

Installation Guide

**Cryogenic Oven Cooling (N₂ or CO₂) with Optional Cryoblast
Accessories G1565A, G1566A, G1567A, G1568A**



Agilent Technologies

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Printed in USA

Safety Information

The Agilent Technologies 6890 Gas Chromatograph meets the following IEC (International Electrotechnical Commission) classifications: Safety Class 1, Transient Overvoltage Category II, and Pollution Degree 2.

This unit has been designed and tested in accordance with recognized safety standards and designed for use indoors. If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Whenever the safety protection of the Agilent 6890 has been compromised, disconnect the unit from all power sources and secure the unit against unintended operation.

Refer servicing to qualified service personnel. Substituting parts or performing any unauthorized modification to the instrument may result in a safety hazard. Disconnect the AC power cord before removing covers. The customer should not attempt to replace the battery or fuses in this instrument. The battery contained in this instrument is recyclable.

Safety Symbols

Warnings in the manual or on the instrument must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions violates safety standards of design and the intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

A warning calls attention to a condition or possible situation that could cause injury to the user.

CAUTION

A caution calls attention to a condition or possible situation that could damage or destroy the product or the user's work.



Indicates a hot surface



Indicates earth (ground) terminal

Sound Emission Certification for Federal Republic of Germany

Sound pressure L_p < 68 dB(A)

During normal operation

At the operator position

According to ISO 7779 (Type Test)

Schallemission

Schalldruckpegel LP < 68 dB(A)

Am Arbeitsplatz

Normaler Betrieb

Nach DIN 45635 T. 19 (Typprüfung)

Overview

This document contains the procedures for installing cryogenic oven cooling with liquid nitrogen (LN₂) or liquid carbon dioxide (LCO₂) and optional cryoblast cooling of one or two cool on-column inlets in an Agilent 6890 Gas Chromatograph (hereafter referred to as the GC).

Before following this procedure, refer to the safety information below and on the inside front cover.

WARNING

Cryogenic liquids can cause very serious burns requiring emergency medical attention. This is especially true with liquid nitrogen (LN₂), which can cause skin damage equivalent to a serious thermal burn. Use extreme caution when working with these materials.

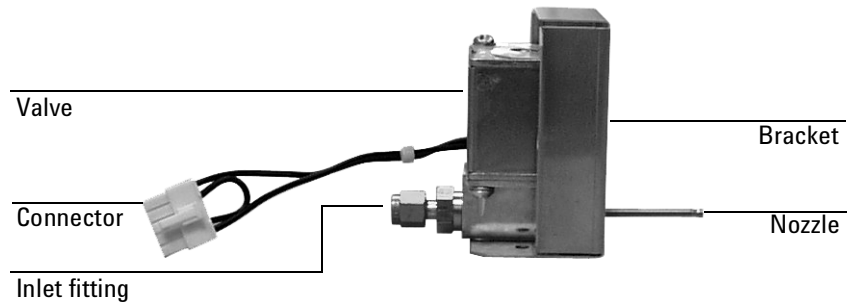
WARNING

Always bleed lines containing cryogenic fluids to atmospheric pressure before separating fittings. Wear safety glasses and cover fittings with a towel when separating them.

