

Stainless Steel Seamless Tubing and Tube Support Systems

Fractional, Metric, and Imperial Sizes



- 316 / 316L and 304 / 304L stainless steel
- Standard instrumentation tubing
- 1/8 to 2 in. and 3 to 25 mm sizes
- Marked to indicate size, material, specifications, and heat code

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Material Standards

Fractional Sizes	Metric and Imperial Sizes
316 / 316L	
UNS S31600 / S31603 ASTM A213 / A269 W.-NR 1.4401 / 1.4404	UNS S31600 / S31603 ASTM A213 / A269 W.-NR 1.4435 SS 2353 AFNOR Z2CND17-13
304 / 304L	
UNS S30400 / S30403 ASTM A213 / A269	UNS S30400 / S30403 ASTM A213 / A269 W.-NR 1.4301 / 1.4306 SS 2352 AFNOR Z2CN18-10

Chemical Composition

316 / 316L

Element	Fractional Sizes	Metric and Imperial Sizes
	Composition, wt. %	
Chromium	16.0 to 18.0	17.0 to 19.0
Nickel	11.0 to 14.0	12.5 to 15.0
Molybdenum	2.00 to 3.00	2.50 to 3.00
Manganese	2.00 max	2.00 max
Silicon	0.75 max	1.00 max
Carbon	0.035 max	0.030 max
Sulfur	0.030 max	0.015 max

304 / 304L

Element	All Sizes Composition wt. %
Chromium	18.0 to 20.0
Nickel	8.0 to 11.0
Manganese	2.00 max
Silicon	0.75 max
Carbon	0.035 max
Sulfur	0.030 max

Ordering Information, Dimensions, and Pressure Ratings

Select an ordering number.

Ordering numbers specify 316 / 316L stainless steel material. For tubing of 304 / 304L stainless steel, replace **SS** in the ordering number with **304L**.

Examples: **304L**-T4-S-035-20
304L-T6M-S-1,5M-6ME
304L-T4-S-065-6ME

Pressure ratings of tubing used with Swagelok® tube fittings may be limited by the end connection. For more information, see Swagelok *Tubing Data*, MS-01-107.

Fractional Sizes

Allowable working pressures are calculated from an S value of 20 000 psi (137.8 MPa) for ASTM A269 tubing at -20 to 100°F (-28 to 37°C), as listed in ASME B31.3 and ASME B31.1.

Tubing nominal length is 20 ft.

Tube OD in.	Tube Wall in.	Ordering Number	Weight lb/ft	Working Pressure psig
1/8	0.028	SS-T2-S-028-20	0.029	8 500
1/4	0.035	SS-T4-S-035-20	0.080	5 100
	0.049	SS-T4-S-049-20	0.105	7 500
	0.065	SS-T4-S-065-20	0.128	10 200
3/8	0.035	SS-T6-S-035-20	0.127	3 300
	0.049	SS-T6-S-049-20	0.171	4 800
	0.065	SS-T6-S-065-20	0.215	6 500
1/2	0.035 ^①	SS-T8-S-035-20	0.174	2 600
	0.049	SS-T8-S-049-20	0.236	3 700
	0.065	SS-T8-S-065-20	0.302	5 100
5/8	0.065	SS-T10-S-065-20	0.389	4 000
3/4	0.065	SS-T12-S-065-20	0.476	3 300
1	0.083	SS-T16-S-083-20	0.813	3 100
1 1/4	0.095 ^①	SS-T20-S-095-20	1.187	2 800
	0.120	SS-T20-S-120-20	1.473	3 600
1 1/2	0.120 ^①	SS-T24-S-120-20	1.792	3 000
	0.134	SS-T24-S-134-20	1.981	3 400
2	0.134 ^①	SS-T32-S-134-20	2.705	2 500
	0.188	SS-T32-S-188-20	3.686	3 600

^① Not recommended for use with Swagelok tube fittings in gas service.

