How to Prepare/Install/Clean/Pressurize Gas Lines & Fittings for the EC-MS

EC-MS Technical Note #19

Last Updated 11-06-2025

Introduction:

The purpose of this document is to supplement the EC-MS site requirements and explain how to prepare, install, clean and pressurize gas lines for installing and operating the EC-MS.

Prepare:

- Regardless of the source and location (wall outlet/pressurized air bottle/compressor), the pressurized air needs to meet our site requirements and terminate into 6mm O.D. plastic tubing to be compatible with the EC-MS.
- Determine which carrier gas option (1 or 2 from site requirements) is best for you/your lab/facility.
- Determine/confirm location of pressurized gas bottles (minimum 10L for both carrier gases and pressurized air) **OR** determine/confirm location of wall outlet for pressurized air and carrier gas lines.
- Determine location of the EC-MS in the lab/facility.
- Determine required stainless steel tubing length for carrier gas connections. **Make sure the tubing is cut to length, deburred on the inner/outer diameter and clean of any metal shavings/shards for Option 1 (detailed below).**

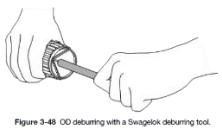


Figure 3-48 OD deburring with a Swagelok deburring tool.

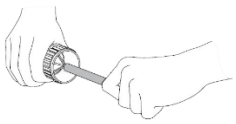


Figure 3-50 ID deburring with a Swagelok deburring tool.

Inside deburring can easily be accomplished using the Swagelok deburring tool with rugged, heavy-duty, die-cast housing and steel blades for long life (part ordering number MS-44CT-27). This tool is used for deburring the inside diameter of 1/4, 3/8, and 9/16 in. stainless steel tubing.

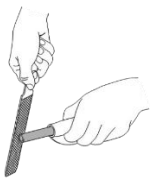


Figure 3-49 OD deburring with a file.



Figure 3-51 ID deburring with a Swagelok deburring tool.

- Determine plastic tubing length for pressurized air connections.
- Gather the parts (**listed at the end of the document**) needed:
    - **Gas Cylinders (if necessary)**: 10L Minimum (Pressurized Air, Carrier Gases etc.)
    - **PRESSURIZED AIR**: Regulator, Regulator Outlet Fitting, PE Tubing.
    - **CARRIER GAS OPTION 1 (No Welding)**: Regulator(s), Regulator Outlet Fitting(s), Stainless Steel Tubing, Instrument Side Tube Fitting(s), Gaskets.
    - **CARRIER GAS OPTION 2 (Welding)**: Regulator(s), Regulator Outlet Fitting(s), Stainless Steel Tubing (Welded with VCR Nuts and Short Tube Butt Weld Glands), Gaskets.

Install:

- **PRESSURIZED AIR**:
  - Gas Cylinder/Wall Outlet **CLOSED.**
  - Mount an appropriate regulator to the pressurized gas cylinder or wall outlet (Pressurized air needs to be **accurately regulated between 6.5 – 8 bar**).
  - Attach the appropriate regulator outlet fitting to the regulator (1/4" MNPT to 6mm Swagelok Tube Fitting // utilize Teflon tape).
  - Be sure the 6mm PE Tubing is cut flush and flat on both sides.
  - Insert one end of the 6mm PE Tubing into the appropriate (slightly loosened) nut on the regulator outlet fitting. Be sure the tubing is fed/inserted fully into the fitting against the shoulder.
  - Hand-tighten the nut until the tube will not turn by hand or move axially in the fitting (very light wrench use to ensure security is permitted).
  - Hold the regulator outlet fitting steady and tighten the nut between ¾ and 1 ¼ turns to secure the fitting (detailed below).



Figure 1-6 Swagelok tube fitting: four components.

  - The other end of the 6mm tube is ready to be connected to the EC-MS.

