

High Volume AbT Swaging Unit (HVSU)

User's Manual



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Safety

Safety Summary

This manual contains important information for the operation of the Swagelok® High Volume Swaging Unit (HVSU). Users should read and understand the contents before operating the HVSU.

The HVSU has no internal serviceable parts. Return the HVSU to your authorized Swagelok representative for service.

WARNING	Statements that indicate a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Statements that indicate a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Statements that indicate a hazardous situation which, if not avoided, could result in damage to the equipment or other property.



Safety alert symbol indicating a potential personal injury hazard.



Safety alert symbol indicating a potential for personal injury from electrical shock.

High Volume Swaging Unit (HVSU) Safety Information



WARNING

ELECTRIC SHOCK can kill.



Touching live electrical parts and failure to operate equipment properly can cause fatal electric shock and severe burns. Incorrectly installed or improperly grounded equipment is a hazard. To avoid injury:

- Do not touch live electrical parts.
- Keep all panels and covers securely in place.
- Follow local electrical codes and the guidelines in this manual when installing the HVSU. Shock hazards can exist even when equipment is properly installed, so it is important that the operator be trained in the proper use of the equipment and follow established safety practices.
- Frequently inspect input power cord for damage or bare wiring—replace immediately if damaged.
- Properly unplug the power cord. Grasp the plug to remove it from the receptacle.



WARNING

Danger of eyes being injured.

Eye protection must be worn while operating or working near the equipment.



WARNING

Keep dry. Equipment and components are not waterproof.

Do not use electric tools in a damp or wet environment.

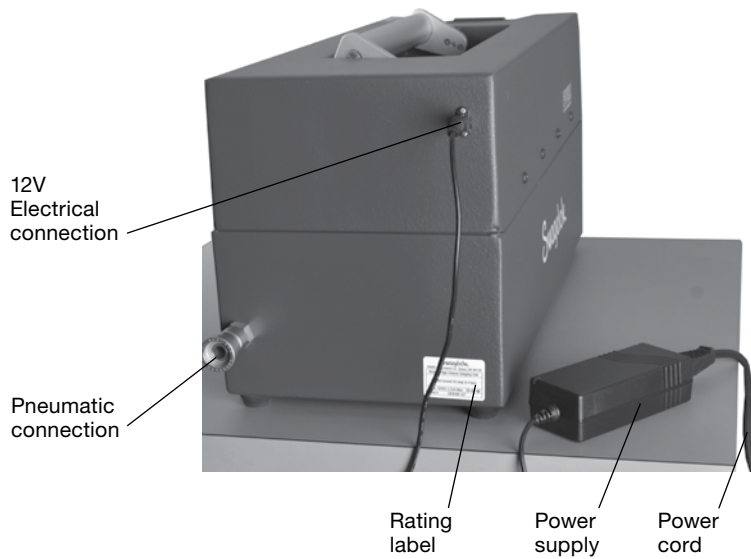
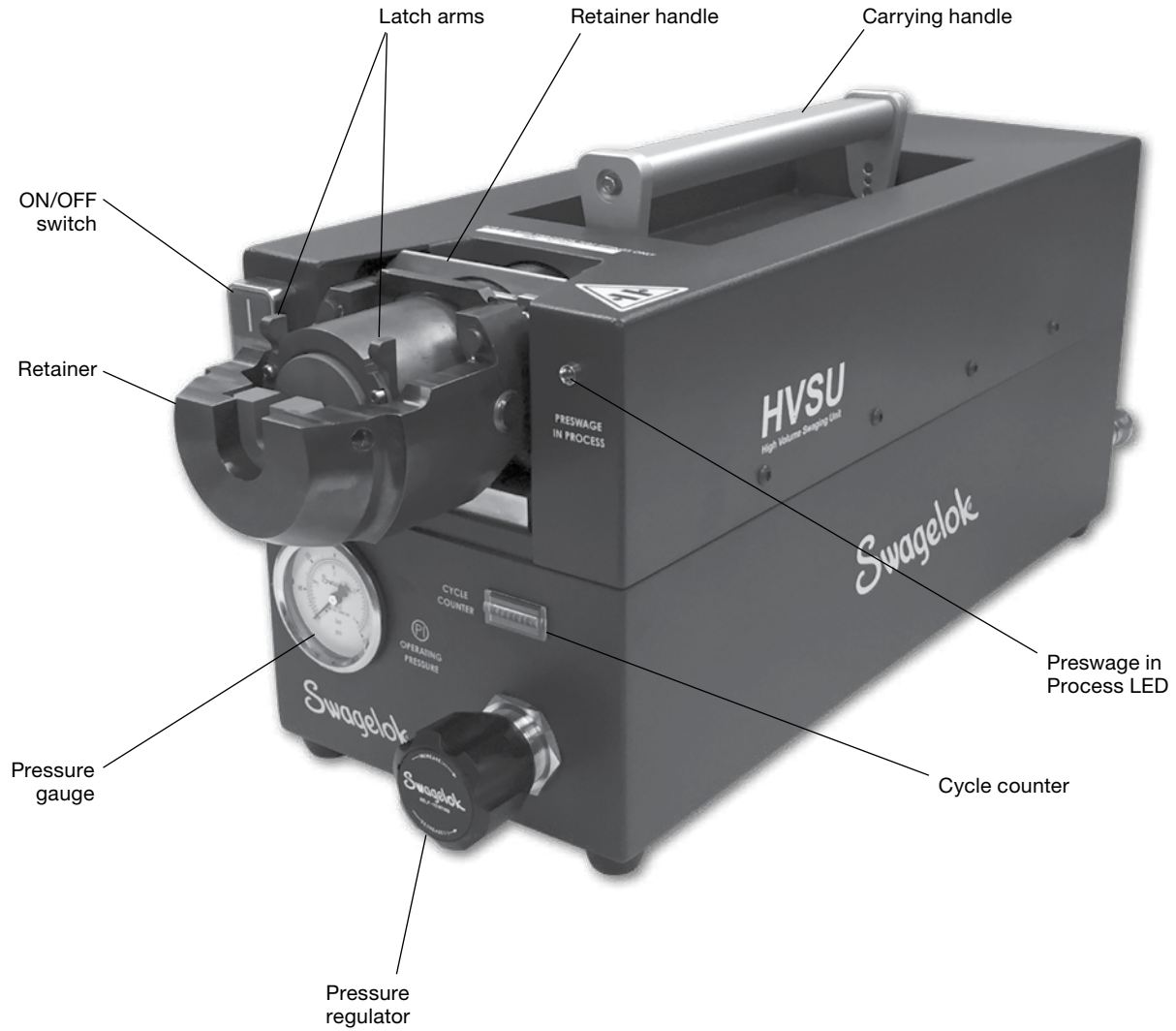


