Thermo Scientific

TRACE 1600/1610

Hardware Manual

Gas Chromatographs

MI-317000-0033 Revision B February 2023

Thermo Fisher
SCIENTIFIC

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General Lab Equipment. Not for Clinical, Patient, or Diagnostic Use.

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Reader's Survey

TRACE 1600/1610 Hardware Manual, MI-317000-0033, Revision B

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The manual is well organized.	1	2	3	4	5
The manual is clearly written.	1	2	3	4	5
The manual contains all the information I need.	1	2	3	4	5
The instructions are easy to follow.	1	2	3	4	5
The instructions are complete.	1	2	3	4	5
The technical information is easy to understand.	1	2	3	4	5
Examples of operation are clear and useful.	1	2	3	4	5
The figures are helpful.	1	2	3	4	5
I was able to operate the system using this manual.	1	2	3	4	5

fold

If not, please comment below. Attach additional sheets if necessary.

____

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- ❑ Veterinary
- ❑ Other____________________

***MY PRIMARY JOB FUNCTION IS*: (Check only one)**

fold

- ❑ Administration
- ❑ Lab management
- ❑ Operator
- ❑ Other____________________

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- ❑ Environmental
- ❑ Food/Agricultural
- ❑ Forensic/Toxicology
- ❑ Pharmaceutical
- ❑ Research/Education
- ❑ Other____________________

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Thermo Fisher Scientific GC-GC/MS
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Declaration

Manufacturer: **Thermo Fisher Scientific**

Thermo Fisher Scientific is the manufacturer of the instrument described in this manual and, as such, is responsible for the instrument safety, reliability and performance only if:

- installation
- re-calibration
- changes and repairs

have been carried out by authorized personnel and if:

- the local installation complies with local law regulations
- the instrument is used according to the instructions provided and if its operation is only entrusted to qualified trained personnel

Thermo Fisher Scientific is not liable for any damages derived from the non-compliance with the aforementioned recommendations.

Thermo Fisher Scientific S.p.A.
Strada Rivoltana, km 4, 20090 Rodano - Milan - Italy — Tel: +39 02 950591 - Fax: +39 02 9505276

Regulatory Compliance

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations.

Thermo Fisher Scientific declares, under sole responsibility, that the product as originally delivered complies with the requirements of the following applicable European Directives and carries the CE marking accordingly:

- Low Voltage Directive:2014/35/EU
- EMC Directive:2014/30/EU
- RoHS Directive 2011/65/EU, including amending Delegate Directive 2015/863/EU

… and conforms with the following product standards:

Safety

This device complies with:

- IEC 61010-1:2010/AMD1:2016, IEC 61010-2-010:2019
- CAN/CSA C22.2 No. 61010-1
- EN 61010-1:2020, EN 61010-2-010:2015
- UL 61010-1

Electromagnetic Compatibility

This device complies with:

- CISPR 11/EN 55011: Group 1 Class A
- IEC 61326-1:2012
- EN 61326-1:2012
- FCC part 15, Subpart B, §15.107(a) and §15.109(a)

IMPORTANT: Class A equipment is intended for use in an industrial environment. In other environments there may be potential difficulties in ensuring electromagnetic compatibility, due to the conducted as well as radiated disturbances.

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

CAUTION Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

Notice on Lifting and Handling of Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Fisher Scientific instrument ***requires a team effort*** to lift and/or move the instrument. This instrument is too heavy and/or bulky for one person alone to handle safely.

Notice on the Proper Use of Thermo Scientific Instruments

In compliance with international regulations: Use of this instrument in a manner not specified by Thermo Fisher Scientific could impair any protection provided by the instrument.

Notice on the Susceptibility to Electromagnetic Transmissions

Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.

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Declaration of Conformity

-Original-

EU Declaration of Conformity

Thermo Fisher SCIENTIFIC

Thermo Fisher Scientific S.p.A.
Strada Rivoltana
20053 Rodano Milan
Italy

We hereby declare that the following products

Designation:	**Gas chromatograph**
Model:	**Thermo Scientific Trace 1600 Series** *Trace 1600, Trace 1610*

fulfill all the relevant requirements of the following directives:

Low Voltage Directive	**2014/35/EU**
Electromagnetic Compatibility Directive	**2014/30/EU**
RoHS Directive	**2011/65/EU and (EU) 2015/863**

The following relevant harmonized standards were used:

EN 61010-1:2020-03	**EN 61326-1:2013-07**

Person authorized to compile the technical file:

Giacinto Zilioli
(Director, Strategic Projects)
Thermo Fisher Scientific S.p.A.

