

Gaugeable Alloy 400 Mechanically Attached Pipe and Tube Fittings



- For use with MIL-T-16420K 70/30 and 90/10 copper-nickel tubing and pipe
- Excellent corrosion resistance in chloride-containing environments
- ASTM F1387-qualified for shipboard use
- Easy installation using hand tools
- Available in sizes for 1/8 to 1/2 in. pipe and 1/4 to 1 in. tubing

Features

Swagelok Company has qualified the Swagelok® alloy 400 fitting product line in sizes from 1/8 to 1/2 in. pipe and 1/4 to 1 in. tubing based on ASTM F1387, “Standard Specification for Performance of Piping and Tubing Mechanically Attached Fittings” and received U.S. Navy approval for use on surface ships (see table footnote ①, below).

This standard establishes the performance characteristics required for mechanically attached fittings (MAF), such as the Swagelok tube fitting. The Swagelok alloy 400 mechanically attached pipe and tube fittings are rated for use to the working pressures listed in the table below.

The ASTM F1387 qualification tests included:

- Examination of Specimen
- Hydrostatic Proof
- Flexure Fatigue
- Hydrostatic Burst
- Rotary Flexure
- Elevated Temperature Soak
- Torsion
- Fire
- Pneumatic Proof
- Impulse
- Tensile
- Repeated Assembly
- Thermal Cycling
- Stress Corrosion
- Shock
- Vibration



Materials of Construction

Component	Material	Material Specification	
		Bar Stock	Forgings
1 Nut	Alloy 400	ASTM B164	ASTM B564, ASME SB564
2 Back ferrule			
3 Front ferrule			
4 Body			

Wetted components listed in *italics*.

For improved performance, fitting components of alloy 400 are coated with a hydrocarbon film.

Pressure Ratings

Pressure ratings listed in the tables below are in accordance with the pressure classes listed in MIL-T-16420K, “Military Specifications, Tube, Copper-Nickel Alloy, Seamless and Welded (Copper Alloy Numbers 715 and 706)” for the applicable copper-nickel alloy tubing and pipe grades.

Swagelok alloy 400 mechanically attached pipe and tube fittings, used with MIL-T-16420K copper-nickel alloy tubing and pipe, are rated for general use to these pressures.

Temperature Rating

–65 to 600°F (–53 to 315°C)

Suggested Allowable Working Pressures^① for Swagelok Alloy 400 Tube Fittings

With Copper-Nickel Alloy 715^② (70/30) Tubing

Fitting	Outside Diameter in.	Tube Wall Thickness, in.								
		0.035	0.049	0.058	0.065	0.072	0.095	0.109	0.120	0.134
		Working Pressure, psig (bar)								
1/8 in. pipe	0.405	–	–	3300 (227)	–	–	–	–	–	–
1/4 in. pipe	0.540	–	–	–	700 (48.2)	3300 (227)	–	–	–	–
3/8 in. pipe	0.675	–	–	–	200 (13.7)	700 (48.2)	3300 (227)	–	–	–
1/2 in. pipe	0.840	–	–	–	–	700 (48.2)	–	–	3300 (227)	–
1/4 in. tube	0.250	3300 (227)	–	6000 (413)	–	–	–	–	–	–
3/8 in. tube	0.375	–	3300 (227)	–	–	–	–	–	–	–
1/2 in. tube	0.500	–	–	–	700 (48.2)	3300 (227)	–	–	–	–
3/4 in. tube	0.750	–	–	–	–	–	–	3300 (227)	–	–
1 in. tube	1.00	–	–	–	–	–	–	–	–	3300 (227)

With Copper-Nickel Alloy 706^③ (90/10) Tubing

Copper-nickel alloy 706 (90/10) purchased to MIL-T-16420K may be used up to 200 psig (13.7 bar).