CAUTION

Fingers can be injured.

Do not place fingers or hands near the retainer assembly while operating the HVSU.

Product Information



General Information

Description

The Swagelok High Volume Swaging Unit (HVSU) is designed to preswage ferrules on to a tube. Refer to the table below, and the *Assembly-by-Torque (AbT) Fittings* catalog, MS-02-466, for applicable AbT fittings and tube wall thicknesses.

A tube bottoming sensor starts the preswage process and helps to achieve proper tube bottoming.

A nut bottoming sensor stops the preswage process after the designated preswage stroke has been achieved.

Swagelok Fitting Size	Tube Size OD × Wall	Tube Size Max OD	Series	Tubing Material
Fractional, in.				
1/4	1/4 × 0.028	0.254	400 ABT	316/316L SS 304/304L SS
	1/4 × 0.035			
	1/4 × 0.049			
3/8	3/8 × 0.049	0.379	600 ABT	
	3/8 × 0.065		600 ABT	
1/2	1/2 × 0.049	0.503	810 ABT	
	1/2 × 0.065			
	1/2 × 0.083			
Metric, mm				
6	6 × 1.0	6.09	6M0 ABT	
8	8 × 1.0	8.10	8M0 ABT	
	8 × 1.2			
10	10 × 1.0	10.11	10M0 ABT	
	10 × 1.5			
12	12 × 1.5	12.08	12M0 ABT	
	12 × 1.8			

CAUTION: Use of tubing above the recommended max OD may result in the tube not fully bottoming into the preswage tool.

Product Technical Data

Dimensions, in. (mm) 8.3 W by 11.1 H by 26 L
 (211 W by 279 H by 660 L)

Weight, lbs (kg) 70 (31.8)

Electrical Requirements

	Voltage Requirements	Service Current Requirement
HVSU	12 V (dc)	3.33 A maximum
Power supply	120 to 240 V (ac)	1 A

NOTICE

The HVSU should be used to preswage only Swagelok tube fittings.

Unpacking the HVSU

Shipping Case Contents

- HVSU (MS-HVSU-X, with X indicating power cord)
 - Power supply (MS-HVSU-PS-12V)
 - 3/8 in. Male quick connect stem (SS-QC6-D-600)
 - 0.050 in. hex key (MS-HD-050)
 - User manual (MS-13-223)
- To use the HVSU with AbT fittings, reference this manual, HVSU AbT User Manual, MS-13-334.

Report any missing or damaged parts to your authorized Swagelok sales and service representative immediately.

Note: The tooling kit for these AbT sizes, comprised of a puck assembly, a die assembly, a spacer, and AbT HVSU User Manual (MS-13-334) is ordered and shipped separately.



Fig. 1 Shipping Case (Tooling ordered separately.)

Setup

HVSU Setup

1. Lift the HVSU from the shipping case using the handle on the top of the unit. Place the HVSU on a stable surface.

⚠ CAUTION: The HVSU weighs 70 lbs (31.8 kg).

2. Inspect the HVSU and tooling for damage.
3. Record the model number and serial number from the rating label on the back of the unit for your reference. Fig. 2.
4. Connect the power supply to the electrical connection on the back of the HVSU. Fig. 3. Connect the power cord to a properly rated and grounded electrical receptacle.
5. Connect a filtered, dry compressed air supply line (maximum 125 psig [8.6 bar]) to the supplied quick connect.