Ordering Information, Dimensions, and Pressure Ratings

Metric Sizes

Allowable working pressures are based on equations from ASME B31.3 and ASME B31.1 for EN ISO 1127 tubing (D4, T4 tolerance for 3 to 12 mm; D4, T3 tolerance 14 to 50 mm), using a stress value of 137.8 MPa (20 000 psi) and tensile strength of 516.4 MPa (74 900 psi).

Tubing nominal length is 6 m.

Tube OD mm	Tube Wall mm	Ordering Number	Weight kg/m	Working Pressure bar
3	0.5 ^①	SS-T3M-S-0,5M-6ME	0.021	330
	0.7 ^①	SS-T3M-S-0,7M-6ME	0.027	560
6	1.0	SS-T6M-S-1,0M-6ME	0.125	420
	1.5	SS-T6M-S-1,5M-6ME	0.169	710
8	1.0	SS-T8M-S-1,0M-6ME	0.175	310
	1.5	SS-T8M-S-1,5M-6ME	0.244	520
10	1.0	SS-T10M-S-1,0M-6ME	0.225	240
	1.5	SS-T10M-S-1,5M-6ME	0.319	400
12	1.0	SS-T12M-S-1,0M-6ME	0.275	200
	1.5	SS-T12M-S-1,5M-6ME	0.394	330
	2.0	SS-T12M-S-2,0M-6ME	0.500	470
16	1.0 ^①	SS-T16M-S-1,0M-6ME	0.375	140
	1.5	SS-T16M-S-1,5M-6ME	0.507	230
	2.0	SS-T16M-S-2,0M-6ME	0.651	330
18	1.0 ^①	SS-T18M-S-1,0M-6ME	0.425	120
	1.5	SS-T18M-S-1,5M-6ME	0.619	200
	2.0	SS-T18M-S-2,0M-6ME	0.801	290
20	2.0	SS-T20M-S-2,0M-6ME	0.901	260
22	2.0	SS-T22M-S-2,0M-6ME	1.00	230
25	2.0 ^②	SS-T25M-S-2,0M-6ME	1.15	200
	2.5	SS-T25M-S-2,5M-6ME	1.41	260

^① Not recommended for use with Swagelok tube fittings.

^② Not recommended for use with Swagelok tube fittings in gas service.

Imperial Sizes

Allowable working pressures are calculated from an S value of 20 000 psi (137.8 MPa) for ASTM A269 tubing at –20 to 100°F (–28 to 37°C), as listed in ASME B31.3 and ASME B31.1.

Tubing nominal length is 6 m.

Tube OD in.	Tube Wall in.	Ordering Number	Weight kg/m	Working Pressure psig
1/16	0.014	SS-T1-S-014-6ME	0.01	8 100
	0.020	SS-T1-S-020-6ME	0.01	12 000
1/8	0.028	SS-T2-S-028-6ME	0.04	8 500
	0.035	SS-T2-S-035-6ME	0.05	10 900
1/4	0.035	SS-T4-S-035-6ME	0.12	5 100
	0.049	SS-T4-S-049-6ME	0.16	7 500
	0.065	SS-T4-S-065-6ME	0.19	10 200
3/8	0.035	SS-T6-S-035-6ME	0.19	3 300
	0.049	SS-T6-S-049-6ME	0.25	4 800
	0.065	SS-T6-S-065-6ME	0.32	6 500
1/2	0.035 ^①	SS-T8-S-035-6ME	0.26	2 600
	0.049	SS-T8-S-049-6ME	0.35	3 700
	0.065	SS-T8-S-065-6ME	0.45	5 100
	0.083	SS-T8-S-083-6ME	0.55	6 700
5/8	0.049 ^①	SS-T10-S-049-6ME	0.45	2 900
	0.065	SS-T10-S-065-6ME	0.58	4 000
3/4	0.049 ^①	SS-T12-S-049-6ME	0.56	2 400
	0.065	SS-T12-S-065-6ME	0.71	3 300
1	0.083	SS-T16-S-083-6ME	1.2	3 100

^① Not recommended for use with Swagelok tube fittings in gas service.