① Swagelok alloy 400 tube fittings have been qualified for use on surface ships by the U.S. Navy as Type IV, Grade C, Class 8 (Class 10 for 1/4 in. size), 600°F, separable, 70/30 NiCu fittings, 3750 psig (6000 psig for 1/4 in. size) pressure ratings when used with 70/30 CuNi or 90/10 CuNi (400 psig max) tubing in accordance with MIL-T-16420K, Type 1, Grade 2, alloy 715, for size ranges 1/4 to 1 in. OD (0.035 to 0.134 in. wall thickness). The 1/4 in. tube size is approved for fire-hardened applications; all other tube sizes and all pipe sizes are approved for non-fire-hardened applications only. Pressure ratings in the tables above are in accordance with MIL-T-16420K pressure classes.

② Specified to Table III of MIL-T-16420K.

③ Specified to paragraph 1.2.1. of MIL-T-16420K.

Ordering Information

Select an ordering number.

Male Connectors



Tube

Tube OD in.	Pipe Size in.	Ordering Number
1/4	1/8	M-400-1-2
1/4	1/4	M-400-1-4
3/8	1/4	M-600-1-4
3/8	1/2	M-600-1-8
1/2	1/4	M-810-1-4
1/2	1/2	M-810-1-8
5/8	1/2	M-1010-1-8
3/4	3/4	M-1210-1-12
7/8	3/4	M-1410-1-12
1	1	M-1610-1-16

Pipe

Pipe Size in.	NPT Size in.	Ordering Number
1/8	1/8	M-2P0-1-2
1/4	1/8	M-4P0-1-2
1/4	1/4	M-4P0-1-4
3/8	1/4	M-6P0-1-4
3/8	1/2	M-6P0-1-8
1/2	1/4	M-8P0-1-4
1/2	1/2	M-8P0-1-8

Unions



Tube

Tube OD in.	Ordering Number
1/4	M-400-6
3/8	M-600-6
1/2	M-810-6
5/8	M-1010-6
3/4	M-1210-6
7/8	M-1410-6
1	M-1610-6

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P0-6
1/4	M-4P0-6
3/8	M-6P0-6
1/2	M-8P0-6

Reducing Unions



Tube

Tube OD, in.		Ordering Number
T	Tx	
3/8	1/4	M-600-6-4
1/2	1/4	M-810-6-4
1/2	3/8	M-810-6-6
5/8	1/2	M-1010-6-8
3/4	1/2	M-1210-6-8
1	3/4	M-1610-6-12

Pipe

Pipe Size, in.		Ordering Number
P	Px	
1/4	1/8	M-4P0-6-2P
3/8	1/4	M-6P0-6-4P
1/2	1/4	M-8P0-6-4P
1/2	3/8	M-8P0-6-6P

90° Union Elbows



Tube

Tube OD in.	Ordering Number
1/4	M-400-9
3/8	M-600-9
1/2	M-810-9
5/8	M-1010-9
3/4	M-1210-9
1	M-1610-9

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P0-9
1/4	M-4P0-9
3/8	M-6P0-9
1/2	M-8P0-9

Ordering Information

Select an ordering number.

Union Tees



Tube

Tube OD in.	Ordering Number
1/4	M-400-3
3/8	M-600-3
1/2	M-810-3
5/8	M-1010-3
3/4	M-1210-3
1	M-1610-3

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P0-3
1/4	M-4P0-3
3/8	M-6P0-3
1/2	M-8P0-3

Union Branch Reducing Tees



Tube

Tube OD, in.		Ordering Number
Main	Branch	
3/8	1/4	M-600-3-6-4
1/2	1/4	M-810-3-8-4
1/2	3/8	M-810-3-8-6
5/8	3/8	M-1010-3-10-6
3/4	1/2	M-1210-3-12-8
1	3/4	M-1610-3-16-12