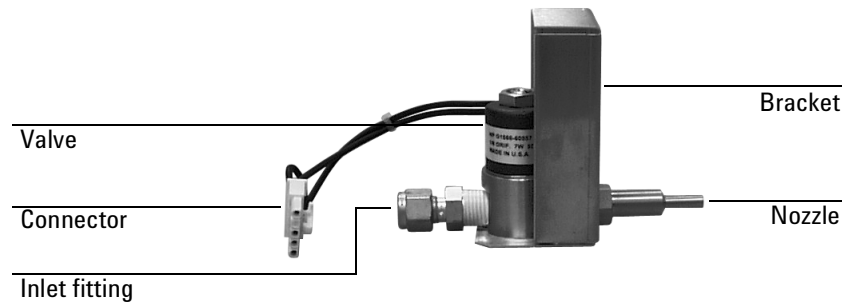
Overview

Part identification

G1565A - LC02 oven cryo only

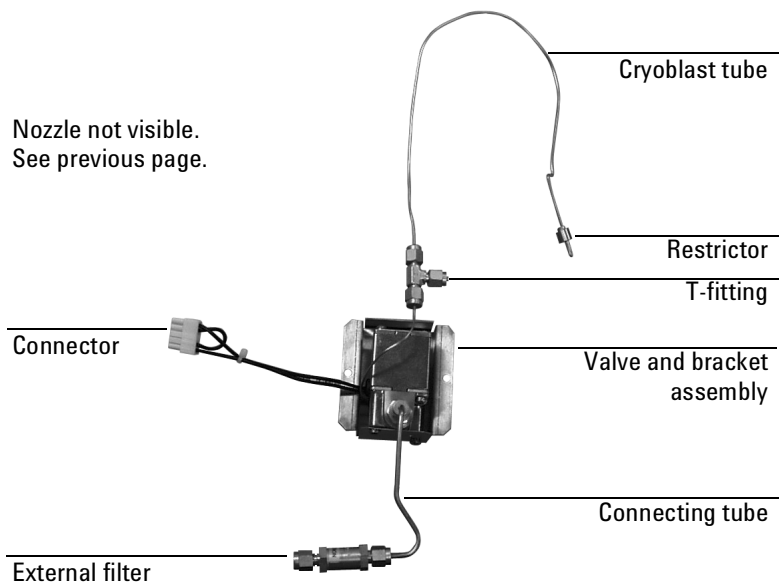


G1566A - LN2 oven cryo only



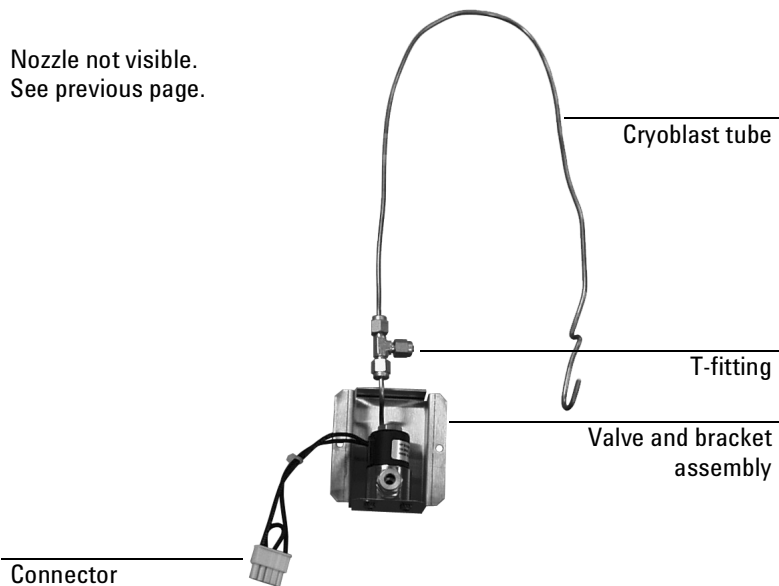
G1567A - LC02 oven cryo and cool on-column cryoblast

Nozzle not visible.
See previous page.



G1568A - LN2 oven cryo and cool on-column cryoblast

Nozzle not visible.
See previous page.