Pressure Ratings at Elevated Temperatures

To determine elevated-temperature pressure ratings in accordance with B31.3 and B31.1, multiply the pressure ratings provided in the tables above by the factors in the table below.

Temperature		Material	
°F	°C	304, 304 / 304L	316, 316 / 316L
200	93	1.00	1.00
400	204	0.93	0.96
600	315	0.82	0.85
800	426	0.76	0.79
1000	537	0.69	0.76

Dual-certified grades 304 / 304L and 316 / 316L meet the requirements for the lower maximum carbon content of the L grades and for the higher minimum yield and tensile strength of the non-L grades.

Example:

Type 316 stainless steel 1/2 in. OD × 0.035 in. wall at 1000°F

1. The allowable working pressure at –20 to 100°F (–28 to 37°C) is 2600 psig (**Fractional Sizes**, page 3).

2. The elevated temperature factor for 1000°F (537°C) is 0.76:

$$2600 \text{ psig} \times 0.76 = 1976 \text{ psig}$$

The allowable working pressure for 316 SS 1/2 in. OD × 0.035 in. wall tubing at 1000°F (537°C) is 1976 psig.

Tube Support Systems

Bolted Plastic Clamp Supports

Swagelok bolted plastic clamp supports offer versatility for mounting tubing and pipe. Three support kit configurations—single, twin, and single stacking—are available. See page 00.

Three mounting configurations—weld plate, mounting rail and rail nuts, and strut nuts—are available. See page 00.

Features

- Absorb shock and vibration
- Resist many chemicals and corrosives
- Reduce stress on system components
- Enhance system reliability
- Resist ultraviolet light
- Make system easily accessible for installation and maintenance.

Temperature Rating

-22 to 194°F (-30 to 90°C)

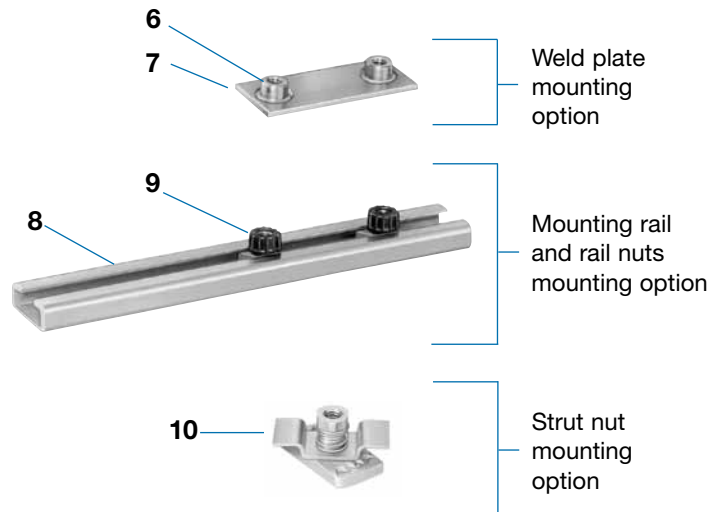
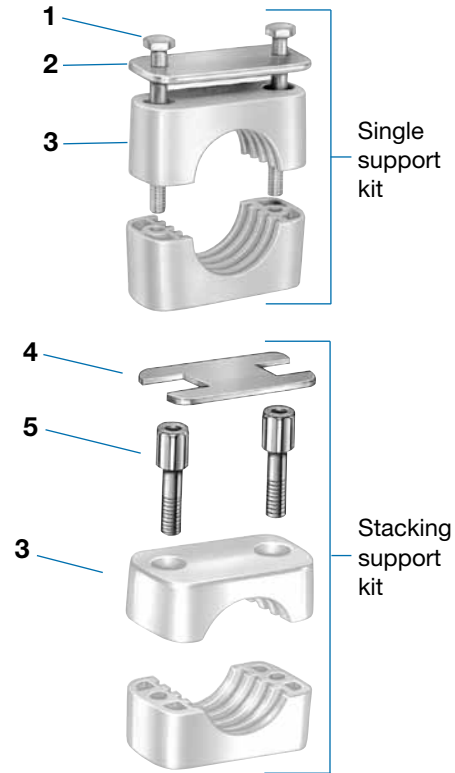
Materials of Construction