Pipe

Pipe Size, in.		Ordering Number
Main	Branch	
1/4	1/8	M-4P0-3-4P-2P
3/8	1/4	M-6P0-3-6P-4P
1/2	1/4	M-8P0-3-8P-4P
1/2	3/8	M-8P0-3-8P-6P

Male Adapters



Tube

Tube OD in.	NPT Size in.	Ordering Number
1/4	1/4	M-4-TA-1-4
3/8	1/4	M-6-TA-1-4
1/2	1/2	M-8-TA-1-8
3/4	3/4	M-12-TA-1-12
1	1	M-16-TA-1-16

Female ISO Parallel (RG, Gauge) Thread



Tube

Tube OD in.	ISO Pipe Size in.	Ordering Number
1/4	1/4	M-400-7-4RG
3/8	3/8	M-600-7-6RG
1/2	1/2	M-810-7-8RG

Pipe

Pipe Size in.	ISO Pipe Size in.	Ordering Number
1/8	1/8	M-2P0-7-2RG
1/4	1/4	M-4P0-7-4RG
3/8	3/8	M-6P0-7-6RG
1/2	1/2	M-8P0-7-8RG

Female VCO® Fittings



Tube

1/4 in. size only; fluorocarbon FKM O-ring standard (other O-ring materials available).

Ordering number:

M-4-FVCO-6-400

Ordering Information

Select an ordering number.

Caps



Tube

Tube OD in.	Ordering Number
1/4	M-400-C
3/8	M-600-C
1/2	M-810-C
5/8	M-1010-C
3/4	M-1210-C
7/8	M-1410-C
1	M-1610-C

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P0-C
1/4	M-4P0-C
3/8	M-6P0-C
1/2	M-8P0-C

Plugs



Tube

Tube OD in.	Ordering Number
1/4	M-400-P
3/8	M-600-P
1/2	M-810-P
5/8	M-1010-P
3/4	M-1210-P
7/8	M-1410-P
1	M-1610-P

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P0-P
1/4	M-4P0-P
3/8	M-6P0-P
1/2	M-8P0-P

Back Ferrules



Tube

Tube OD in.	Ordering Number
1/4	M-404-1
3/8	M-604-1
1/2	M-814-1
5/8	M-1014-1
3/4	M-1214-1
7/8	M-1414-1
1	M-1614-1

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P4-1
1/4	M-4P4-1
3/8	M-6P4-1
1/2	M-8P4-1

Front Ferrules



Tube

Tube OD in.	Ordering Number
1/4	M-403-1
3/8	M-603-1
1/2	M-813-1
5/8	M-1013-1
3/4	M-1213-1
7/8	M-1413-1
1	M-1613-1

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P3-1
1/4	M-4P3-1
3/8	M-6P3-1
1/2	M-8P3-1

Nuts



Tube

Tube OD in.	Ordering Number
1/4	M-402-1
3/8	M-602-1
1/2	M-812-1
5/8	M-1012-1
3/4	M-1212-1
7/8	M-1412-1
1	M-1612-1

Pipe

Pipe Size in.	Ordering Number
1/8	M-2P2-1
1/4	M-4P2-1
3/8	M-6P2-1
1/2	M-8P2-1

Additional Products

Other Swagelok pipe and tube fitting configurations and adapters, such as tailpiece adapters in accordance with MIL-F-1183, "Military Specifications, Fittings, Pipe, Cast Bronze, Silver Brazing," are available. Contact your authorized Swagelok sales and service representative.

Cleaning and Packaging

Fitting components are cleaned to remove machine oil, grease, and loose particles. For more information, see *Swagelok Standard Cleaning and Packaging (SC-10)*, MS-06-62.

Tools for Use with Alloy 400 Tube Fittings

Gap Inspection Gauges

Swagelok gap inspection gauges assure the installer or inspector that the fitting has been sufficiently pulled up on initial installation.