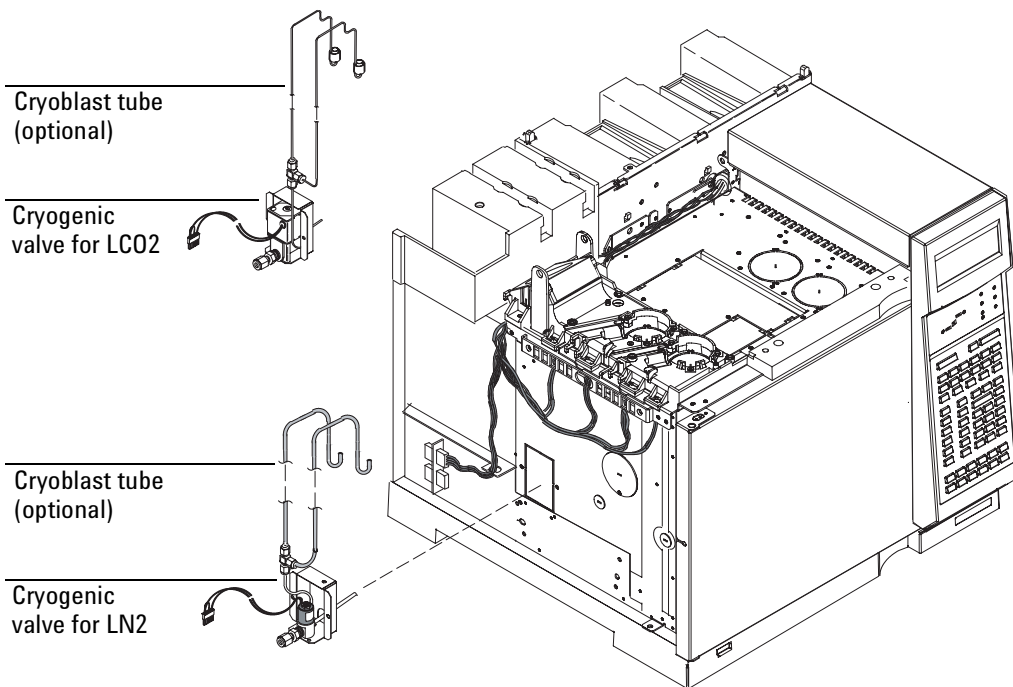
Overview

Required Tools

- T-20 Torx screwdriver
- Diagonal cutters
- Flat file

Steps

1. Preparing the GC
2. Installing the cryogenic valve
3. Installing cryoblast to your cool on-column inlet (optional)
4. Restoring the GC to operating condition
5. Plumbing cryogenic coolants
6. Configuring and testing the GC

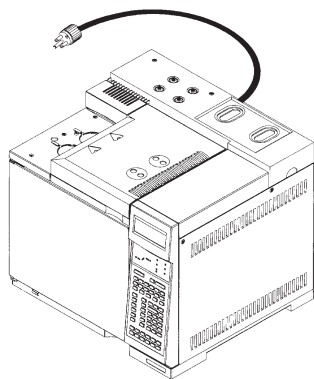


Preparing the GC

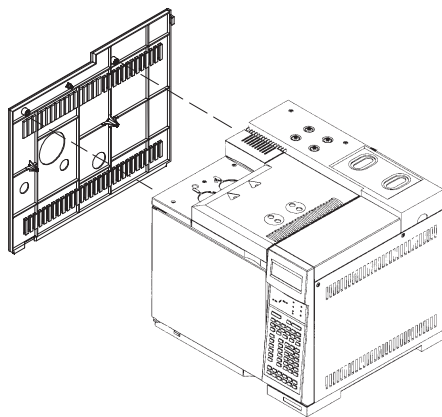
WARNING

Hazardous voltages are present in the mainframe when the GC power cord is plugged in. Avoid a potentially dangerous shock hazard by unplugging the power cord before removing the side panels.

1. Turn off the GC and unplug the power cord. Allow time for all heated zones to cool and then turn off supply gases at their sources.



2. Remove the left side cover from the GC or, if you have a nonEPC unit, from the side carrier by removing two screws.



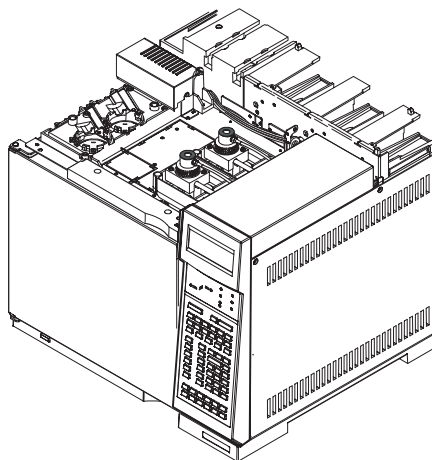
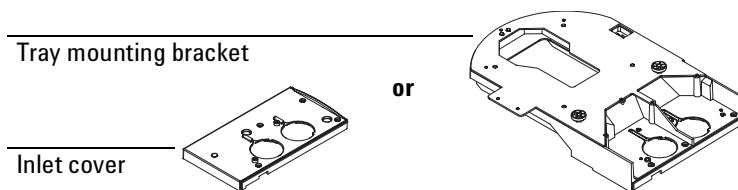
Preparing the GC

3. If you are also installing cryoblast:

Remove injectors and tray mounting bracket, if installed.

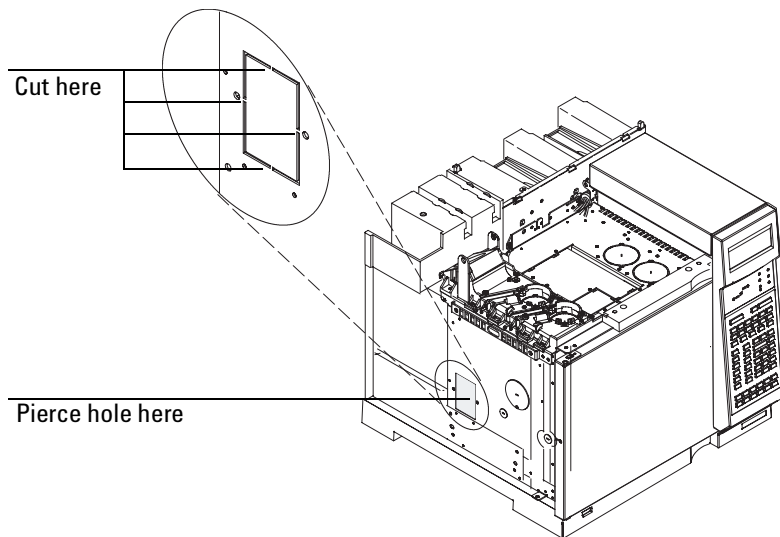
or

Remove the inlet cover by loosening five screws with a T-20 screwdriver and lifting it off.