- **CARRIER GAS**:
  - Gas Cylinder/Wall Outlet **CLOSED**
  - Mount an appropriate regulator to the pressurized gas cylinder or wall outlet (Carrier gas needs to be **accurately regulated between 1 – 3 bar**).
  - Attach the appropriate regulator outlet fitting to the regulator, utilize Teflon tape**.**

    - **Option 1**: ¼" MNPT to Swagelok Compression.
    - **Option 2**: ¼" MNPT to Swagelok ¼" MVCR.

  - Attach Stainless Steel Tubing to the regulator outlet fitting:

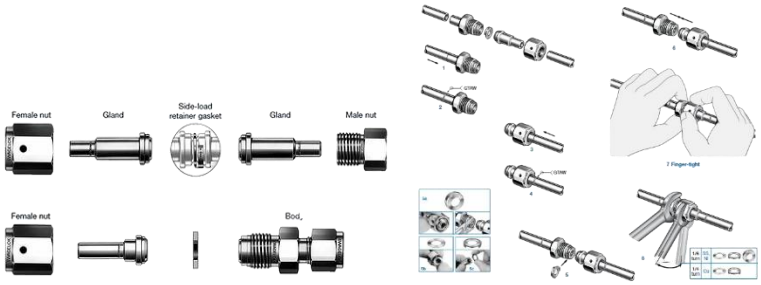
    - **Option 1**:
      - Be sure the stainless-steel tubing is cut flush and flat on both sides, filed/deburred so that the edges are not sharp and clean of metal shavings/shards.
      - Insert one end of the stainless-steel tubing into the appropriate (slightly loosened) nut on the regulator outlet fitting. Be sure the tubing is fed/inserted fully into the fitting against the shoulder.

- Hand-tighten the nut until the tube will not turn by hand or move axially in the fitting (very light wrench use to ensure security is permitted).
- Hold the regulator outlet fitting steady and tighten the nut between ¾ and 1 ¼ turns to secure the fitting (detailed below).



Figure 1-6 Swagelok tube fitting: four components.

- **Option 2**:
  - Take one end of the stainless-steel welded tube with a stainless-steel gasket to the regulator outlet fitting attached to the carrier gas.
  - Extend the FVCR nut over the butt weld gland at the end of the tube and place the stainless-steel gasket inside without touching it directly (use gloves, plastic tipped pliers/tweezers).
  - Hand-tighten the FVCR nut onto the MVCR connection on the regulator outlet fitting until the tube will not turn by hand or move axially in the fitting (the nut should thread easily, if it does not something is misaligned or there is too much tension on the tube/fitting // very light wrench use to ensure security is permitted).
  - Hold the MVCR regulator outlet fitting steady and tighten the FVCR nut between 1/8 and ¼ turn to secure the fitting (detailed below).



- Attach Stainless Steel Tubing to the EC-MS:

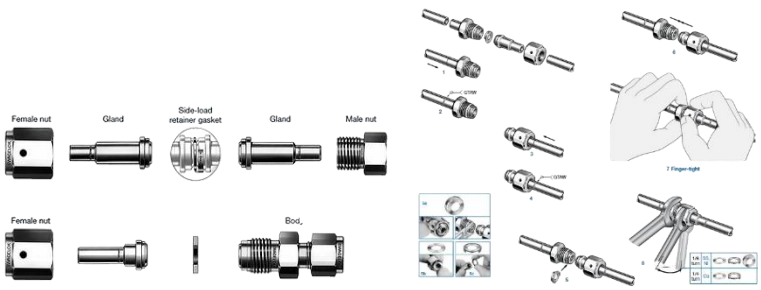
  - **Option 1**:
    - Attach the instrument side tube fitting to the stainless-steel tubing:
      - Be sure the stainless-steel tubing is cut flush and flat, filed so the edges are not sharp.