Component	Material/Specification
1 Hex head support bolts	304 SS ^①
2 Cover plate	304 SS/DIN 1.4301 SS ^①
3 Support body	Virgin polypropylene ^②
4 Lock plate	304 SS/DIN 1.4301 SS ^①
5 7/16 in. or 10 mm hex head stacking bolts	304 SS ^①
6 Weld nut	303 SS/DIN 1.4305 SS
7 Weld plate	304 SS/DIN 1.4301 SS ^①
8 Mounting rail	303 SS/DIN 1.4305 SS
9 Rail nut	CF8M/DIN 1.4408 SS
10 Strut nut	Zinc-plated steel ^③

① 316 stainless steel bolts and plates are available (see **Bolted Plastic Clamp Support Options**, page 10).

② Polyamide support bodies are available (see **Bolted Plastic Clamp Support Options**, page 10).

③ 316 stainless steel strut nuts are available (see **Bolted Plastic Clamp Support Options**, page 10).

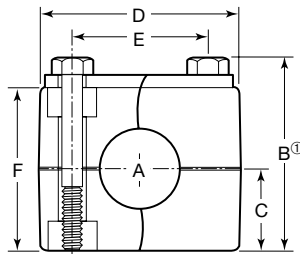


Tube Support Systems

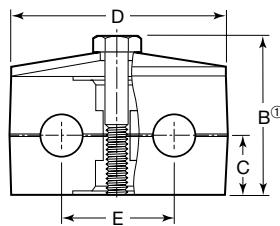
Ordering Information and Dimensions, Bolted Plastic Clamp Support Kit

Dimensions are for reference only and are subject to change.

For hose applications, consult your authorized Swagelok sales and service representative.



Single-Support Kits



Twin-Support Kits

Pipe Kits		Tube Kits				Group	Dimensions, in. (mm)						
Pipe Size A in.	Ordering Number	Tube Size A in.	Ordering Number	Tube Size A mm	Ordering Number		B ^①	C	D	E	F		
Single Support^②													
—	—	1/4	304-S1-PP-4T	6	304-S1-PP-6TM	1	1.30 (33.0)	0.51 (13.0)	1.34 (34.0)	0.79 (20.0)	1.06 (27.0)		
				8	304-S1-PP-8TM								
		3/8	304-S1-PP-6T	10	304-S1-PP-10TM								
				12	304-S1-PP-12TM								
1/2	304-S3-PP-8P	1/2	304-S3-PP-8T	14	304-S3-PP-14TM	3	1.61 (40.9)	0.67 (17.0)	1.89 (48.0)	1.30 (33.0)	1.38 (35.1)		
				15	304-S3-PP-15TM								
				16	304-S3-PP-16TM								
		5/8	304-S3-PP-10T	18	304-S3-PP-18TM								
		3/4	304-S3-PP-12T	20	304-S3-PP-20TM								
		7/8	304-S3-PP-14T	22	304-S3-PP-22TM								
1	304-S3-PP-16T	25	304-S3-PP-25TM										
3/4	304-S5-PP-12P	1 1/4	304-S5-PP-20T	30	303-S5-PP-30TM	5	2.56 (65.0)	1.14 (29.0)	2.76 (70.1)	2.05 (52.1)	2.28 (57.9)		
1	304-S5-PP-16P			32	303-S5-PP-32TM								
1 1/4	304-S5-PP-20P	1 1/2	304-S5-PP-24T	38	303-S5-PP-38TM	6	2.84 (72.1)	1.28 (32.5)	3.39 (86.1)	2.60 (66.0)	2.60 (66.0)		
1 1/2	304-S6-PP-24P	2	304-S6-PP-32T	40	303-S6-PP-40TM								
Twin Support^③													
—	—	1/4	304-S1T-PP-4T	6	304-S1T-PP-6TM	1	1.50 (38.1)	0.53 (13.5)	1.42 (36.1)	0.79 (20.1)	—		
				8	304-S1T-PP-8TM								
				10	304-S1T-PP-10TM								
		3/8	304-S1T-PP-6T	12	304-S1T-PP-12TM	3	1.93 (49.0)	0.73 (18.5)	2.64 (67.1)	1.42 (36.1)			
				1/2	304-S3T-PP-8T							15	304-S3T-15TA
				3/4	304-S3T-PP-12T							16	304-S3T-16TA
1	304-S3T-PP-16T	18	304-S3T-18TA										
		20	304-S3T-20TA										