Installing the cryogenic valve

1. Remove the rectangular sheet metal cutout on the left side of the GC by clipping each of the four notches with a pair of diagonal cutters. Keep the flat side of the cutters flush with the outside edge of the cutout so that the piece you remove has the nibs attached. You may need to file the burrs remaining on the inside edges of the cutout on the GC.
2. Examine the cryogenic valve. Note the location of the nozzle relative to the two mounting holes on the side of the oven. Create a path for the nozzle to the oven by piercing the insulation with a screwdriver. This is best done from inside the oven, since there is a hole in the inner oven wall to accommodate the nozzle.

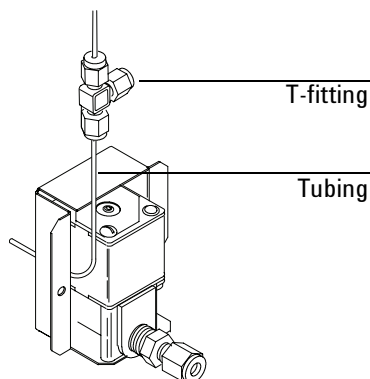


3. Orient the cryogenic valve as shown. If it has the cryoblast option, the tubing with the T-fitting must point upward and the T-fitting must point to the right.

Installing the cryogenic valve

Caution

If you have a valve with cryoblast but do not wish to install cryoblast at this time, remove the tubing from the top of the T-fitting and replace the nut and ferrules with a plug (not provided).

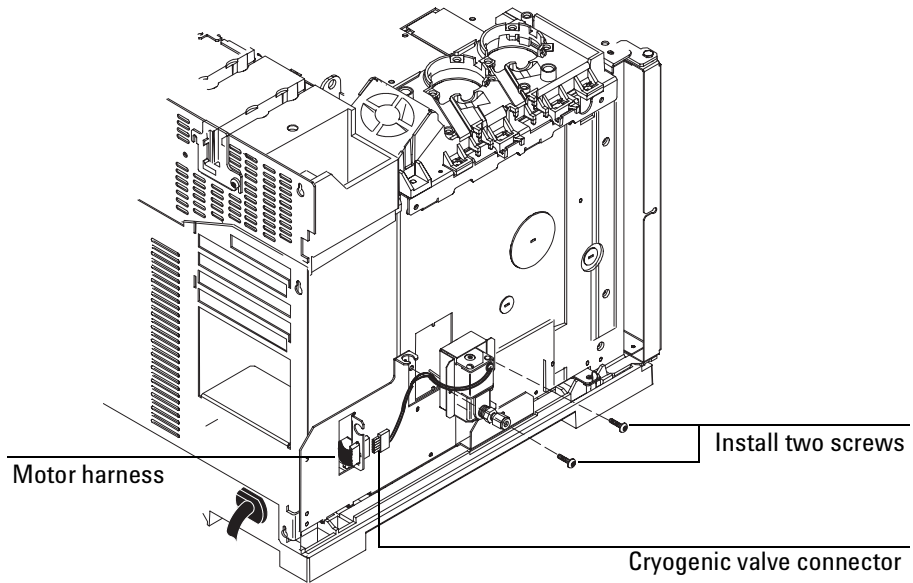


LCO2 valve with cryoblast shown;
LN2 is similar

4. Install the cryogenic valve, being careful not to let any insulation get into the nozzle opening. A small piece of masking tape over the nozzle opening will help.
5. Push the valve assembly into the insulation until the tabs on the bracket are flush with the outside of the oven. You will have to apply some pressure to compress the insulation. Hold the valve assembly firmly in place and attach it with two screws. Tighten the screws with a T-20 Torx screwdriver.

Installing the cryogenic valve

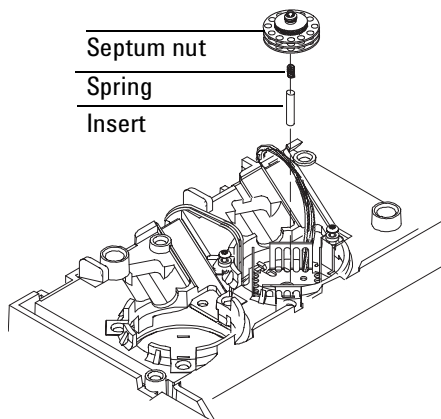
6. Plug the cryogenic valve connector into the motor harness. If you are also installing cryoblast, proceed to "Installing cryoblast." Otherwise, proceed to "Restoring the GC to operating condition".