NOTICE

Do not exceed a 125 psig (8.6 bar) supply line. Damage to the unit could result.

6. Connect the supplied quick connect to the pneumatic connection on the back of the HVSU. Fig. 3.

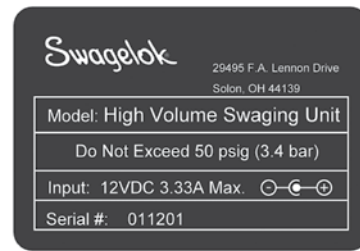


Fig. 2 Rating Label

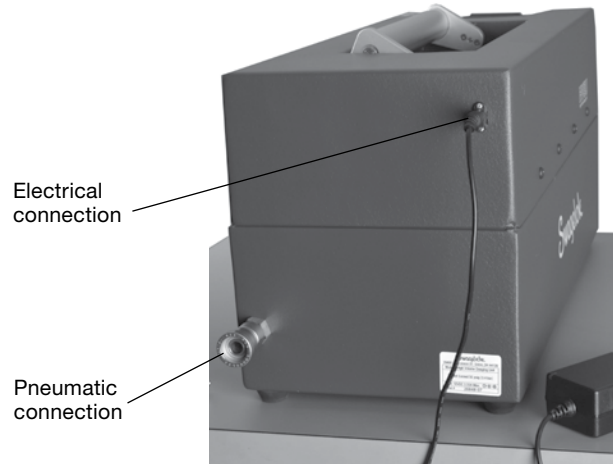


Fig. 3 Back of the HVSU

Tooling Assembly and Installation

Assembly

Select a tooling set consisting of a puck assembly, a die assembly, and a spacer to match the size of tubing to be used. The puck and die must be assembled according to the following instruction.

1. Place the die into the puck with the flange facing upward.
2. Ensure the notch of the die assembly is aligned with the pin of the puck and the die assembly is seated flush with the puck assembly face. Fig. 4.
3. Use a 0.050 in. hex key to turn the set screw until the die assembly is held in place. Then, back off the set screw one-eighth turn to ensure the die has slight movement in the puck. Fig. 5.

NOTICE

Do not overtighten the set screw. Damage to the die assembly could result.

Note: To disassemble the puck from the die, heat may need to be applied to the set screw.

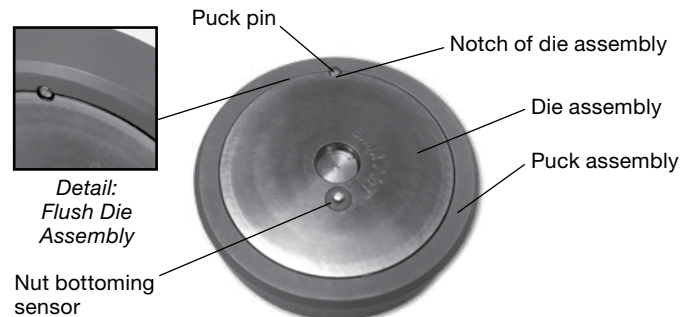


Fig. 4 Die and Puck Assemblies



Fig. 5 Securing the Puck Set Screw

⚠ CAUTION

To avoid personal injury, disconnect the air pressure and turn the power off prior to installing or changing tooling.

Installation

1. Pull the retainer latch handle forward to lower the retainer. Fig. 6 and 7.

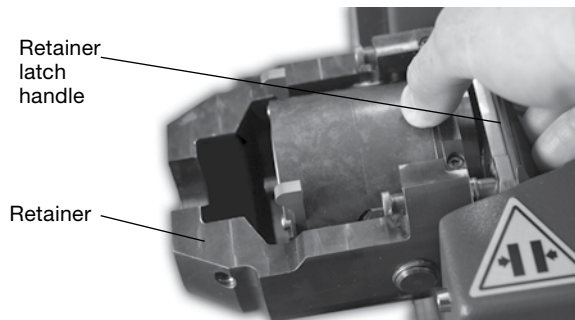


Fig. 6 Pulling the Retainer Latch Handle

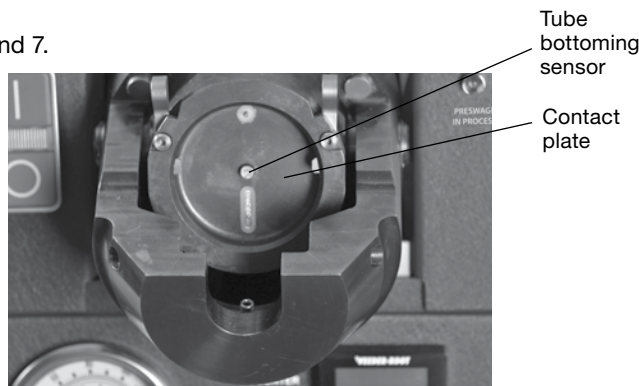


Fig. 7 Lowered Retainer

2. Squeeze the left and right latch arms and place the die/puck assembly into the contact plate with the marks on the die/puck assembly aligning with the latch arm screws and release the arms. Ensure that the nut contact sensor is pointing downward. Fig. 8 and 9.