① For overall height, add appropriate mounting option dimension.

② Threads for single fractional supports are 1/4-20 (metal M6).

③ Threads for group 1 twin supports are 1/4-20 (metal M6), group 3 twin supports are 5/16-18 (metal M5).

Single-Support Stacking Kit

You can stack up to three single bolted plastic clamp supports. The top support uses a cover plate. The lower support(s) uses a lock plate. To order a stacking support kit, add **-ST** to the single tube kit ordering number.

Example: 304-S1-PP-4T-**ST**

Tube Support Systems

Bolted Plastic Clamp Support Mounting Configurations

To order a bolted plastic clamp system, choose from the three mounting options listed below and on the next page..

Weld Plate Mounting Option

- Weld plates are available in standard and elongated lengths.
- Weld nuts are welded, not press fit, to the weld plate.

To order, select a support kit ordering number from the table on page 6.

Example: **304-S1-PP-4T**

Then identify the support kit group number listed in the table.

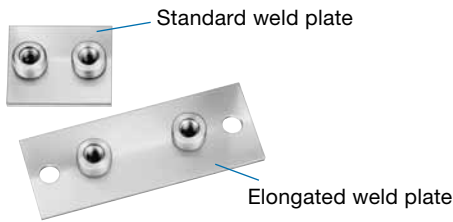
Example: **Group 1**

Select the corresponding weld plate ordering number.

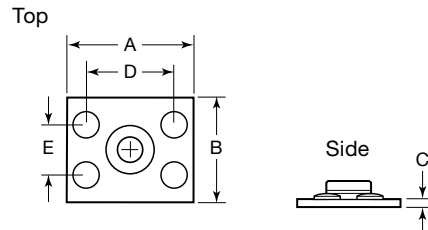
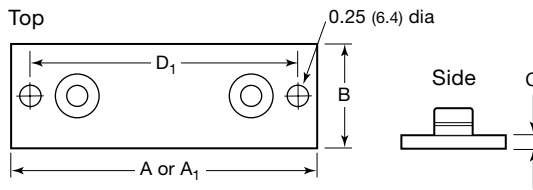
Note: The Group number for the support kit and the weld kit must be the same.

Example: **304-S1-WP**

Single-Support Weld Plate



Twin-Support Weld Plate



Weld Plate Ordering Information and Dimensions

Dimensions are for reference only and are subject to change.

Group	Ordering Number				Dimensions, in. (mm)						
	Standard		Elongated		A	A ₁ ^①	B	C	D	D ₁ ^①	E
	Fractional	Metric	Fractional	Metric							
Single-Support Weld Plate											
1	304-S1-WP	304-S1-WPM	304-S1-WPE	304-S1-WPEM	1.42 (36.1)	2.52 (64.0)	1.18 (30.0)	0.12 (3.0)	-	1.97 (50.0)	-
3	304-S3-WP	304-S3-WPM	304-S3-WPE	304-S3-WPEM	1.97 (50.0)	3.07 (78.0)				2.52 (64.0)	
5	304-S5-WP	304-S5-WPA	304-S5-WPE	304-S5-WPEM	2.83 (71.9)	3.94 (100)				3.39 (86.1)	
6	304-S6-WP	304-S6-WPA	304-S6-WPE	304-S6-WPEM	3.46 (87.9)	4.57 (116)				3.94 (100)	
Twin-Support Weld Plate											
1	304-S1T-WP	304-S1T-WPM	304-S1T-WPE	316-S1T-WPEM	1.46 (37.1)	-	1.18 (30.0)	0.12 (3.0)	0.84 (21.3)	-	0.56 (14.2)
3	304-S3T-WP	304-S3T-WPM	304-S3T-WPE	316-S3T-WPE	2.76 (70.1)	-		0.20 (5.1)	2.04 (51.8)	-	0.45 (11.4)

