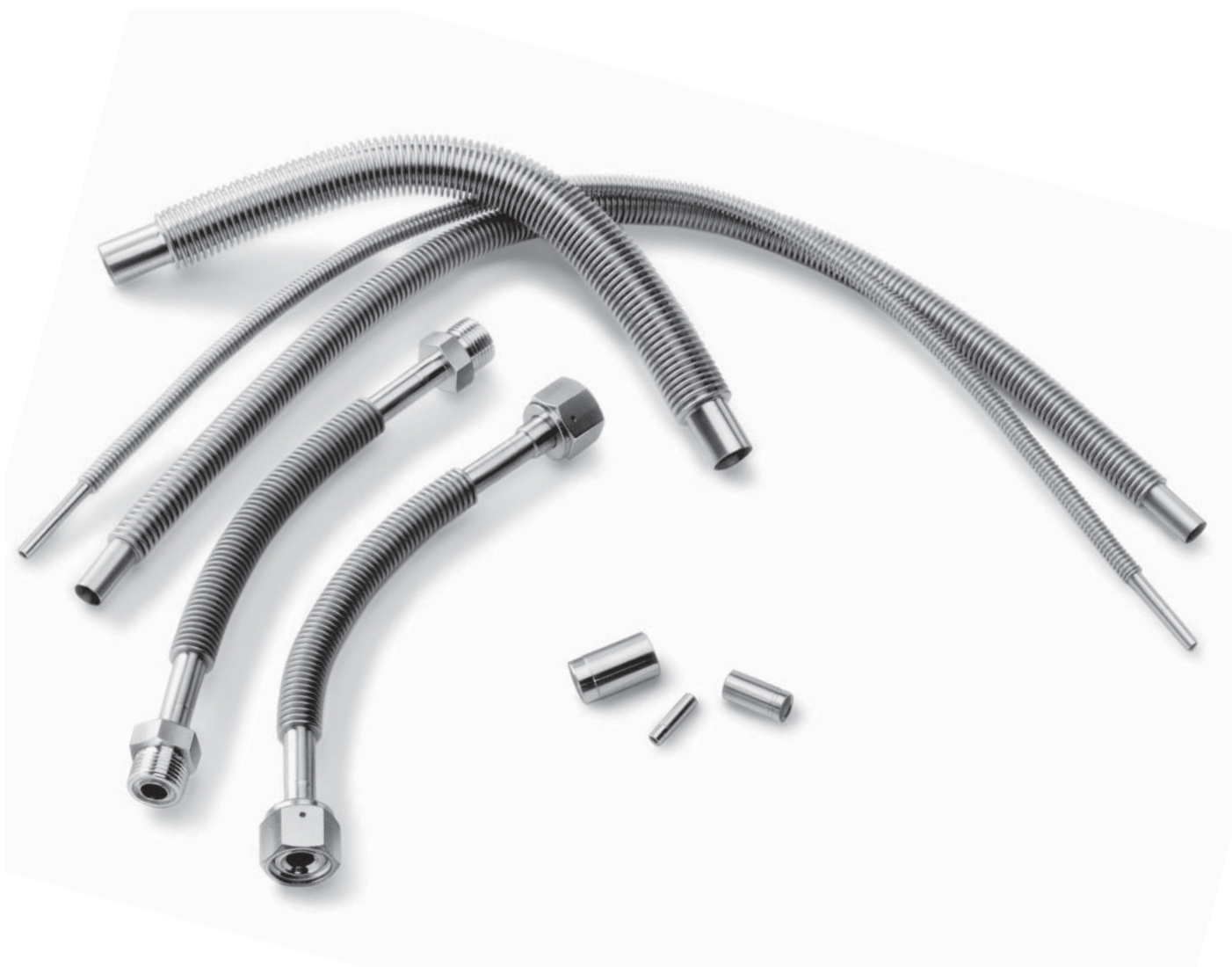


Vacuum Tubing Products



- Convoluted stainless steel tubing
- Stainless steel adapters
- Factory-welded end connections

Convolved Tubing



Convolved tubing compensates for misalignment between static connections in vacuum or low-pressure applications. During installation, convolved tubing can be compressed by at least 15 % or extended by up to 50 % of the manufactured length.