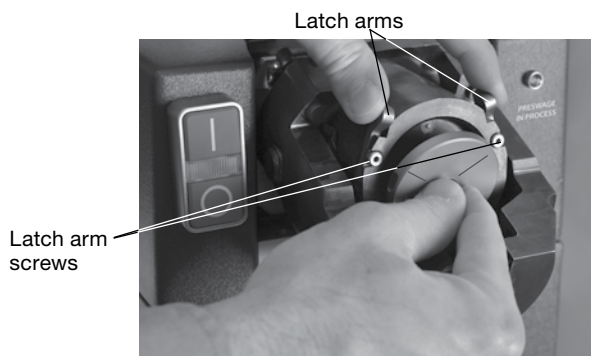


Fig. 8 Squeezing the Latch Arms

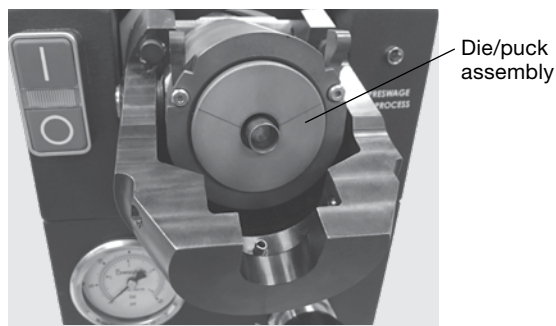


Fig. 9 Installed Die/Puck Assembly

3. Install the spacer into the retainer with the recess facing the puck and the chamfer facing away from the puck, aligning the orientation pin and sliding the spacer down until it is flush with the retainer surface. Fig. 10 and 11.

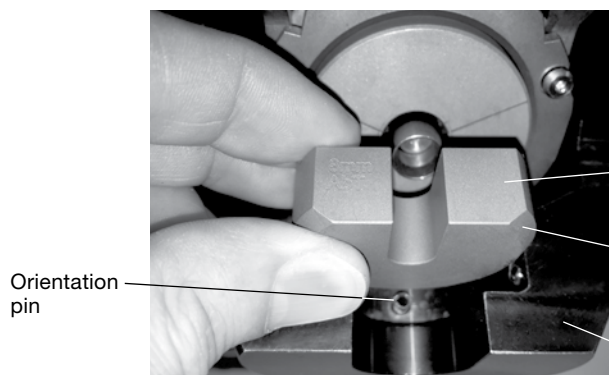


Fig. 10 Installing the Spacer

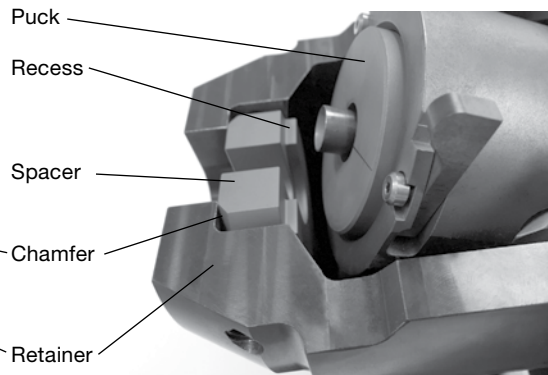
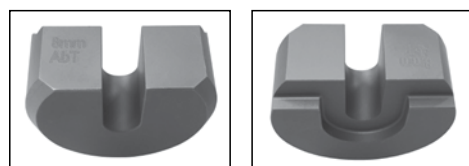


Fig. 11 Spacer Flush with the Retainer



Spacer Front

Spacer Back

Operation

WARNING

Fitting performance may be affected if recommended pressure setting is not used.

CAUTION

To avoid personal injury, do not place fingers or hands behind or in the retainer when operating the HVSU.

1. Use the ON/OFF switch to turn on the power to the HVSU.
2. Refer to *Table 2 Recommended Air Pressure* for the correct operating pressure.

Table 2 Recommended Air Pressure

Tube OD	Air Pressure psig (bar)
1/4 in. 6 mm	20 ± 2.0 (1.4 ± 0.14)
3/8 in. 8 mm 10 mm	30 ± 2.0 (2.1 ± 0.20)
1/2 in. 12 mm	40 ± 2.0 (2.8 ± 0.20)

3. Turn the handle on the pressure regulator on the front of the HVSU until the pressure gauge displays the correct operating pressure. Fig. 12.
4. To ensure the proper pressure, verify the retainer latch handle is up. Insert a piece of tube without nut and ferrules into the die to actuate it. Remove the tube and verify the pressure gauge has returned to the desired value.
5. Pull the retainer latch handle forward to lower the retainer.
6. Cut the tube squarely and remove any burrs.

WARNING: Failure to deburr the OD of the tube could prevent the tube from bottoming properly against the tooling shoulder.

CAUTION: Failure to deburr the ID of the tube could result in burrs entering the system and damaging other components of your system.

7. To ensure tube end will activate the tube bottoming sensor, refer to *Table 3, Recommended Tube OD & Minimum Chamfer*, only if tube OD exceeds the nominal size.

