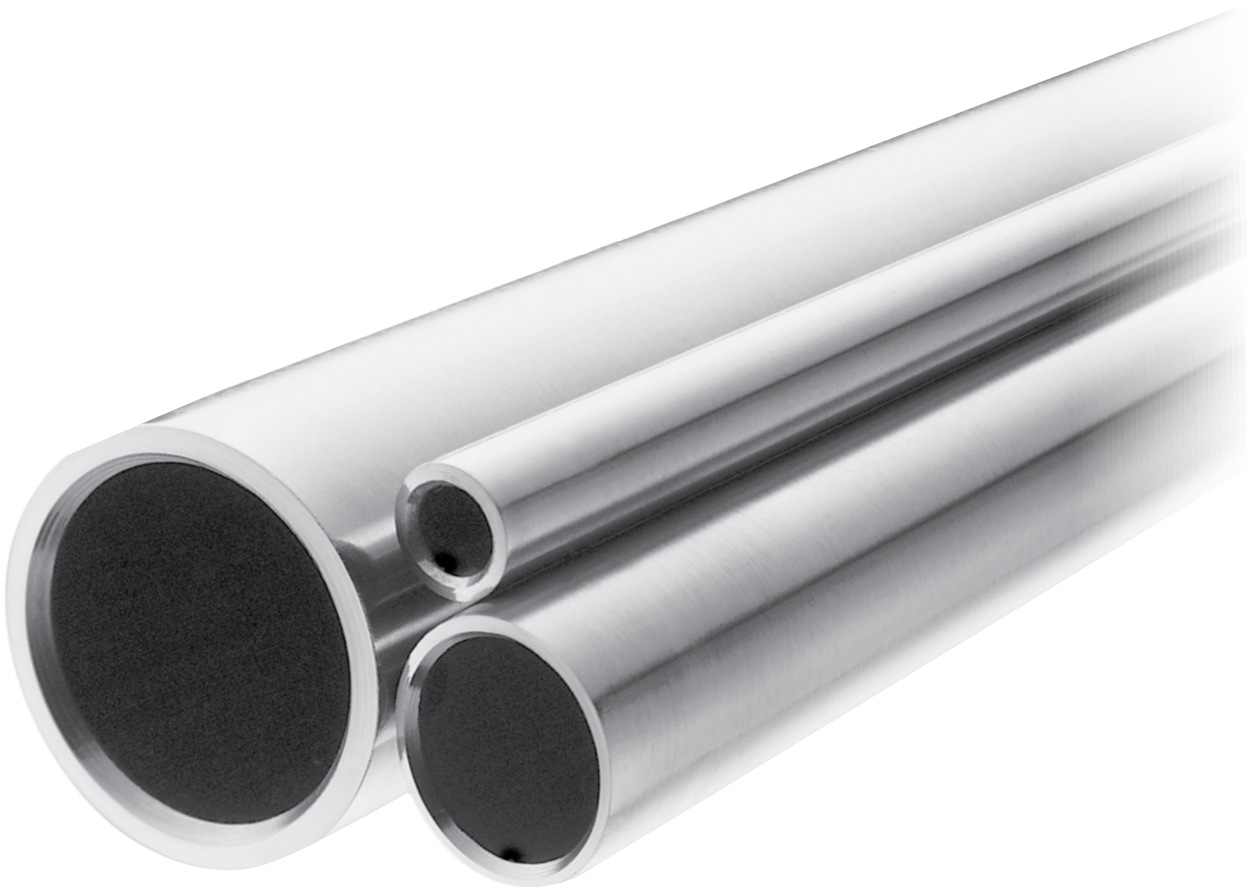
Ultrahigh-Purity (UHP) and High-Purity Stainless Steel Tubing

Fractional, Metric, and Imperial Sizes



- 316L stainless steel
- Ultrahigh-purity, coaxial, chemically cleaned and passivated, and thermocouple-cleaned tubing
- Ends prepared for orbital welding
- 1/8 to 2 in. and 6 to 18 mm sizes
- Marked to indicate size, material specifications, and heat code

Material Standards

Fractional Sizes	Metric and Imperial Sizes
UNS S31603 ASTM A269 ASME SA213	UNS S31603 ASTM A269 ASME SA213 EN 1.4404①

① W.-NR 1.4435 material available upon request.

Chemical Composition

Element	All Sizes Composition wt. %
Chromium	16.0 to 18.0
Nickel	10.0 to 15.0
Molybdenum	2.00 to 3.00
Manganese	2.00 max
Silicon	0.75 max
Carbon	0.035 max①
Sulfur	0.005 to 0.012 (seamless); 0.005 to 0.017 (welded); 0.030 max (thermocouple-cleaned)

① Tubing sizes smaller than 1/2 in. / 12 mm outside diameter contain up to 0.040 wt. % carbon.