① Elongated weld plate only.

Tube Support Systems

Bolted Plastic Clamp Support Mounting Configurations

Dimensions, in inches (millimeters), are for reference only and are subject to change.

Mounting Rail and Rail Nuts Mounting Option

- Rail nuts can be added or removed anywhere along the rail span.
- Neoprene cap holds nuts and support body in place.
- Two rail nuts are required for single-support kits; one rail nut is required for twin-support kits.

To order, select a support kit ordering number from the table on page 6.

Example: **304-S1-PP-4T**

Then select a mounting rail ordering number.

Example: **303-S0-R-3.3**

Select the corresponding (fractional or metric) rail nut ordering number.

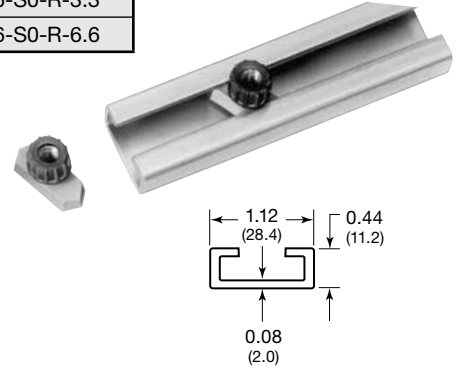
Example: 2 pc **SS-S0-RN**

Mounting Rail Ordering Information

Length, ft (m)	Ordering Number	Ordering Number
3.3 (1)	303-S0-R-3.3	316-S0-R-3.3
6.6 (2)	303-S0-R-6.6	316-S0-R-6.6

Rail Nuts Ordering Information

Group	Ordering Number	
	Fractional	Metric
Single (two nuts required)		
All	SS-S0-RN	SS-S0-RNM
Twin (one nut required)		
1	SS-S0-RN	SS-S0-RNM
3	SS-S3T-RN	SS-S3T-RNM



Strut Nuts Mounting Option

- Strut nuts are for use on 1 5/8 in. (41.3 mm) strut rail mounting systems.
- Strut nuts can be added or removed anywhere along the strut rail span.
- Two strut nuts are required for single-support kits; one strut nut is required for twin-support kits.

To order, select a support kit ordering number from the table on page 6.

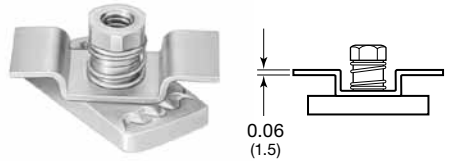
Example: **304-S1-PP-4T**

Then select the corresponding (fractional or metric) strut nut ordering number(s).

Example: 2 pc **S-S0-SN**

Strut Nuts Ordering Information

Group	Ordering Number	
	Fractional	Metric
Single (two nuts required)		
All	S-S0-SN	S-S0-SNM
Twin (one nut required)		
1	S-S0-SN	S-S0-SNM
3	S-S3T-SN	—



Group	Ordering Number	
	Fractional	Metric
Single (two nuts required)		
All	SS-S0-SN	SS-S0-SNM
Twin (one nut required)		
1	SS-S0-SN	SS-S0-SNM
3	SS-S3T-SN	—

Bolted Plastic Clamp Support Options

Blind Support Body (Undrilled)

To order, replace the tube size designator in the support kit ordering number with **BL**.