Table 3 Recommended Tube OD & Minimum Chamfer

Size	Max Allowable Tube OD in. (mm)	Min. Chamfer ^① in. (mm)
1/4 in.	0.254 (6.45)	5 to 30° × 0.015 (5 to 30° × 0.40)
3/8 in.	0.379 (9.62)	
1/2 in.	0.503 (12.78)	None required
6 mm	0.240 (6.09)	5 to 30° × 0.020 (5 to 30° × 0.50)
8 mm	0.319 (8.10)	
10 mm	0.398 (10.11)	
12 mm	0.475 (12.08)	

① May be required only for greater than nominal OD tube

CAUTION: Use of tubing above the recommended max OD may result in the tube not fully bottoming into the preswage tool.

8. Wipe the ID and OD of the tooling free of debris.

WARNING: Debris on the tooling ID could result in damage to the ferrules.

9. Load the nut and ferrule assembly from the arbor onto the die and raise the retainer up. Fig. 13.



Fig. 12 Front Panel of HVSU

Note: The retainer may not rise into position unless the nut is pushed completely forward onto the die.

10. Insert the tubing into the nut and ferrule assembly as far as the tube will go. Press the tube firmly against the bottom of the tooling die for 1 to 2 seconds after the tube bottoming sensor activates the preswaging process.

Note: Pushing hard enough to overcome the tube bottoming sensor spring force will not affect tooling die life.

Note: The green Preswage in Process light will illuminate when the tube bottoming sensor activates the cycle, however this alone does not indicate full tube bottoming. Follow the instructions in step 10 above to ensure proper tube bottoming, Fig 14.

11. Pull the retainer latch handle to lower the retainer, then remove the preswaged assembly.

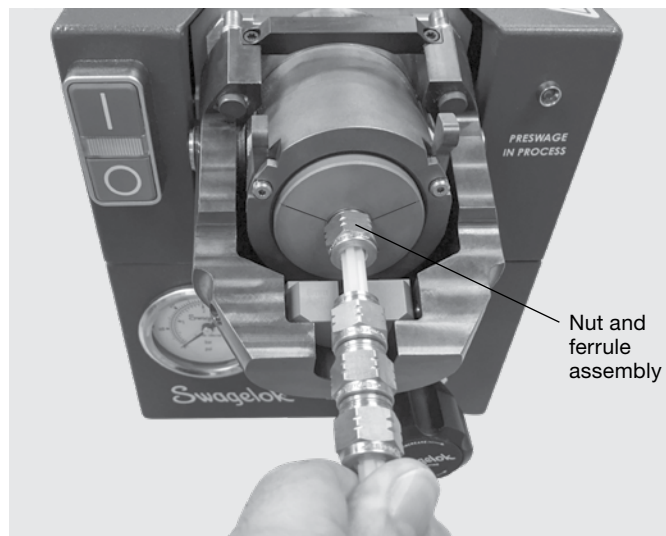


Fig. 13 Loading the Nut and Ferrule Assembly

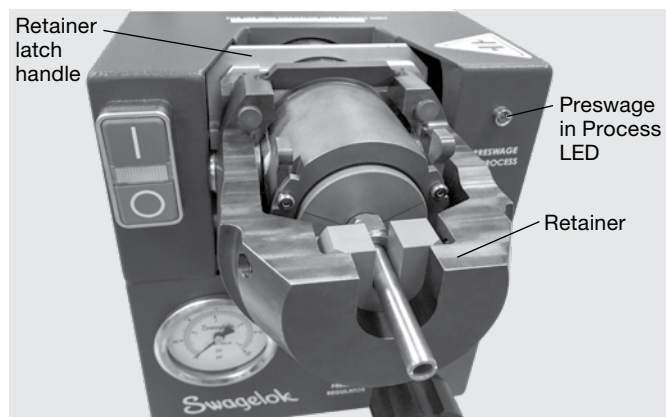


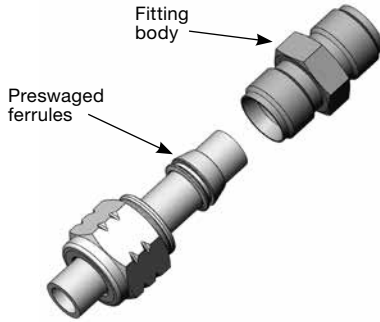
Fig. 14 Preswaging the Tubing

Initial Installation Instructions

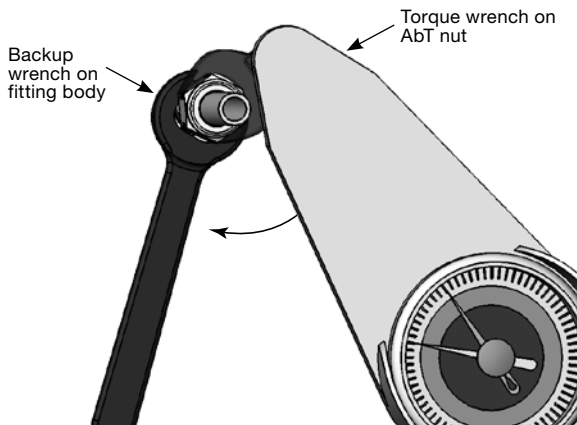
Note: Preswaging is required for all AbT connections.