Tube

Tube OD in.	Ordering Number
1/4	MS-IG-400
3/8	MS-IG-600
1/2	MS-IG-810
5/8	MS-IG-1010
3/4	MS-IG-1210
7/8	MS-IG-1410
1	MS-IG-1610

Pipe

Pipe Size in.	Ordering Number
1/8	MS-IG-810
1/4	MS-IG-1010
3/8	MS-IG-1210
1/2	MS-IG-1410

Preswaging Tool



For Swagelok tube fitting installations in close quarters, the Swagelok preswaging tool is a convenient accessory.

Features

- Preswages ferrules onto the tube
- Enables the installer to work in a more open, safe area
- Makes it possible to complete the installation by following retightening instructions for Swagelok tube fittings

Tube OD in.	Ordering Number
1/4 ^①	MS-ST-400GA
3/8 ^①	MS-ST-600GA
1/2 ^①	MS-ST-810GA
5/8	MS-ST-1010GA
3/4	MS-ST-1210

^① Ordering numbers containing **GA** at the end are gaugeable preswage tools, all others are non-gaugeable preswage tools.

Depth Marking Tool



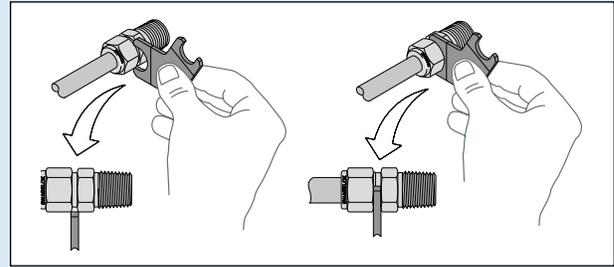
Swagelok depth marking tools help ensure that tubing is bottomed on the shoulder inside the Swagelok tube fitting body.

Tube OD in.	Ordering Number
1/4	MS-DMT-400
3/8	MS-DMT-600
1/2	MS-DMT-810
5/8	MS-DMT-1010
3/4	MS-DMT-1210
7/8	MS-DMT-1410
1	MS-DMT-1610

Gaugeability

On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened.

Position the Swagelok gap inspection gauge next to the gap between the nut and body.



If the gauge **will not** enter the gap, **the fitting is sufficiently tightened.**

If the gauge **will** enter the gap, **additional tightening is required.**

⚠ Always depressurize a system before adjusting the tightness of a tube fitting connection.

Interchangeability

Intermixing and interchanging tube fitting components of different manufacturers can be dangerous. Leak-tight seals that will withstand high pressure, vibration, vacuum, and temperature changes depend on close tolerances and consistent, exacting quality control in conjunction with good design principles.

Components of other manufacturers may look like Swagelok tube fitting components—but they cannot be manufactured in accordance with Swagelok engineering standards, nor do they benefit from innovations in design and manufacture defined by active Swagelok tube fitting patents.

Installation Instructions

Swagelok alloy 400 tube fittings can be installed quickly, easily, and reliably.

Safety Precautions

- Do not bleed system by loosening fitting nut or fitting plug.
- Do not make up and tighten fittings when system is pressurized.
- Make sure that the tubing rests firmly on the shoulder of the tube fitting body before tightening the nut.
- Use Swagelok gap inspection gauge to ensure sufficient pull-up upon initial installation.
- Always use proper thread sealants on tapered pipe threads.
- Do not mix materials or fitting components from various manufacturers—ferrules, nuts, and fitting bodies.
- Never turn fitting body. Instead, hold fitting body and turn nut.
- Avoid unnecessary disassembly of unused fittings.
- Use only long reducers in female Swagelok end connections.

Tools and Accessories

Hydraulic Swaging Units

Swagelok hydraulic swaging units preswage Swagelok ferrules onto tubing prior to assembly and provide Swagelok tube fitting connections that are 100 % gaugeable upon initial installation. Multihead hydraulic and air-actuated hydraulic swaging units:

- Place no initial strain on fitting body threads or on body seal surfaces
- Are available with interchangeable fractional and metric tooling
- Fit neatly in a rugged plastic carrying case
- Reduce assembly and installation time and operator error.