- Insert one end of the stainless-steel tubing into the appropriate (slightly loosened) nut on the instrument side tube fitting. Be sure the tubing is fed/inserted fully into the fitting against the shoulder.
- Hand-tighten the nut until the tube will not turn by hand or move axially in the fitting (very light wrench use to ensure security is permitted).
- Hold the instrument side tube fitting steady and tighten the nut between ¾ and 1 ¼ turns to secure the fitting (detailed below).

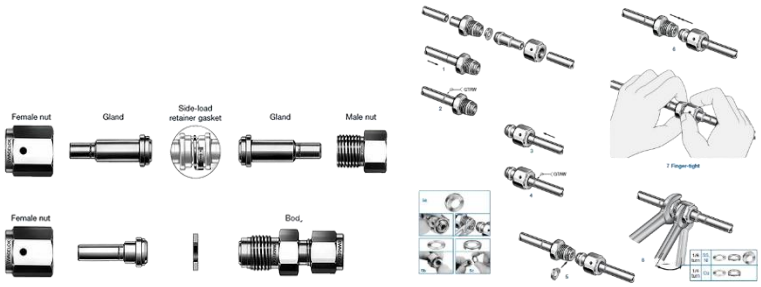


Figure 1-6 Swagelok tube fitting: four components.

- Attach the instrument side tube fitting to the EC-MS:
  - Take the newly fitted tube (now terminating in FVCR) with a stainless-steel gasket to the EC-MS.
  - Extend the FVCR nut over the butt weld gland at the end of the fitting and place the stainless-steel gasket inside without touching it directly (use plastic tipped pliers/tweezers).
  - Hand-tighten the FVCR nut onto the MVCR connection on the EC-MS until the tube will not turn by hand or move axially in the fitting (the nut should thread easily, if it does not something is misaligned or there is too much tension on the tube/fitting // very light wrench use to ensure security is permitted).
  - Hold the MVCR fitting on the EC-MS steady and tighten the FVCR nut between 1/8 and ¼ turns to secure the fitting (detailed below).



- **Option 2**:
  - Take the available end of the stainless-steel welded tube with a stainless-steel gasket to the EC-MS.
  - Extend the FVCR nut over the butt weld gland at the end of the tube and place the stainless-steel gasket inside without touching it directly (use plastic tipped pliers/tweezers).
  - Hand-tighten the FVCR nut onto the MVCR connection on the EC-MS until the tube will not turn by hand or move axially in the fitting (the nut should thread easily, if it does not something is misaligned or there is too much tension on the tube/fitting // very light wrench use to ensure security is permitted).
  - Hold the MVCR fitting on the EC-MS steady and tighten the FVCR nut between 1/8 and ¼ turn to secure the fitting (detailed below).



Clean:

- Pump the Manifold on the EC-MS
  - System is in a safe state; any connected carrier gas bottles/regulators are closed.
  - Close V1 and V14
  - Switch V8 **away** from the line to be evacuated.
  - Set the MFC on the line to be evacuated on “purge”
  - Open V6 **or** V7 (the line which will be pumped)
  - Open V13
  - Let the system pump until Pirani 3 falls below 1E-2 mbar.
  - Close V13
  - Set MFC on the line back to “normal” mode
  - Open V14
  - Open V1 when Pirani 3 has fallen below 1E-2 mbar
  - **WHEN EVACUATING THE CARRIER GAS LINE:** Flush the manifold with the desired gas by opening the corresponding inlet valve for a very short time (half a second). Close the inlet immediately after flushing.
  - Repeat this process a minimum of **three** times