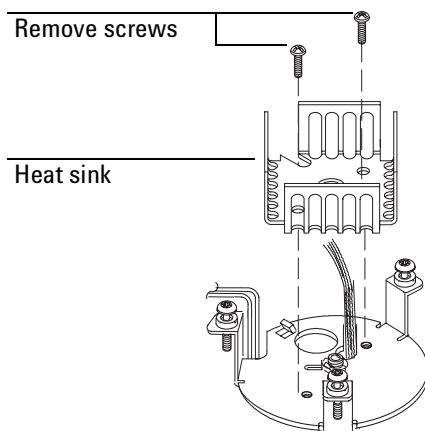
Installing cryoblast

This procedure assumes that the cool on-column inlet is installed in the back position. If it is in the front position, exchange the cryogenic tube and fittings on the top of the T-fitting with the plug on the side of the T-fitting.

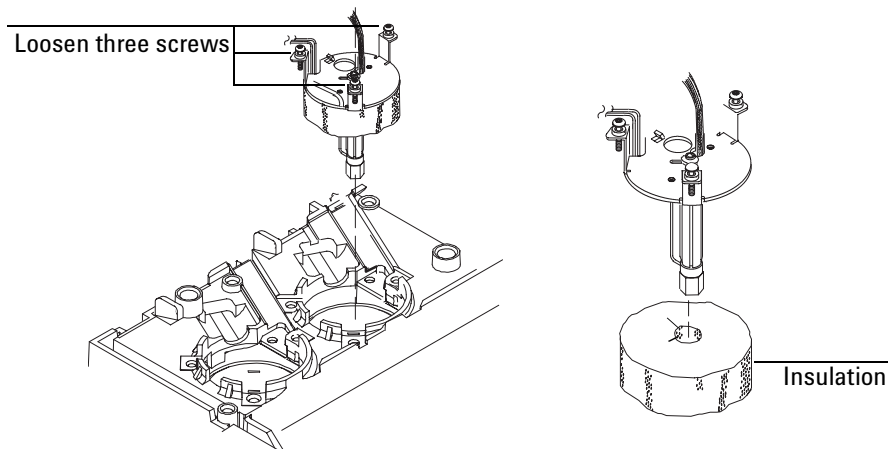
1. Remove the column from the cool on-column inlet. If you need help with this procedure, refer to the *Agilent 6890 GC Operating Manual*.
2. Remove the septum nut, spring, and insert from the inlet.



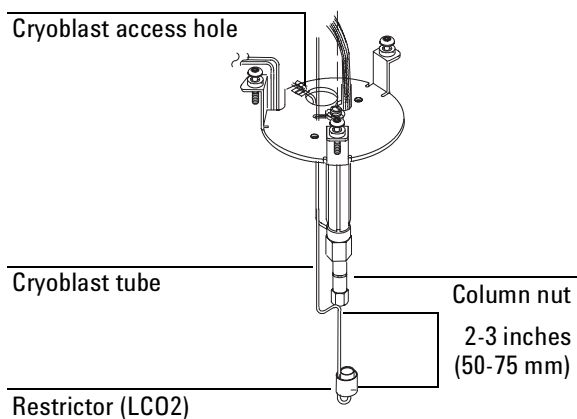
3. Remove the heat sink by removing the two screws with a Torx T-20 screwdriver.



4. Remove the inlet by loosening the three screws with a T-20 Torx screwdriver. Carefully remove the insulation from the inlet.

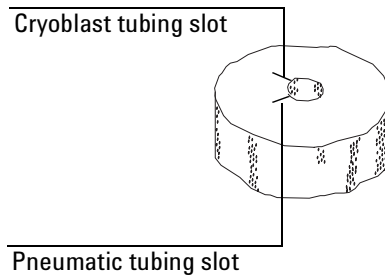


5. Place the cryoblast tube in the cryoblast access hole. Position it so that the bottom of the tube (LN2) or restrictor (LCO2) is 2 to 3 inches (50 to 75 mm) below the column nut.