Tube Fitting Initial Installation Instructions

1. Insert the tube with the preswaged ferrules into the fitting body until the front ferrule seats against the body, aligning the tubing and fitting body to avoid damaging the components. Rotate the nut finger-tight.



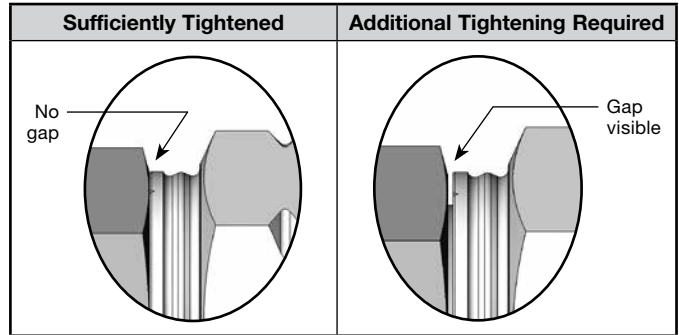
2. While holding the fitting body steady, tighten the nut (clockwise) with a wrench until the appropriate torque range for the applicable tube size is attained. See table on this page for torque ranges.



Proper torque is the best way to ensure a correctly installed AbT fitting.

Optional Initial Installation Inspection

Visually confirm that no gap appears on the completed pull-up when the dynamic zone makes contact with the shoulder of the fitting body.



Tube Size		Initial Assembly Torque Allowable Range in.·lb (N·m)
OD × Wall	Max OD	
Fractional, in.		
1/4 × 0.028	0.254	170 ± 13 (19 ± 1.5)
1/4 × 0.035		150 ± 13 (17 ± 1.5)
1/4 × 0.049		170 ± 13 (19 ± 1.5)
3/8 × 0.049	0.379	270 ± 14 (30.5 ± 1.5)
3/8 × 0.065		360 ± 18 (40.5 ± 2)
1/2 × 0.049	0.503	540 ± 27 (61 ± 3)
1/2 × 0.065		660 ± 33 (74.5 ± 3.75)
1/2 × 0.083		
Metric, mm		
6 × 1.0	6.09	150 ± 13 (17 ± 1.5)
8 × 1.0	8.10	215 ± 11 (24 ± 1.25)
8 × 1.2		
10 × 1.0	10.11	360 ± 18 (40.5 ± 2)
10 × 1.5		
12 × 1.5	12.08	660 ± 33 (74.5 ± 3.75)
12 × 1.8		

⚠ CAUTION: Use of tubing above the recommended max OD may result in the tube not fully bottoming into the preswage tool.

Troubleshooting

Problem	Cause	Remedy
Tubing will not enter or fully bottom into preswage tool.	Burrs on tubing from tube cutting operation.	Deburr tubing. Use outside diameter (OD) deburring tool.
	Flattened tubing from cutting operation.	Use caution in cutting soft tubing.
	Tubing out of round from bending.	If tubing is bent too far out of round the tubing will not fit into the preswage tool. Use caution with bends when near the end of tubing.
	Tubing is the wrong size.	Check OD of tubing. Determine if it is fractional or metric size tubing.
	Wrong size preswage tool.	Make sure you use the proper size ABT preswage tool for each diameter tubing.
	Tubing OD is oversize or beyond AbT size requirements.	Use tubing that meets the max OD requirements for the AbT fitting and AbT preswage tool.
	Tubing end raised due to dull tube cutter wheel.	Replace with good sharp wheel or use good quality hacksaw for cutting.
Front ferrule or back ferrule movement after preswaging.	Is acceptable for front and/or back ferrules to rotate freely around tube.	No action required.
	Axial movement of front and/or back ferrules is acceptable.	No action required.
Front ferrule not retained to tube and free to fall off end.	Fitting not sufficiently preswaged.	Discard and replace tube assembly.
	Tube not fully bottomed into preswage tool.	Discard and replace tube assembly. See above Corrective Measures for Trouble "Tubing will not enter or fully bottom into preswage tool."
Front ferrule lubricant extrusion after preswaging.	This is normal.	If desired, remove loose lubricant using a blast of clean dry shop air or nitrogen from a distance of 1 to 3 inches. Alternatively lightly wiping with a clean dry towel may be used.
Front ferrule damaged after preswaging.	Contamination between front ferrule and preswage tool die.	Preswaging tool and fitting should be free of contamination before use. Remove contamination with clean, dry cloth; clean dry shop air; or nitrogen gas prior to preswaging.
	Worn preswage tool die.	If the front ferrule dry lubricant is being removed or damaged then replace die assembly.
Nut shoulder damaged after preswaging.	Stop surface on puck is worn or damaged.	If stop surface on puck is significantly worn or damaged then replace puck assembly.
Tubing is difficult to remove from the HVSU after preswaging.	Tube wall thickness may be below recommended minimum wall thickness.	Gently rock the tubing back and forth to remove it. Use tubing with a wall thickness recommended for AbT fittings. ⚠ NOTICE Do not rotate the tubing.
The HVSU fails to swage sufficiently as indicated by the gap inspection gauge after fitting installation.	The working pressure is too low.	Verify the working pressure is set to the recommended air pressure defined in Table 2. Check the air line connections to the HVSU. ⚠ NOTICE Do not swage a tube more than once. If the working pressure is sufficient, return the unit to your authorized Swagelok sales and service representative.
There is audible air flow.	The regulator is set too high.	Adjust the regulator. If the problem persists, return the unit to your authorized Swagelok sales and service representative.
Oil is leaking from the HVSU.		Return the unit to your authorized Swagelok sales and service representative.