Example: 304-S1-PP-**BL**

316 Stainless Steel Bolts and Plates

To order, replace **304** with **316** in the support kit ordering number.

Examples: **316-S1-PP-4T**
316-S1-WP

Hammerhead Bolt (Cable for Fastening)

Available on request.

Polyamide Support Body

A polyamide support body is available for use in temperatures from -40 to 284°F (-40 to 140°C). To order, replace **PP** with **PA** in the support kit ordering number.

Example: 304-S1-**PA**-4T

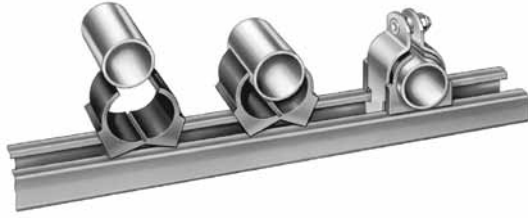
316 Stainless Steel Strut Nuts

To order, replace **S** with **SS** in the strut nuts ordering number.

Example: **SS-S0-SN**

Tube Support Systems

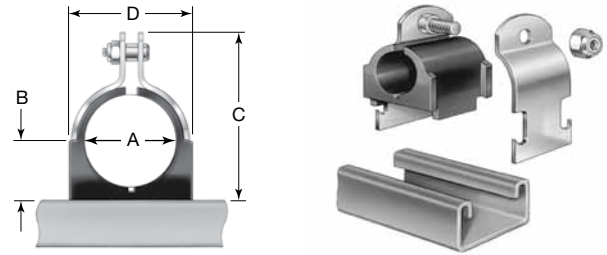
Cushioned Clamp Tube Supports



- Provide channel-mounted tube support
- Dampen shock and vibration
- Resist galvanic corrosion.

Technical Data

Component	Material	Temperature Rating
Clamp	Electro-dichromate-finished carbon steel or 316 stainless steel	-50 to 275°F (-45 to 135°C)
Cushion	Thermoplastic polypropylene-based elastomer	



Ordering Information and Dimensions

Dimensions are for reference only and are subject to change.

A, Tube Size		Basic Ordering Number	Dimensions, in. (mm)		
in.	mm		B	C	D
1/4	—	TBC4	0.27 (6.9)	0.98 (24.9)	0.62 (15.7)
3/8	10	TBC6	0.33 (8.4)	1.13 (28.7)	0.82 (20.8)
1/2	—	TBC8	0.40 (10.2)	1.34 (34.0)	0.94 (23.9)
3/4	20	TBC12	0.52 (13.2)	1.68 (42.7)	1.20 (30.5)
1	25	TBC16	0.65 (16.5)	1.95 (49.5)	1.44 (36.6)

Contact your authorized Swagelok representative for additional sizes.
Clamp fits any 1 5/8 in. mounting channel.

To order, select a basic ordering number and add a clamp material designator.
Example: **S-TBC4**

Clamp Material	Designator
Electro-dichromate-finished carbon steel	S-
316 stainless steel	SS-

Tube Support Systems

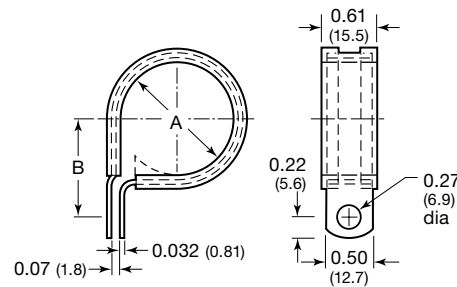
P Clamp Supports

- Are an economical way to support tube or hose runs in a variety of sizes
- Install easily to a wall or equipment frame using a single screw or bolt.



Technical Data

Component	Material	Temperature Rating
Clamp	316 SS/AMS 5524	-40 to 212°F (-40 to 100°C)
Cushion	Black EPDM/ SAE J200BC715 C12, C20	



Ordering Information and Dimensions

Dimensions, in inches (millimeters), are for reference only and are subject to change.