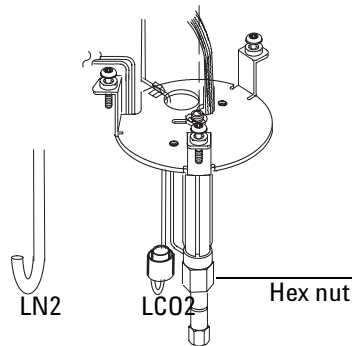


Installing cryoblast

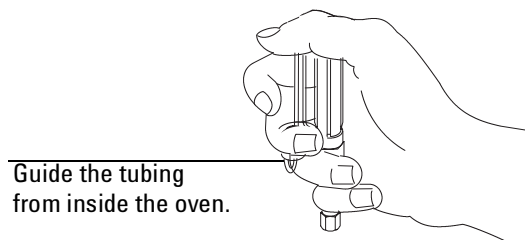
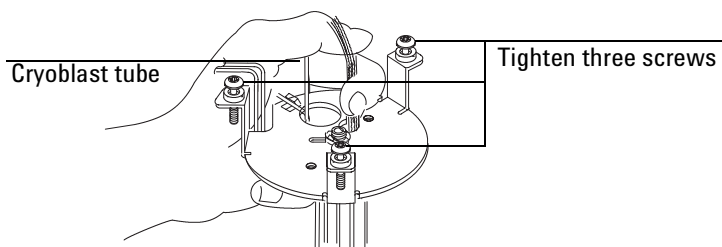
6. Reinstall the insulation. Feed the cryoblast tube through the hole in the insulation first, then the inlet fitting. Align the insulation so that the pneumatic and cryoblast tubes each fit into their own slot.



7. Position the cryoblast tube so that it is behind the pneumatic tubing and the bottom of the tube (LN2) or restrictor (LCO2) is approximately flush with the top of the hex nut on the inlet fitting.



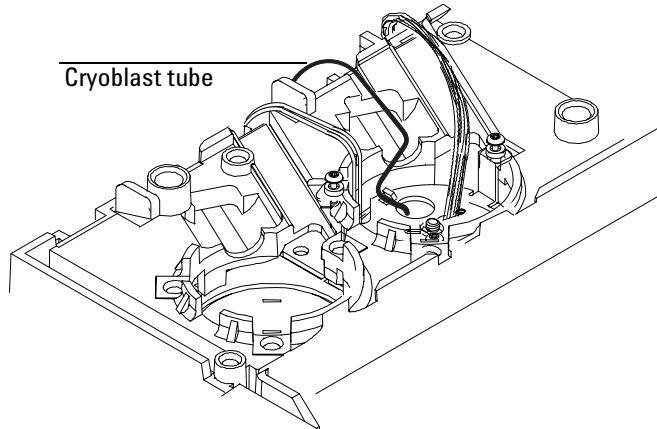
8. Open the oven door and replace the inlet on the oven top while holding onto the cryoblast tube. With your other hand, guide the tube or restrictor from inside the oven.
9. Secure the inlet to the oven top by tightening the three screws with a T-20 Torx screwdriver while simultaneously holding the tube or restrictor in position from inside the oven.



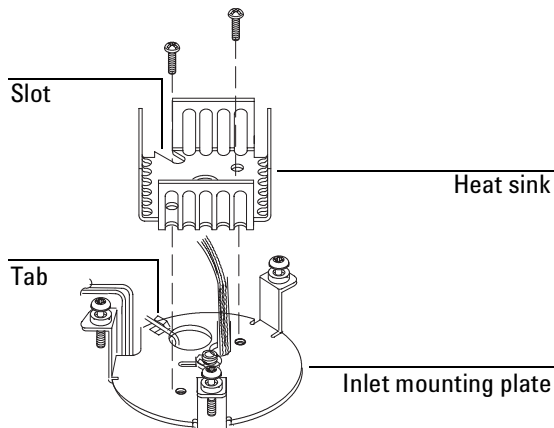
Hold it in place while you tighten the three screws on the oven top.

Installing cryoblast

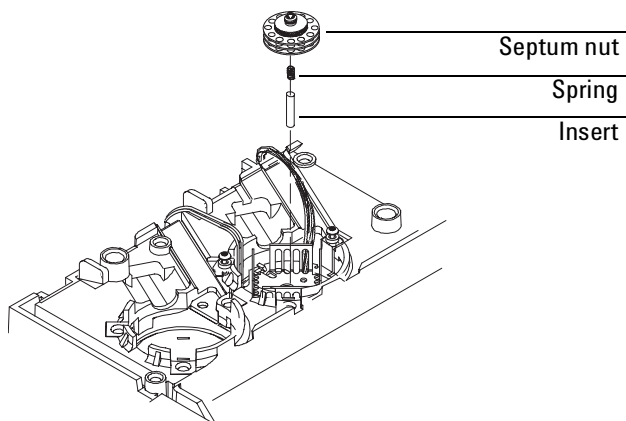
10. Bend the cryoblast tube at a 90° angle so that it can be routed over the inlet bezel.