Contact your authorized Swagelok representative for additional assistance.

Tooling Ordering Information

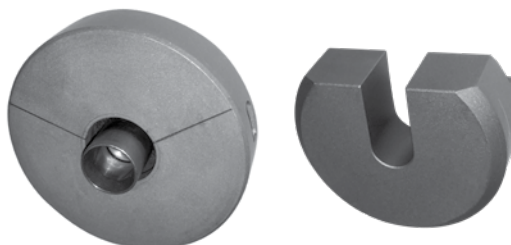
Tooling Kit

Tool kits are ordered separately according to size.

Each kit contains a die assembly, a puck assembly, and a spacer to match the size of tubing to be used.

An AbT HVSU User Manual (MS-13-334) is included with these tooling kits.

Nominal Tube Size	Tooling Kit Ordering Number
1/4 in.	MS-HVSU-TLG-KIT-400-ABT
3/8 in.	MS-HVSU-TLG-KIT-600-ABT
1/2 in.	MS-HVSU-TLG-KIT-810-ABT
6 mm	MS-HVSU-TLG-KIT-6M-ABT
8 mm	MS-HVSU-TLG-KIT-8M-ABT
10 mm	MS-HVSU-TLG-KIT-10M-ABT
12 mm	MS-HVSU-TLG-KIT-12M-ABT



Replacement Die Assemblies

Die assemblies are consumable and can be reordered individually as needed.

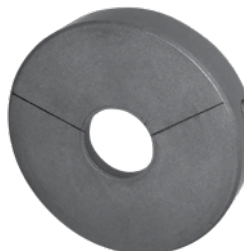
Nominal Tube Size	Die Assembly Ordering Number
1/4 in.	MS-HVSU-TLG-ASM-400-ABT
3/8 in.	MS-HVSU-TLG-ASM-600-ABT
1/2 in.	MS-HVSU-TLG-ASM-810-ABT
6 mm	MS-HVSU-TLG-ASM-6M-ABT
8 mm	MS-HVSU-TLG-ASM-8M-ABT
10 mm	MS-HVSU-TLG-ASM-10M-ABT
12 mm	MS-HVSU-TLG-ASM-12M-ABT



Puck Assemblies

Puck assemblies can be reordered individually as needed.

Nominal Tube Size	Puck Assembly Ordering Number
1/4 in.	MS-HVSU-PCK-ASM-400-ABT
3/8 in.	MS-HVSU-PCK-ASM-600-ABT
1/2 in.	MS-HVSU-PCK-ASM-810-ABT
6 mm	MS-HVSU-PCK-ASM-6M-ABT
8 mm	MS-HVSU-PCK-ASM-8M-ABT
10 mm	MS-HVSU-PCK-ASM-10M-ABT
12 mm	MS-HVSU-PCK-ASM-12M-ABT



Spacers

Spacers can be reordered individually as needed.

Nominal Tube Size	Spacer Ordering Number
1/4 in.	MS-HVSU-SPC-400-ABT
3/8 in.	MS-HVSU-SPC-600-ABT
1/2 in.	MS-HVSU-SPC-810-ABT
6 mm	MS-HVSU-SPC-6M-ABT
8 mm	MS-HVSU-SPC-8M-ABT
10 mm	MS-HVSU-SPC-10M-ABT
12 mm	MS-HVSU-SPC-810-ABT



Maintenance

Cycle Counter

The cycle counter can be used to track the number of preswage cycles and/or tooling usage. Fig. 18.

Puck and Contact Plate Cleaning

Every 25 000 cycles, clean the puck and contact plate according to the following procedure.

1. Squeeze the latch arms and remove the puck assembly from the contact plate.
2. Use a clean towel and spray WD-40® lubricant or an equivalent water dispersal lubricant (liquid only) onto the towel.
3. Wipe the puck assembly and the face of the contact plate with the towel to remove dirt and contaminants.

NOTICE: Do not spray lubricant directly onto the puck assembly or contact plate. Unit performance could be affected.