Dimensions

Dimensions are for reference only and are subject to change.

Material

321 stainless steel

Nominal Wall Thickness

0.006 in. (0.15 mm)

Pressure Rating

- 1/4 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 100 psig (6.8 bar)
- 3/8 through 1 1/2 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 25 psig (1.7 bar)

Temperature Rating

70 to 1000°F (20 to 537°C)

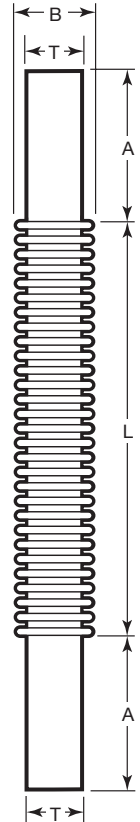
Testing

Every convolved tubing product is inboard helium leak tested to maximum leak rate of 1.8×10^{-7} std cm³/s at the envelope.

Ordering Information

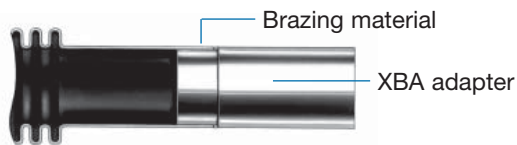
Select a convolved tubing ordering number.

T in.	Ordering Number	Dimensions, in. (mm)					Maximum Angular Displacement ^①		
		A	B	L					
				Manufactured	Compressed	Extended			
1/4	321-4-X-2	0.75 (19.1)	0.38 (9.7)	2.00 (50.8)	1.50 (38.1)	3.00 (76.2)	180°		
	321-4-X-4			4.00 (102)	3.25 (82.6)	6.00 (152)			
	321-4-X-6			6.00 (152)	4.75 (121)	9.00 (229)			
	321-4-X-12					12.0 (305)	9.00 (229)	18.0 (457)	360°
	321-4-X-24					24.0 (610)	18.0 (457)	36.0 (914)	
	321-4-X-48					48.0 (1220)	36.0 (914)	72.0 (1830)	
3/8	321-6-X-1	0.75 (19.1)	0.58 (14.7)	1.00 (25.4)	0.75 (19.1)	1.50 (38.1)	90°		
	321-6-X-3			3.00 (76.2)	2.50 (63.5)	4.50 (114)	225°		
	321-6-X-6			6.00 (152)	4.75 (121)	9.00 (229)	360°		
	321-6-X-12			12.0 (305)	9.00 (229)	18.0 (457)			
	321-6-X-24			24.0 (610)	18.0 (457)	36.0 (914)			
	1/2			321-8-X-1	1.00 (25.4)	0.71 (18.0)	1.00 (25.4)	0.75 (19.1)	1.50 (38.1)
321-8-X-3		3.00 (76.2)	2.50 (63.5)	4.50 (114)			180°		
321-8-X-6		6.00 (152)	4.75 (121)	9.00 (229)			360°		
321-8-X-12		12.0 (305)	9.00 (229)	18.0 (457)					
321-8-X-24		24.0 (610)	18.0 (457)	36.0 (914)					
321-8-X-36		36.0 (914)	24.0 (610)	54.0 (1370)					
3/4	321-12-X-1	1.00 (25.4)	1.08 (27.4)	1.00 (25.4)	0.75 (19.1)	1.50 (38.1)	30°		
	321-12-X-3			3.00 (76.2)	2.50 (63.5)	4.50 (114)	90°		
	321-12-X-6			6.00 (152)	4.75 (121)	9.00 (229)	180°		
	321-12-X-12			12.0 (305)	9.00 (229)	18.0 (457)	360°		
	321-12-X-24			24.0 (610)	18.0 (457)	36.0 (914)			
	321-12-X-36			36.0 (914)	24.0 (610)	54.0 (1370)			
1	321-16-X-1	1.00 (25.4)	1.36 (34.5)	1.00 (25.4)	0.75 (19.1)	1.50 (38.1)	20°		
	321-16-X-3			3.00 (76.2)	2.50 (63.5)	4.50 (114)	90°		
	321-16-X-6			6.00 (152)	4.75 (121)	9.00 (229)	180°		
	321-16-X-12			12.0 (305)	9.00 (229)	18.0 (457)	360°		
	321-16-X-24			24.0 (610)	18.0 (457)	36.0 (914)			
	321-16-X-36			36.0 (914)	24.0 (610)	54.0 (1370)			
1 1/2	321-24-X-1	1.00 (25.4)	1.92 (48.8)	1.00 (25.4)	0.75 (19.1)	1.50 (38.1)	15°		
	321-24-X-3			3.00 (76.2)	2.50 (63.5)	4.50 (114)	60°		
	321-24-X-6			6.00 (152)	4.75 (121)	9.00 (229)	120°		
	321-24-X-12			12.0 (305)	9.00 (229)	18.0 (457)	240°		
	321-24-X-24			24.0 (610)	18.0 (457)	36.0 (914)	360°		
	321-24-X-36			36.0 (914)	24.0 (610)	54.0 (1370)			