Giacinto Zilioli — Milan, March 9, 2022

Signature **Date**

-Original-

UK Declaration of Conformity

Thermo Fisher SCIENTIFIC

Thermo Fisher Scientific S.p.A.
Strada Rivoltana
20053 Rodano Milan
Italy

Declares, under sole responsibility, that products

Designation:	**Gas chromatograph**
Model:	**Thermo Scientific Trace 1600 Series** *Trace 1600, Trace 1610*

as originally delivered complies with the essential requirements of the following applicable UK Regulations:

Electrical Equipment (Safety) Regulations	**2016**
Electromagnetic Compatibility Regulations	**2016**
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (ROHS) Regulations	**2012**

and complies with the following harmonized standards and other technical specifications:

BS EN 61010-1:2010+A1:2019	**BS EN 61326-1:2021**

Signed for and on behalf of: Thermo Fisher Scientific S.p.A.:

Giacinto Zilioli
(Director, Strategic Projects)
Thermo Fisher Scientific S.p.A.

Giacinto Zilioli — Milan, March 4, 2022

Signature **Date**

China EEP Hazardous Substances Information

产品中有害物质的名称及含量
China EEP Hazardous Substances Information

部件名称 Component Name	有害物质 Hazardous Substances (TRACE 1600 Series)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
(主机:背部接线电路板) Base Unit: PCBA BACKPLANE	X	O	O	O	O	O
(主机：炉箱电路板) Base Unit: PCBA OVEN CPU	X	O	O	O	O	O
(主机: 主控电路板) Base Unit: PCBA CPU	X	O	O	O	O	O
(主机：存储器电路板) Base Unit: PCBA MEMORY	X	O	O	O	O	O
(主机：接口电路板) Base Unit: PCBA EXTERNAL INTERFACE	X	O	O	O	O	O
(主机：电源供应电路板) Base Unit: PCBA POWER SUPPLY	X	O	O	O	O	O
(主机：显示屏控制电路板) Base Unit: PCBA RSR1277	X	O	O	O	O	O
(主机：USB接口控制电路板) Base Unit: PCBA RSR1284	X	O	O	O	O	O
(主机：液晶显示屏) Base Unit: DISPLAY LCD 7"	X	O	O	O	O	O
(分流/不分流进样器电路板) PCBA's MODULE SSL	X	O	O	O	O	O
(程序升温进样器电路板) PCBA's MODULE PTV	X	O	O	O	O	O
(火焰离子化检测器电路板) PCBA's MODULE FID	X	O	O	O	O	O
(电导检测器电路板) PCBA's MODULE ECD	X	O	O	O	O	O
(氮磷检测器电路板) PCBA's MODULE NPD	X	O	O	O	O	O
(热导检测器电路板) PCBA's MODULE TCD	X	O	O	O	O	O
(火焰光度检测器电路板) PCBA's MODULE FPD	X	O	O	O	O	O
(辅助温度模块电路板)PCBA's MODULE AUXILIARY TEMPERATU	X	O	O	O	O	O
(辅助气体模块电路板) PCBA MODULE AUXILIARY GASES	X	O	O	O	O	O
(模拟输出接口电路板) PCBA MODULE AOI	X	O	O	O	O	O
(脉冲放电检测器电路板) PCBA's MODULE PDD	X	O	O	O	O	O
(通用检测器接口电路板) PCBA MODULE GDI	X	O	O	O	O	O
(辅助炉箱电路板) PCBA's AUXILIARY OVEN	X	O	O	O	O	O
(机加工件) MACHINED PARTS	O	O	O	O	O	O
(模具) MOLDED PARTS	O	O	O	O	O	O
(钣金件) SHEETMETAL PARTS	O	O	O	O	O	O
(电机组件) ELECTROMECHANICAL ASSEMBLIES	O	O	O	O	O	O
(电缆组件) CABLE ASSEMBLIES	O	O	O	O	O	O
(标签) LABELS	O	O	O	O	O	O

本表格依据SJ/T11364的规定编制 This table is compiled according to SJ/T 11364 standard.

O: 表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下.
Indicates that the concentration of the hazardous substance in all homogeneous materials for the part is below the relevant threshold of the GB/T 26572 standard.

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T26572规定的限量要.
Indicates that the concentration of the hazardous substance in at least one homogenous material of the part is above the relevant threshold of the GB/T 26572 standard.

该些产品的环保使用期为
The Environment Friendly Use Period for these products is: 25

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WEEE Directive

2012/19/EU

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

This symbol indicates that the equipment must not be thrown into general waste and should be collected separately and processed in accordance with local and state requirements.

Thermo Fisher Scientific is registered with one or more recycling/disposal companies in the UK and all other countries of the European Union and in Norway. If this product is located in Europe and you want to participate in the Thermo Fisher Scientific Business-to-Business (B2B) Recycling Program, send an email request to weee.recycle@thermofisher.com with the following information:

- WEEE product class
- Name of the manufacturer or distributor (where you purchased the product)
- Number of product pieces, and the estimated total weight and volume
- Pick-up address and contact person (include contact information)
- Appropriate pick-up time
- Declaration of decontamination, stating that all hazardous fluids or material have been removed from the product

For additional information about the Restriction on Hazardous Substances (RoHS) Directive for the European Union, search for RoHS on the Thermo Fisher Scientific European language websites.