Ultrahigh-Purity Tubing

Swagelok® stainless steel UHP tubing has an electropolished internal surface finish of 10 µin. / 0.25 µm R_a max and is cleaned and packaged in accordance with the specifications listed in the table at right.

Cleaning	Packaging	Individual Certificates	Process Designator
Rinsed with 0.1 µm-filtered, 18 MΩ·cm DI water heated to 60°C; purged with heated and filtered nitrogen	Ends are capped; tubes are individually double bagged, then bulk bagged in an ISO Class 4 clean room	Mill Test Reports Certificate of Conformance①	E2
		Mill Test Reports Surface Roughness Dimensional Tolerances	E3

Process specifications are available upon request. Contact your authorized Swagelok sales and service representative.

① Certificate of Conformance for surface roughness, dimensional tolerances, purity test for moisture and particulates, SEM pits, inclusions, or other raw material defects, XPS minimum chromium-to-iron and chromium oxide-to-iron oxide ratios, and DI water cleaning for effluent resistivity.

Ordering Information, Dimensions, and Pressure Ratings

Select a basic ordering number and add a process designator from the table above. Example: 6L-T4-S-035-20-**E2**

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.	Basic Ordering Number	Weight lb/ft	Working Pressure psig
316L Seamless				
1/4	0.035	6L-T4-S-035-20-	0.080	5100
3/8	0.035	6L-T6-S-035-20-	0.127	3300
1/2	0.049	6L-T8-S-049-20-	0.236	3700
3/4	0.065	6L-T12-S-065-20-	0.476	3300
1	0.065	6L-T16-S-065-20-	0.813	2400
316L Welded				
1 1/2	0.065	6L-T24-W-065-20-	0.996	1250
2	0.065	6L-T32-W-065-20-	1.34	950

Fractional Coaxial Sizes

Process tube is 316L seamless. Containment tube is 316L welded.

Tubing nominal length is 20 ft.

Process Tube		Containment Tube			
OD in.	Wall in.	OD in.	Wall in.	Ordering Number	Weight lb/ft
1/4	0.035	1/2	0.049	6L-CXT4-S-035-20-	0.320
3/8	0.035	5/8	0.049	6L-CXT6-S-035-20-	0.490
1/2	0.049	3/4	0.065	6L-CXT8-S-049-20-	0.720
3/4	0.065	1	0.065	6L-CXT12-S-065-20-	1.29
1	0.065	1 1/4	0.065	6L-CXT16-S-065-20-	1.52

Ultrahigh-Purity Tubing

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 6 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
316L Seamless				
6	1.0	6L-T6M-S-1.0M-6M-	0.125	420
8	1.0	6L-T8M-S-1.0M-6M-	0.175	310
10	1.0	6L-T10M-S-1.0M-6M-	0.225	240
12	1.0	6L-T12M-S-1.0M-6M-	0.275	200
18	1.5	6L-T18M-S-1.5M-6M-	0.619	200

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.	Basic Ordering Number	Weight kg/m	Working Pressure psig
316L Seamless				
1/4	0.035	6L-T4-S-035-6M-	0.12	5100
3/8	0.035	6L-T6-S-035-6M-	0.19	3300
1/2	0.049	6L-T8-S-049-6M-	0.35	3700
3/4	0.065	6L-T12-S-065-6M-	0.71	3300
1	0.065	6L-T16-S-065-6M-	1.2	2400
316L Welded				
1 1/2	0.065	6L-T24-W-065-6M-	1.5	1250
2	0.065	6L-T32-W-065-6M-	2.0	950

Imperial Coaxial Sizes

Process tube is 316L seamless. Containment tube is 316L welded.

Tubing nominal length is 6 m.

Process Tube		Containment Tube		Ordering Number	Weight kg/m
OD in.	Wall in.	OD in.	Wall in.		
1/4	0.035	1/2	0.049	6L-CXT4-S-035-6M-	0.48
3/8	0.035	5/8	0.049	6L-CXT6-S-035-6M-	0.73
1/2	0.049	3/4	0.065	6L-CXT8-S-049-6M-	1.1
3/4	0.065	1	0.065	6L-CXT12-S-065-6M-	1.9
1	0.065	1 1/4	0.065	6L-CXT16-S-065-6M-	2.3

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 at right.

Temperature		Factor
°F	°C	
200	93	1.00
400	204	0.96
600	315	0.85
800	426	0.79
1000	537	0.76

Example:

Type 316L stainless steel 1/2 in. OD × 0.049 in. wall at 1000°F

1. The allowable working pressure at –20 to 100°F (–28 to 37°C) is 3700 psig (**Fractional Sizes,** page 2).
2. The elevated temperature factor for 1000°F (537°C) is 0.76:

   3700 psig × 0.76 = 2812 psig

The allowable working pressure for 316L SS 1/2 in. OD × 0.049 in. wall tubing at 1000°F (537°C) is 2812 psig.