① Angular displacement based on nominal manufactured length. **Angular displacement is not recommended for applications involving pressure surges.**

XBA Adapters



XBA adapters are brazed or soldered to convoluted tubing for connecting to socket or butt weld fittings, Swagelok® tube fittings, or Ultra-Torr® fittings.

Material

304 stainless steel

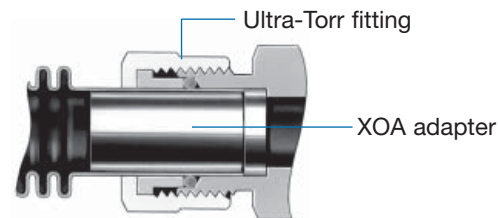
Pressure Rating

- 1/4 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 100psig (6.8 bar)
- 3/8 through 1 1/2 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 25 psig (1.7 bar)

Temperature Rating

- 70 to 1000°F (20 to 537°C)
 - When used with Ultra-Torr fittings—70 to 400°F (20 to 204°C)

XOA Adapters



XOA adapters support the tubing cuff when using convoluted tubing products with Ultra-Torr fittings. XOA adapters provide a leak-tight connection and are reusable.

Material

304 stainless steel

Pressure Rating

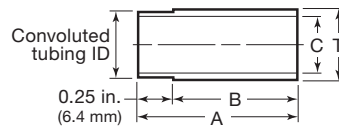
Ultrahigh vacuum (10^{-9} torr) to atmospheric pressure.

Temperature Rating

70 to 400°F (20 to 204°C)

Dimensions

Dimensions are for reference only and are subject to change.



T in.	Ordering Number	Dimensions, in. (mm)		
		A	B	C
1/4	304-4-XBA	0.94 (23.9)	0.69 (17.5)	0.16 (4.1)
3/8	304-6-XBA	1.00 (25.4)	0.75 (19.1)	0.28 (7.1)
1/2	304-8-XBA	1.19 (30.2)	0.94 (23.9)	0.38 (9.7)
3/4	304-12-XBA	1.28 (32.5)	1.03 (26.2)	0.60 (15.2)
1	304-16-XBA ^①	1.56 (39.6)	1.31 (33.3)	0.85 (21.6)
1 1/2	304-24-XBA ^①	2.31 (58.7)	2.06 (52.3)	1.35 (34.3)

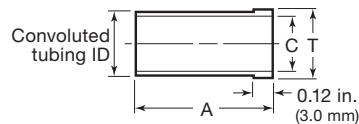
^① Not recommended for gas service.

Ordering Information

Select an adapter ordering number.

Dimensions

Dimensions are for reference only and are subject to change.