- Evacuating the gas line though the regulator

- Carrier gas is connected to the EC-MS without being pressurized.
- Main valve on the carrier gas bottle is closed
- Fully open the regulator attached to the gas bottle. **WARNING: Never open the main valve of a pressurized bottle while the regulator is fully opened**.
- Ensure that V6, V7, V9, V10, V11, V12 and V13 are closed
- Open the valve (V9, V10, V11 or V12) corresponding to the connected gas
- Pump on the manifold (see above or section 13.1 of the EC-MS manual)
- The pumpdown is complete when Pirani 3 falls in the E-3 mbar range. Once completed, close the valve (V9, V10, V11 or V12) which corresponds to the connected carrier gas.
- Fully close the pressure regulator on the carrier gas bottle
- Open the main valve on the carrier gas bottle
- Set the regulator to the desired working pressure (1.4 mbar absolute)
- Repeat this process a minimum of **three** times
- Before opening the valve (V9, V10, V11 or V12) corresponding to the connected carrier gas, make sure that V6, V7, V13 and whichever of V9, V10, V11 and V12 are not being used are closed.
- Assign the appropriate label to the valve (V9, V10, V11 or V12) corresponding to the connected carrier gas and open the valve

Pressurize:

- Pressurizing a line via direct gas supply (V9 or V10 – same procedure for both)
  - Go to Zilien System View
  - V6, V7 and V13 must be closed
  - Open V9 or V10
  - **IMPORTANT**: Choose the appropriate/correct carrier gas on the corresponding MFC dropdown menu (MFC2 for V9 and MFC1 for V10)
  - Fill the dead volume between the appropriate MFC and V8
    - V8 switched **away** from the line to be pressurized and MFC **on line** to be pressurized set to normal flow.
    - Apply a flow of 10 ml/min for ~15 seconds on the MFC to fill the volume at 1 bar.
  - Your gas line is pressurized

- Pressurizing a line via secondary gas supply (V11 or V12 – same procedure for both valves and gas/MFC lines)
  - Go to Zilien System View
  - For line 1 (MFC1) V7, V10, V12 and V13 must be closed. For line 2 (MFC2) V6, V10, V11 and V13 must be closed.
  - Open V11 or V12
  - **IMPORTANT**: Choose the appropriate/correct carrier gas on the corresponding MFC dropdown menu and set MFC mode to “normal”
  - Fill the dead volume between the MFC and V8 (see above or refer to section 13.3 in the EC-MS manual)
- Your gas line is pressurized

Parts:

Regulators:

- Linde Redline C200 2-Stage 6 Bar (**Carrier Gas // Welding/Non-Welding**)
- Linde Redline C200 2-Stage 10 Bar (**Pressurized Air ONLY**)



Regulator Outlet Fittings (listed top to bottom = pictured left to right):

- ¼" Male NPT to 6mm Swagelok Tube Fitting (Swagelok Part No. SS-6M0-1-4 // **Pressurized Air ONLY**)
- ¼" Male NPT to Swagelok Compression (Swagelok Part No. SS-200-1-4 // **No Welding**)
- ¼" Male NPT to Swagelok ¼" Male VCR (Swagelok Part No. SS-4-VCR-1-4 // **Welding**)





Short Tube Butt Weld Gland:

- VCR ¼" to 1/8" Short Tube Butt Weld Gland (Swagelok Part No. 6LV-4-VCR-3S-2TB7 // **Welding ONLY**)



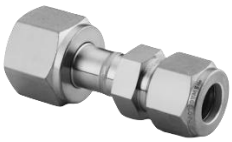
VCR Nut:

- ¼" Female VCR Nut (Swagelok Part No. SS-4-VCR-1 // **Welding ONLY**)



Instrument Side Tube Fitting:

- Instrument Side Tube Fitting: FVCR to Swagelok 1/8" Tube Fitting (Part No. SS-4-WVCR-6-200 // **Non-Welding ONLY**)



Tubing (listed top to bottom = pictured left to right):

- Stainless Steel 1/8" OD (**Welding/Non-Welding**)
- PE 6mm OD Tubing (Festo Part No. PEN-6X1-BL // **Pressurized Air ONLY**)





Gaskets:

- Stainless Steel ¼" VCR Gasket (Swagelok Part No. SS-4-VCR-2-VS // **Welding/Non-Welding**)