Chemically Cleaned and Passivated and Thermocouple-Cleaned Tubing

Chemically cleaned and passivated tubing complies with ASTM G93, Level A requirement for nonvolatile residue levels and also meets requirements of CGA G4.1.

Thermocouple-cleaned tubing meets the cleanliness requirements of ASTM A632-S3.

Tubing	Inside Diameter Surface Finish	Packaging	External Finish	Process Designator
Seamless, chemically cleaned and passivated	20 µin. / 0.51 µm R_a max	Ends are protected with polyamide nylon film and polyethylene caps; tubes are individually packed in heat-sealed polyethylene bags	Satin	G20
	32 µin. / 0.76 µm R_a max			G30
Seamless, thermocouple-cleaned	Standard finish (see ASTM A269)	Ends are polyethylene capped; tubes are bulk packaged in heat-sealed polyethylene bags		G

Ordering Information, Dimensions, and Pressure Ratings

Select a basic ordering number and add a process designator from the table above. Example: 6L-T6M-S-1.0M-6M-**G20**

Fractional Sizes

Tubing nominal length is 20 ft.

Tube OD in.	Tube Wall in.	Basic Ordering Number	Weight lb/ft	Working Pressure psig
1/8	0.020	6L-T2-S-020-20-	0.022	6000
	0.028	6L-T2-S-028-20-G①	0.029	8500
1/4	0.035	6L-T4-S-035-20-	0.080	5100
3/8	0.035	6L-T6-S-035-20-	0.127	3300
1/2	0.049	6L-T8-S-049-20-	0.236	3700
	0.065	6L-T8-S-065-20-	0.302	5100
3/4	0.065	6L-T12-S-065-20-	0.476	3300
1	0.065	6L-T16-S-065-20-G20②	0.649	2400

① Available thermocouple-cleaned only. Use ordering number shown.
② Available with G20 process only. Use ordering number shown.

Metric Sizes

Tubing nominal length is 6 m.

Tube OD mm	Tube Wall mm	Ordering Number	Weight kg/m	Working Pressure bar
6	1.0	6L-T6M-S-1.0M-6M-	0.125	420
8	1.0	6L-T8M-S-1.0M-6M-	0.175	310
10	1.0	6L-T10M-S-1.0M-6M-	0.225	240
12	1.0	6L-T12M-S-1.0M-6M-	0.275	200
18	1.5	6L-T18M-S-1.5M-6M-	0.619	200

Imperial Sizes

Tubing nominal length is 6 m.

Tube OD in.	Tube Wall in.	Basic Ordering Number	Weight lb/ft	Working Pressure psig
1/8	0.020	6L-T2-S-020-6M-	0.03	6000
	0.028	6L-T2-S-028-6M-G①	0.04	8500
1/4	0.035	6L-T4-S-035-6M-	0.12	5100
3/8	0.035	6L-T6-S-035-6M-	0.19	3300
1/2	0.049	6L-T8-S-049-6M-	0.35	3700
	0.065	6L-T8-S-065-6M-	0.45	5100
3/4	0.065	6L-T12-S-065-6M-	0.71	3300
1	0.065	6L-T16-S-065-6M-G20②	0.97	2400

① Available thermocouple-cleaned only. Use ordering number shown.
② Available with G20 process only. Use ordering number shown.

Standard Instrumentation Tubing

See the Swagelok *Stainless Steel Seamless Tubing—Fractional, Metric, and Imperial Sizes* catalog, MS-01-181, for ordering numbers and complete information on 316 / 316L and 304 / 304L standard instrumentation tubing.

Warranty Information

All tubing listed in this catalog are backed by the tube manufacturer's warranty and not The Swagelok Limited Lifetime Warranty. For more information contact your authorized Swagelok representative.

Swagelok

Introduction

Since 1947, Swagelok has designed, developed, and manufactured high-quality, general-purpose and specialty fluid system products to meet the evolving needs of global industries. Our focus is on understanding our customers' needs, finding timely solutions, and adding value with our products and services.

We are pleased to provide this global edition of the book-bound *Swagelok Product Catalog,* which compiles more than 100 separate product catalogs, technical bulletins, and reference documents into one convenient, easy-to-use volume. Each product catalog is up to date at the time of printing, with its revision number shown on the last page of the individual catalog. Subsequent revisions will supersede the printed version and will be posted on the Swagelok website and in the Swagelok electronic Desktop Technical Reference (eDTR) tool.

For more information, visit your Swagelok website or contact your authorized Swagelok sales and service representative.

Warranty Information

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

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.

⚠ WARNING
Do not mix/interchange Swagelok products or components not governed by industrial design standards, including Swagelok tube fitting end connections, with those of other manufacturers.