T in.	Ordering Number	Dimensions, in. (mm)	
		A	C
1/4	304-4-XOA	0.75 (19.1)	0.16 (4.1)
3/8	304-6-XOA		0.28 (7.1)
1/2	304-8-XOA	1.00 (25.4)	0.38 (9.7)
3/4	304-12-XOA		0.60 (15.2)
1	304-16-XOA		0.85 (21.6)
1 1/2	304-24-XOA		1.35 (34.3)

Ordering Information

Select an adapter ordering number.

Factory-Welded End Connections



Convoluted tubing is available with factory-welded VCR® metal gasket face seal, VCO® O-ring face seal, and XBA adapter connections. End connections are assembled using gas tungsten arc welds (GTAW) without filler materials.

Material

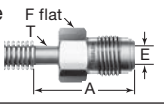
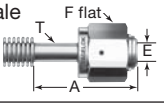
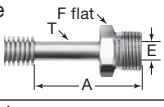
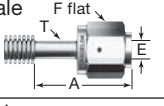
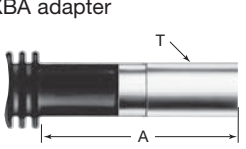
316 stainless steel

Pressure Rating

- 1/4 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 100 psig (6.8 bar)
- 3/8 in. through 1 1/2 in. outside diameter tube—ultrahigh vacuum (10^{-9} torr) to 25 psig (1.7 bar)

Dimensions

Dimensions are for reference only and are subject to change.

End Connection	Dimensions, in. (mm)			
	T	A	E	F
 VCR male	1/4	1.87 (47.5)	0.18 (4.6)	5/8
	3/8	2.06 (52.3)	0.28 (7.1)	15/16
	1/2	2.25 (57.2)	0.40 (10.2)	
 VCR female	1/4	1.87 (47.5)	0.18 (4.6)	3/4
	3/8	2.06 (52.3)	0.28 (7.1)	1 1/16
	1/2	2.25 (57.2)	0.40 (10.2)	
 VCO male	1/4	2.07 (52.6)	0.18 (4.6)	5/8
	3/8	2.22 (56.4)	0.30 (7.6)	15/16
	1/2	2.40 (61.0)	0.40 (10.2)	
 VCO female	1/4	1.68 (42.7)	0.12 (3.0)	11/16
	3/8	1.40 (35.6)	0.23 (5.8)	1
	1/2	1.81 (46.0)	0.33 (8.4)	
 XBA adapter	1/4	1.55 (39.4)	—	—
	3/8	1.58 (40.1)		
	1/2	1.94 (49.3)		
	3/4	2.03 (51.6)		
	1	2.31 (58.7)		
	1 1/2	3.06 (77.7)		

Temperature Rating

- VCR end connections—70 to 1000°F (20 to 537°C)
- VCO end connections—70 to 400°F (20 to 204°C), based on standard fluorocarbon FKM O-ring material
- XBA end connections—70 to 1000°F (20 to 537°C)
 - When used with Ultra-Torr fittings—70 to 400°F (20 to 204°C)

Testing

Every convoluted tubing product with factory-welded end connections is inboard helium leak tested to maximum leak rate of 1.8×10^{-7} std cm^3/s at the envelope.

Ordering Information

Add an end connection designator to the convoluted tubing ordering number. End connections are available on the convoluted tubing sizes shown in the **Dimensions** table.

End Connection(s)	Designator
VCR female one end only	FR
VCR female both ends	DFR
VCR female one end, VCR male other end	FMR
VCR female one end, XBA adapter other end	FRB
VCR male one end only	MR
VCR male both ends	DMR
VCR male one end, XBA adapter other end	MRB
VCO female one end only	FO
VCO female both ends	DFO
VCO female one end, VCO male other end	FMO
VCO female one end, XBA adapter other end	FOB
VCO male one end only	MO
VCO male both ends	DMO
XBA adapter one end only	-B1
XBA adapter both ends	-B2

Examples: 321-4-X-2**FR** for convoluted tubing with VCR female on one end
 321-4-X-2**DFR** for convoluted tubing with VCR female on both ends.

Safe Product Selection

When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

Caution: Do not mix or interchange parts with those of other manufacturers.

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit swagelok.com or contact your authorized Swagelok representative.