Multihead Hydraulic Swaging Unit (MHSU)

- Is available in two unit sizes, with tooling for:
 - 1/2 to 1 in. and 12 to 25 mm tubing and tube adapters
 - 1 to 2 in. and 25 to 50 mm tubing
- **Must** be used to install 1 1/4, 1 1/2, and 2 in. and 28, 30, 32, 38, and 50 mm Swagelok tube fittings
- Is standard with a tube marking feature to indicate when tube is properly bottomed in the unit
- Is available with a support base (as shown). See **Ordering Information**, page 64.

The MHSU cannot be used for Alloy 2507 tubing 1/2 in. and under or for medium-pressure tubing.

For 5/8 and 3/4 in. alloy 2507 tubing, order the 1 in./25 mm and over unit and alloy 2507 tooling kit and gap inspection gauges.



MHSU Unit Components

- Multihead hydraulic swaging unit
- Hydraulic hose—2 ft (0.6 m) with all units **except** 1 in./25 mm and over unit without support base, which contains 6 ft (1.8 m) hose
- Retaining ring pliers
- Safety glasses
- Operating instructions
- Carrying case

Tooling Kit Components

- Die head sets for Swagelok tube fitting sizes:
 - Fractional, up to 1 in.—1/2, 5/8, 3/4, 7/8, and 1 in.
 - Fractional, 1 in. and over—1, 1 1/4, 1 1/2, and 2 in.
 - Metric, up to 25 mm—12, 14, 15, 16, 18, 20, 22, and 25 mm
 - Metric, 25 mm and over—25, 28, 30, 32, and 38 mm
 - 50 mm tooling available separately
- Gap inspection gauges
- Chamfer block (up to 1 in./25 mm sizes only)

Technical Data

- Dimensions—MHSU case
22 in. (55.9 cm) high, 24 in. (61.0 cm) wide, 8.75 in. (22.2 cm) deep
- Weight
Up to 1 in./25 mm MHSU in case with tooling kit and support base—40 lb (18.1 kg)
1 in./25 mm and over MHSU in case with tooling kit and support base—55 lb (24.9 kg)
- Construction
High-strength stainless steel tooling for durability and corrosion resistance

See next page for **Ordering Information**.

Recommended Minimum Wall Thickness of Tubing for use with the MHSU

Swagelok Tube Fittings		
Tooling Size	Steel, Alloy 400 Grade 2 Titanium	Stainless Steel, Alloy (C-276, 600, 6-moly, 825 and 625)
	Tubing Wall	
Dimensions, in.		
1/2	0.049	0.065
5/8	0.065	
3/4		
7/8		
1		0.083
1 1/4	0.083	0.095
1 1/2		
2	0.095	0.109

Use of tubing below the recommended minimum wall thickness may result in the tube sticking in the die head.

Swagelok Tube Fittings		
Tooling Size	Steel, Alloy 400 Grade 2 Titanium	Stainless Steel, Alloy (C-276, 600, 6-moly, 825 and 625)
	Tubing Wall	
Dimensions, mm		
12	1.5	1.5
14		
15		1.8
16		
18		
20	2.0	2.0
22		
25		
28	2.2	2.2
30		
32		
38		2.5
50		

Tools and Accessories

Hydraulic Swaging Units

MHSU Ordering Information

Select an ordering number.

Ordering Numbers	
MHSU Unit	
Up to 1 in./25 mm sizes	MS-MHSU-U-E
1 in./25 mm and over sizes	MS-MHSU-O-E
MHSU Unit with Tooling Kit	
Fractional up to 1 in. sizes	MS-MHSU-U-E-FKIT-M
Fractional 1 in. and over sizes	MS-MHSU-O-E-FKIT-M
Metric up to 25 mm sizes	MS-MHSU-U-E-MKIT-M
Metric 25 to 38 mm ^① sizes	MS-MHSU-O-E-MKIT-M

① 50 mm tooling available separately.