A, Tube Size		Ordering Number	B in. (mm)
in.	mm		
1/4	6	SS-TBP4	0.52 (13.2)
3/8	10	SS-TBP6	0.59 (15.0)
1/2	12	SS-TBP8	0.65 (16.5)
3/4	20	SS-TBP12	0.84 (21.3)
1	25	SS-TBP16	0.95 (24.1)

Contact your authorized Swagelok representative for additional sizes.

Tube Support Systems

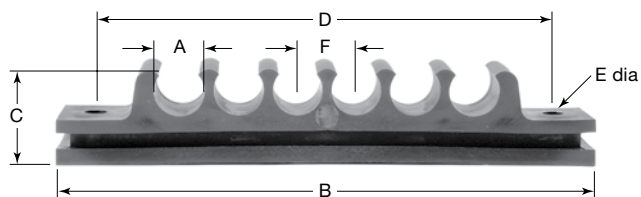
Tube Support Strips



- Organize multiple tubing or hose runs
- Offer push-in installation
- Install easily to a wall or equipment frame using two screws or bolts.

Technical Data

Component	Material	Temperature Rating
Tube support strip	Polypropylene	-40 to 200°F (-40 to 93°C)



Ordering Information and Dimensions

Dimensions are for reference only and are subject to change.

A Tube Size		Ordering Number	Maximum Number of Tubing and Hose Channels	Dimensions in. (mm)					
				B	C	D	E	F	Width
1/8	—	MS-TSS-2	10	4.50 (114)	0.50 (12.7)	4.05 (103)	0.18 (4.6)	0.31 (8.0)	0.49 (12.4)
1/4	—	MS-TSS-4	10	4.50 (114)	0.50 (12.7)	4.05 (103)	0.18 (4.6)	0.31 (8.0)	0.49 (12.4)
5/16	8	MS-TSS-5	10	5.37 (136.3)	0.56 (14.1)	4.93 (125.3)	0.18 (4.6)	0.39 (10.0)	0.49 (12.4)
3/8	10	MS-TSS-6	10	5.62 (143)	0.61 (15.6)	5.15 (131)	0.18 (4.6)	0.43 (11.0)	0.60 (15.3)
1/2	—	MS-TSS-8	6	5.25 (133)	0.93 (23.6)	4.56 (116)	0.24 (6.1)	0.57 (14.5)	0.96 (24.5)

Contact your authorized Swagelok representative for additional sizes.
Minimum order quantities and tooling may apply.

Ultrahigh-Purity and High-Purity Tubing

See the Swagelok *Ultrahigh-Purity and High-Purity Stainless Steel Tubing—Fractional, Metric, and Imperial Sizes* catalog, MS-01-182, for ordering numbers and complete information on:

■ Ultrahigh-Purity Tubing

Ultrahigh-purity tubing with an electropolished inside-diameter internal surface finish of 10 $\mu\text{in.}$ / 0.25 μm R_a max is available.

■ Chemically Cleaned and Passivated Tubing

High-purity tubing with an inside diameter finish of 20 $\mu\text{in.}$ / 0.51 μm R_a (-G20 process) or 30 $\mu\text{in.}$ / 0.76 μm R_a (-G30 process) is available. This tubing complies with ASTM G93, Level A requirement for nonvolatile residue levels and also meets requirements of CGA G4.1.

■ Thermocouple-Cleaned Tubing

High-purity tubing thermocouple cleaned (-G process) is available to meet the cleanliness requirements of ASTM A632-S3.

Tube Fittings

See the Swagelok *Gaugeable Tube Fittings and Adapter Fittings* catalog, MS-01-140, for information.



Tubing Tools and Accessories

See the Swagelok *Tubing Tools and Accessories* catalog, MS-01-179, for more information.



Swagelok Orbital Welding System

See the Swagelok *Welding System M200 Power Supply* catalog, MS-02-342, for more information.



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.

Warranty Information

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