4. Reinstall the puck assembly. Do not wipe off the lubricant.



Fig. 18 Cycle Counter

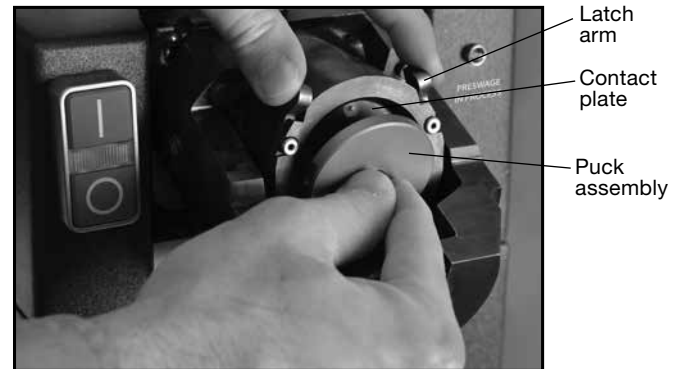


Fig. 19 Puck and Contact Plate

HVSU Lubrication

Every 100 000 cycles, lubricate the following locations with a NLGI grade 2 white lithium grease (spray or brush on).

Retainer Shaft

1. Remove the clip from left end of the retainer shaft. Fig. 20.
2. Remove the retainer shaft.

Note: The retainer will now be loose and should be placed on a stable surface.

3. Clean the shaft with a towel.
4. Spray or brush lithium grease on both ends of the shaft, including the inside of the retainer. Fig. 21.
5. Squeeze the latch arms and set the retainer into place.

Note: Verify brass washers are in counterbores. Lubricate with lithium grease if needed to hold washers in place.

6. Reinsert the retainer shaft and replace the clip.



Fig. 20 Removing Clips from Retainer Shaft



Fig. 21 Applying Lubricant to Retainer Shaft

Connector Shaft

1. Liberally spray or brush lithium grease in the area behind the square block that holds the retainer shaft. Fig. 22.
2. Wipe off any excess grease.



Fig. 22 Applying Lubricant to Connector Shaft

Latch Pins

1. Push one pin forward toward the front of the retainer as far as possible.
2. Clean the pin with a towel.
3. Spray or brush lithium grease on the exposed portion of the pin. Fig. 23.
4. Repeat steps 1 through 3 for the other pin.



Fig. 23 Applying Lubricant to Latch Pins

HVSU ON/OFF Switch Lamp Replacement

Follow these steps to replace the ON/OFF switch lamp.



⚠ Touching live electrical parts can cause fatal electric shock and severe burns.

To avoid injury:

1. Properly unplug the power cord. Grasp the plug to remove it from the receptacle.
2. Disconnect the air connection from the back of the unit.

⚠ CAUTION: The HVSU weighs 70 lbs (31.8 kg).

3. Vent all air pressure by turning the regulator handle as far counterclockwise as it will go.
4. Disconnect the air connection from the back of the unit.
5. Remove eight (8) screws from the HVSU top cover (4 on right side; 4 on left side) using a Torx 25 screwdriver. Fig 24.
6. Use handle and pull top cover off **gently**.

NOTICE

Avoid pulling on wire harness attached to the top cover. Fig 25.

7. Lay top cover on the left side of the HVSU on a clean surface free of debris. Fig 25.
8. Locate latch on the lamp holder and push away from the side of the cover. Fig 26.
9. Carefully pull lamp holder out of switch housing.
10. Lightly push in bulb while also gently twisting counterclockwise (CCW) to remove bulb.
11. Lightly push in new bulb while also gently twisting clockwise to replace bulb. Opposite of Fig 27.
12. Put bulb back into switch housing and align lamp holder so latch can be pushed back toward cover to its original position. Ensure lamp holder is secure in the switch housing.
13. Install top cover. Thread right side screw nearest the front until the head just touches the cover. See "square" in Fig 24.
14. Thread and fully tighten the screws on the left side directly across from the first screw. Finish tightening the right side screws, then install the rest of the screws in any order.
15. To operate the HVSU, follow the setup and operating instructions in this manual.



Fig. 24 Remove screws from top cover

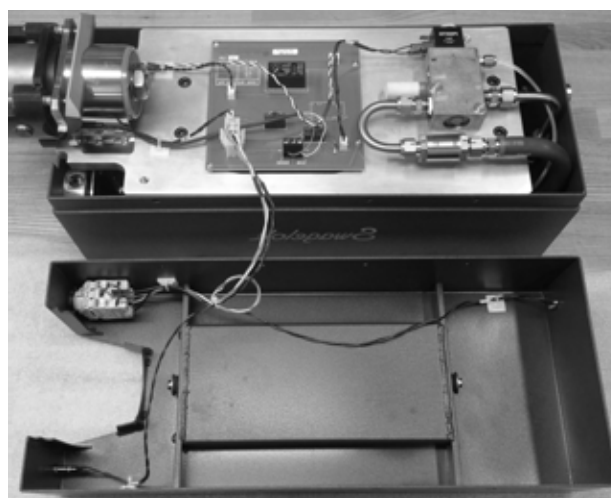


Fig. 25 Top cover off

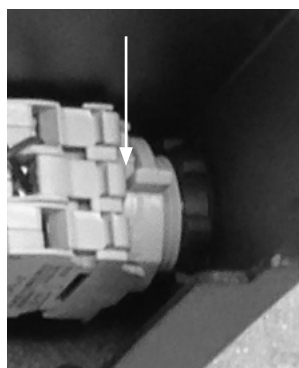


Fig. 26 Locate latch on the lamp holder



Fig. 27 Push and twist bulb CCW to remove.

Warranty Information

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

 **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.

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