Support Base

Add **-B** to the ordering number.

Examples: MS-MHSU-U-E-**B**
MS-MHSU-U-E-FKIT-M-**B**

Operating Instructions

MHSU ordering numbers include English-language instructions. For other languages, visit swagelok.com.

See the Swagelok *Multihead Hydraulic Swaging Unit (MHSU) Setup and Operating Instructions*, MS-12-37, for information about using the MHSU.

Accessories

Additional and replacement gap inspection gauges are available. See page 68.

See the table below for replacement retaining rings, pliers, and chamfer blocks.

MHSU Unit	Ordering Number
Retaining Ring	
Up to 1 in./25 mm sizes	MS-MHSU-N5000-200-H
1 in./25 mm and over sizes	MS-MHSU-N5000-315-H
Retaining Ring Pliers	
Up to 1 in./25 mm sizes	MS-MHSU-0504
1 in./25 mm and over sizes	MS-MHSU-0700

Chamfer Blocks	Ordering Number
in.	
1/2	MS-CB-810
5/8	MS-CB-1010
3/4	MS-CB-1210
7/8	MS-CB-1410
1	MS-CB-1610
mm	
12	MS-CB-12M0
14	MS-CB-14M0
15	MS-CB-15M0
16	MS-CB-16M0
18	MS-CB-18M0
20	MS-CB-20M0
22	MS-CB-22M0
25	MS-CB-25M0

Tooling Kits

Up to 1 in./25 mm

Tube OD	Ordering Number
Dimensions, in.	
1/2	MS-MHSUT-U-810-M
5/8	MS-MHSUT-U-1010-M
3/4	MS-MHSUT-U-1210-M
7/8	MS-MHSUT-U-1410-M
1	MS-MHSUT-U-1610-M
Alloy 2507 Tubing	
5/8	MS-MHSUT-O-2507-1010-M
3/4	MS-MHSUT-O-2507-1210-M
Dimensions, mm	
12	MS-MHSUT-U-12M0-M
14	MS-MHSUT-U-14M0-M
15	MS-MHSUT-U-15M0-M
16	MS-MHSUT-U-16M0-M
18	MS-MHSUT-U-18M0-M
20	MS-MHSUT-U-20M0-M
22	MS-MHSUT-U-22M0-M
25	MS-MHSUT-U-25M0-M

1 in./25 mm and Over

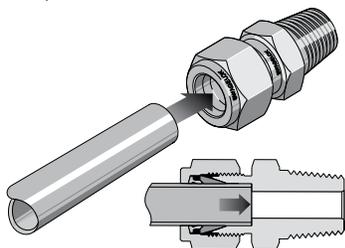
Tube OD	Ordering Number
Dimensions, in.	
1	MS-MHSUT-O-1610-M
1 1/4	MS-MHSUT-O-2000-M
1 1/2	MS-MHSUT-O-2400-M
2	MS-MHSUT-O-3200-M
Dimensions, mm	
25	MS-MHSUT-O-25M0-M
28	MS-MHSUT-O-28M0-M
30	MS-MHSUT-O-30M0-M
32	MS-MHSUT-O-32M0-M
38	MS-MHSUT-O-38M0-M
50	MS-MHSUT-O-50M0-M

Installation Instructions

Swagelok Mechanically Attached Pipe and Tube Fittings

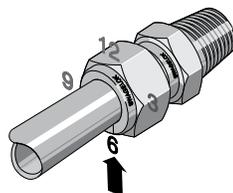
Safe practices and proper installation are imperative to the performance of the Swagelok tube fitting, especially in critical applications.