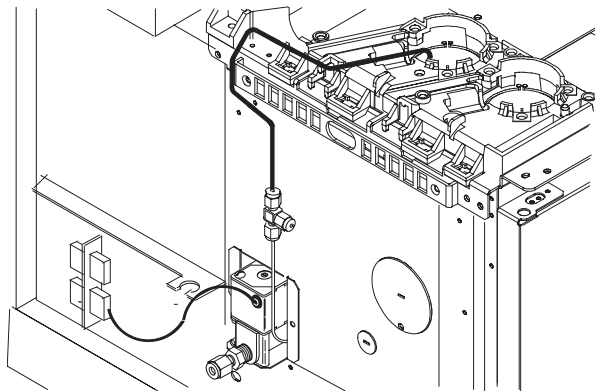
11. Place the heat sink on the inlet mounting plate and rotate the sink clockwise so that the tubing is trapped between the tab on the inlet mounting plate and the slot in the heat sink. Install and tighten the screws while holding the heat sink in place.



12. Reinstall the insert, spring, and septum nut.

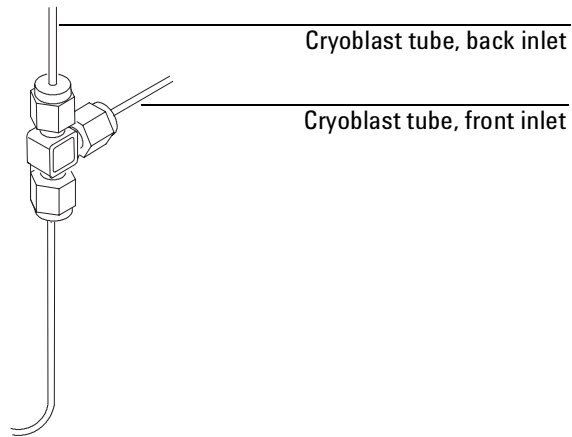


13. Route the cryoblast tube so that it runs parallel to the pneumatic tubing until you get to the side of the GC. Dress the tube down to the T-fitting.



Installing cryoblast

14. Repeat if you are installing cryoblast into two inlets.



Restoring the GC to operating condition

If you have an EPC unit:

1. There is a circular plate on the left side cover at the cryogenic valve location. See the figure on page 5. Remove the plate.
2. Install the left side cover and tighten the two screws. Accessory G1567A (LCO₂ oven cooling with cryoblast) has an external filter and tube attached to the valve inlet. The filter and tube will be outside the left side cover. By flexing the cover, it can be slipped over the filter and tube. If you prefer, remove the filter and tube, install the cover, and re-install the filter and tube.
3. Reinstall the inlet cover or tray mounting bracket.
4. Reinstall the column (if removed).
5. Plug in the GC and turn it on.
6. Connect the LCO₂ or LN₂ cylinder and tubing to the cryogenic valve (or the external filter, if present). See page 18 for details.
7. Turn on the liquid at the tank.

If you have a nonEPC unit:

1. Install the left side cover and tighten the two screws. Accessory G1567A (LCO₂ oven cooling with cryoblast) has an external filter and tube attached to the valve inlet. The filter and tube will be inside the left side cover.
2. Reinstall the inlet cover or tray mounting bracket.
3. Reinstall the column (if removed).
4. Plug in the GC and turn it on.
5. Connect the LCO₂ or LN₂ cylinder and tubing to the cryogenic valve (or the external filter, if present). See page 18 for details.
6. Turn on the liquid at the tank.

Plumbing cryogenic coolants

WARNING

When first connecting a cryogenic fluid source (Dewar flask for LN₂, cylinder for LCO₂), wear protective gloves with sleeves, lab coat, facemask, and safety goggles before opening the source valve.

Carbon dioxide

WARNING

Pressurized liquid CO₂ is a hazardous material. If CO₂ escapes its container, it exits at high pressure and low temperatures that can be dangerous to personnel. CO₂ in high concentrations is toxic to humans. Consult your local supplier for recommended safety precautions and delivery system design.

Caution

Liquid CO₂ should not be used as a coolant for temperatures below -40°C because the expanding liquid may form solid CO₂—dry ice—in the GC oven. If dry ice builds up in the oven, it can seriously damage the GC.

Liquid CO₂ is available in high-pressure tanks containing 50 pounds of liquid. The CO₂ should be free of particulate material, oil, and other contaminants. These contaminants could clog the expansion orifice or affect the proper operation of the GC.

Additional requirements for the liquid CO₂ system include:

- The tank must have an internal dip tube or eductor tube to deliver liquid CO₂ instead of gas (see Figure 1.).
- The liquid CO₂ must be provided to the GC at a pressure of 700 to 1,000 psi at a temperature of 25°C.
- Use 1/8-inch diameter heavy-wall stainless steel tubing for supply tubing. The tubing should be between 5 to 50 feet long.
- Coil and fasten the ends of the tubing to prevent it from “whipping” if it breaks.

- Do not install a pressure regulator on the CO₂ tank, as vaporization and cooling would occur in the regulator instead of the oven.
- Do not use a padded tank (one to which another gas is added to increase the pressure).

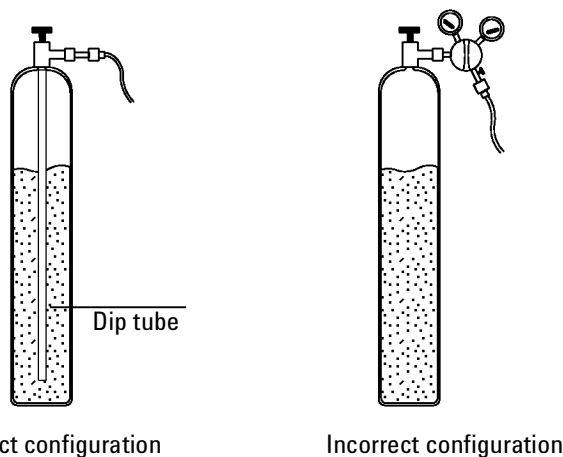


Figure 1. Correct and incorrect liquid CO₂ tank configuration

WARNING

Do not use copper tubing or thin-wall stainless steel tubing with liquid CO₂. Both harden at stress points and may explode.

Liquid nitrogen

WARNING

Liquid nitrogen is a hazard because of the extremely low temperatures and high pressures that may occur in improperly designed supply systems.

Liquid nitrogen can present an asphyxiant hazard if vaporizing nitrogen displaces oxygen in the air. Consult local suppliers for safety precautions and design information.

Plumbing cryogenic coolants

Liquid nitrogen is supplied in insulated Dewar tanks. The correct type for cooling purposes is a *low-pressure* Dewar equipped with a dip tube—to deliver liquid rather than gas—and a safety relief valve to prevent pressure build-up. The relief valve is set by the supplier at 20 to 25 psi.

WARNING

If liquid nitrogen is trapped between a closed tank valve and the cryo valve on the GC, tremendous pressure will develop and may cause an explosion. For this reason, keep the delivery valve on the tank open so that the entire system is protected by the pressure relief valve.

To move or replace a tank, close the delivery valve and carefully disconnect the line at either end to let residual nitrogen escape.

Additional requirements for the liquid N₂ system include:

- Nitrogen must be provided to the GC as a liquid at 20 to 30 psi.
- The supply tubing for liquid N₂ must be *insulated*. Foam tubing used for refrigeration and air-conditioning lines is suitable for insulation. Since pressures are low, *insulated* copper tubing is adequate.
- The liquid nitrogen tank should be close (only 5 to 10 feet) to the GC to insure that liquid, not gas, is supplied to the inlet.

Configuring and testing the GC

1. Connect the LCO₂ or LN₂ cylinder and tubing to the cryogenic valve and turn on the liquid at the tank.
2. Press [Config][Oven], scroll to Cryo (CO₂ or LN₂), and press [On] to enable the cryogenic valve. For information on the other parameters, see the *6890 GC Operating Manual*.

CONFIGURE OVEN	
Maximum temp	450
Equip time	3.00
Cryo (CO ₂)	On <
Quick cryo cool	Off
Ambient temp	25
Cryo timeout	Off
Cryo fault	Off

LCO₂ cryo shown;
LN₂ is similar

3. Press [Oven] and set the oven temperature to -10°C .

OVEN	
Temp	25 -10 <
Init time	0.00
Rate 1 (off)	0.00

4. Wait 2 minutes. The oven temperature should now be -10°C .

OVEN	
Temp	-10 -10 <
Init time	0.00
Rate 1 (off)	0.00

5. If you have cryoblast, set the inlet temperature to *oven track*. With the oven set at -10°C , the inlet should reach -7°C within 2 minutes.
6. If your inlet is not able to reach its setpoint, recheck your installation.

Configuring and testing the GC



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