For 5/8, 3/4, 7/8 and 1 in.; 16, 18, 20, 22 and 25 mm tube fittings, in all materials except for aluminum and brass, it is a best practice to preswage the ferrules onto the tube using a Swagelok multihead hydraulic swaging unit (MHSU) to lower installation time and increase ease of installation (see Multihead Hydraulic Swaging Unit (MHSU), Setup and Operating Instructions, MS-12-37).

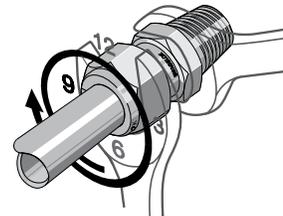


Fully insert the pipe or tube into the fitting and against the shoulder; rotate the nut finger-tight.

High-pressure applications and high safety-factor systems: Further tighten the nut until the pipe or tube will not turn by hand or move axially in the fitting.



Mark the nut at the 6 o'clock position.



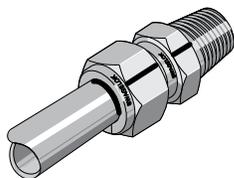
While holding the fitting body steady, tighten the nut one and one-quarter turns to the 9 o'clock position.

For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm fittings, tighten the nut only three-quarters turn to the 3 o'clock position

Reassembly

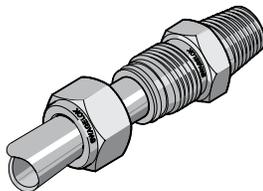
You may disassemble and reassemble Swagelok pipe and tube fittings many times.

⚠ Always depressurize the system before disassembling a Swagelok pipe or tube fitting.

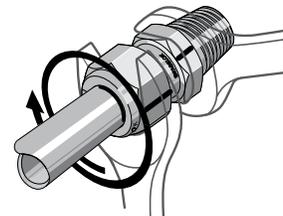


Prior to disassembly, mark the pipe or tube at the back of the nut; mark a line along the nut and fitting body flats.

Use these marks to ensure that you return the nut to the previously pulled-up position.



Insert the pipe or tube with preswaged ferrules into the fitting until the front ferrule seats against the fitting body.



While holding the fitting body steady, rotate the nut with a wrench to the previously pulled-up position, as indicated by the marks on the pipe or tube and flats. At this point, you will feel a significant increase in resistance. Tighten the nut slightly.

⚠ Do not use the Swagelok gap inspection gauge with reassembled fittings.

Caps and Plugs



Caps

See Swagelok mechanically attached pipe and tube fitting installation and reassembly, above.



Plugs

While holding fitting body steady, tighten the plug one-quarter turn from the finger-tight position.

For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the plug one-eighth turn.

⚠ Do not use the Swagelok gap inspection gauge with plug assemblies.

Reassembly

You may disassemble and reassemble Swagelok plugs many times. Make subsequent connections by slightly tightening with a wrench after snugging the nut by hand.

Tube Adapters

Safe practices and proper installation are imperative to the performance of the Swagelok tube fitting, especially in critical applications.

For 5/8, 3/4, 7/8 and 1 in.; 16, 18, 20, 22 and 25 mm tube fittings, in all materials except for aluminum and brass, it is a best practice to preswage the ferrules onto the tube adapter using a Swagelok multihead hydraulic swaging unit (MHSU) to lower installation time and increase ease of installation (see Multihead Hydraulic Swaging Unit (MHSU), Setup and Operating Instructions, MS-12-37).

Fig. 1



Fig. 2



1. Install the end opposite the tube adapter end (Fig. 1).
2. Insert the tube adapter into the Swagelok tube fitting. Make sure that the tube adapter rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight (Fig. 2).
3. Mark the nut at the 6 o'clock position.

4. While holding fitting body steady, tighten the nut one and one-quarter turns to the 9 o'clock position.

For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut only three-quarters turn to the 3 o'clock position.

Reassembly

See **Reassembly**, page 7.

Depth Marking Tool

Fig. 1



Fig. 2



1. Insert cleanly cut, fully deburred tube into the depth marking tool (DMT) until the tube is fully bottomed into the tool. Using a pen or pencil, mark the pipe or tube at the top of the DMT (Fig. 1).
2. Remove the tube from the DMT and insert it into the Swagelok

fitting until it is bottomed inside the fitting body (Fig. 2). If any portion of the mark on the tube can be seen above the fitting nut, the tube is not fully bottomed inside the fitting.

3. While holding the fitting body steady, follow the **Installation Instructions**, page 9.

Non-Gaugeable Preswaging Tool

Fig. 1



Fig. 2



Fig. 3



NOTE: These instructions apply only to the following non-gaugeable preswaging tools, MS-ST-1210. Tool will not have a colored band and the ordering number does not contain GA.

1. Install the Swagelok nut and ferrules onto the preswaging tool.
2. Insert the tube into the preswaging tool.
3. Make sure that the tube rests firmly on the shoulder of the preswaging tool body and that the nut is finger-tight.
4. Mark the nut at the 6 o'clock position.
5. While holding the preswaging tool steady, tighten the nut one and one-quarter turns to the 9 o'clock position.
6. Loosen the nut.

For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut three-quarters turn to the 3 o'clock position (Fig. 1).

7. Remove the tube with preswaged ferrules from the preswaging tool. If the tube sticks in the preswaging tool, remove by gently rocking it back and forth. Do not turn the pipe or tube (Fig. 2).

8. Insert tube with preswaged ferrules into the fitting body until the front ferrule seats.
9. Rotate the nut with a wrench to the previously pulled-up position; at this point, a significant increase in resistance will be encountered.
10. Tighten slightly with a wrench (Fig. 3).

⚠ Do not use the Swagelok gap inspection gauge with fittings that were assembled with MS-ST-1210.

Installation Instructions

Tools Required for Gageable Preswaging Tool Instructions

Fig. 1



Fig. 2



Fig. 3



Fig. 4



1. Gaugeable preswage tool (Fig. 1).
Gaugeable tools are available in sizes 1/4, 3/8, 1/2, and 5/8 in. (6, 8, 10, 12, and 16 mm)
2. Body wrench and nut wrench (Fig. 2).
3. Standard gap gauge for standard assembly (Fig. 3).
4. Severe-service gap gauge for severe service assembly (Fig. 4).

Gageable Preswaging Tool Instructions

Fig. 5



Fig. 6



Fig. 7



Fig. 8



1. Install the Swagelok nut and ferrules onto the preswaging tool (Fig. 5).
2. Insert the tube into the preswaging tool until it rests firmly on the shoulder of the tool; rotate the nut finger-tight (Fig. 6).
3. While holding the preswaging tool steady, tighten the nut with a wrench until it stops against the collar (Fig. 7).
4. Loosen the nut and remove the tube with preswaged ferrules from the preswaging tool. If the tube sticks, gently rock it back and forth. Do not turn the tube (Fig. 8).

Installation Instructions

Gaugeable Preswaging Tool, Tube Fitting Installation

Fig. 1



Fig. 2



Fig. 3



1. Insert the tube with preswaged ferrules into the fitting until the front ferrule seats against the fitting body; rotate the nut finger-tight (Fig. 1).
2. Mark the nut at the 6 o'clock position (Fig. 2).
3. While holding the fitting body steady, tighten the nut one-half turn to the 12 o'clock position (Fig. 3).

Note: If assembling fittings for high-pressure applications or high safety-factor systems, tighten one hex flat further than one-half turn.

Gaugeability

Fig. 4



Fig. 5



On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened.

If the nut was tightened additionally during installation (step 3), use Fig. 4 for gauging, otherwise use Fig. 5.

Position the Swagelok gap inspection gauge next to the gap between the nut and body.

- If the gauge will not enter the gap, the fitting is sufficiently tightened.
- If the gauge will enter the gap, additional tightening is required.

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.

Warranty Information

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