IMPORTANT This recycling program is **not** for biological hazard products or for products that have been medically contaminated. You must treat these types of products as biohazard waste and dispose of them in accordance with your local regulations.

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Directive DEEE

2012/19/EU

Thermo Fisher Scientific s'est associé avec une ou plusieurs sociétés de recyclage dans chaque état membre de l'Union Européenne et ce produit devrait être collecté ou recyclé par celle(s)-ci. Pour davantage d'informations, rendez-vous sur la page www.thermoscientific.fr/rohs.

WEEE Direktive

2012/19/EU

Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Weitere Informationen finden Sie unter www.thermoscientific.de/rohs.

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Preface

This manual contains detailed information about installing, maintaining, and troubleshooting the Thermo Scientific™ TRACE™ 1600 and TRACE™ 1610 gas chromatographs.

About Your System

Thermo Scientific systems provide high-caliber gas chromatography (GC) instrumentation. Your TRACE 1600/1610 GC system can be a stand-alone unit or coupled with other instruments. GC represents a powerful analytical separation technique. Complex mixtures of individual compounds can be injected into the GC, either manually or by using an autosampler, and then separated the eluate for presentation to the detector. The detector generates signals of the GC eluate and its components. These signals are then processed by a Thermo Scientific™ Chromatography Data System for qualitative identification, as well as accurate and precise quantification of the individual compounds present in the sample.

IMPORTANT Thermo Scientific systems optimize the separation and detection capabilities of GC by providing high performance analytical capabilities for both research, and routine applications. More information about the use of this system can be found in related documentation sources, and by using the provided contact information.

WARNING Thermo Scientific systems operate safely and reliably under carefully controlled environmental conditions. If the equipment is used in a manner not specified by the manufacturer, the protections provided by the equipment might be impaired. If you maintain a system outside the specifications listed in this guide, failures of many types, including personal injury or death, might occur. The repair of instrument failures caused by operation in a manner not specified by the manufacturer is specifically excluded from the standard warranty and service contract coverage.

WARNING Operation of this system requires the use of chemical substances with different hazard specifications. Before using any chemicals, read the hazard indications and information reported in the Safety Sheet supplied by the manufacturer, referring to the relevant CAS (Chemical Abstract Service) number.

Power Rating

TRACE 1600/TRACE 1610 gas chromatograph

- 120 Vac ±10%, 50/60 Hz, 2000 VA
- 230 Vac ±10%, 50/60 Hz, 2000 VA

Detailed instrument specifications are in the Product Specifications Sheet.

Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need.

❖ **To find out more about our products**

Go to http://www.thermofisher.com for information about our products.

❖ **To get local contact information for sales or service**

Go to http://www.unitylabservice.com/en/home.html

Related Documentation

In addition to this guide, Thermo Scientific provides the following documents for the TRACE 1600 and TRACE 1610.

TRACE 1600 /1610 Document Set, P/N MI-317AH0-0038

- *TRACE 1600/1610 Preinstallation Requirements Guide,* P/N MI-317000-0032
- *TRACE 1600/1610 Hardware Manual*, P/N MI-317000-0033
- *TRACE 1600 /1610 User Guide,* P/N MI-317000-0034
- *TRACE 1600/1610 Spare Parts Guide*, P/N MI-317000-0035

Safety Alerts and Important Information

Make sure you follow the precautionary notices presented in this manual. The safety and other special notices appear in boxes.

Special Notices

Notices includes the following:

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

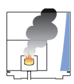
Note Emphasizes important information about a task.

Tip Helpful information that can make a task easier.

Safety Symbols and Signal Words

All safety symbols are followed by **WARNING** or **CAUTION**, which indicates the degree of risk for personal injury, instrument damage, or both. Cautions and warnings are following by a descriptor, such as **BURN HAZARD**. A **WARNING** is intended to prevent improper actions that could cause personal injury. Whereas, a **CAUTION** is intended to prevent improper actions that might cause personal injury, instrument damage, or both. You can find the following safety symbols on your instrument, or in this manual:

Symbol	Descriptor
	**BIOHAZARD:** Indicates that a biohazard *will*, *could*, or *might* occur.
	**BURN HAZARD:** Alerts you to the presence of a hot surface that *could* or *might* cause burn injuries.
	**ELECTRICAL SHOCK HAZARD:** Indicates that an electrical shock *could* or *might* occur.
	**FIRE HAZARD:** Indicates a risk of fire or flammability *could* or *might* occur.
	**EXPLOSION HAZARD.** Indicates an explosion hazard. This symbol indicates this risk *could* or *might* cause physical injury.
	**FLAMMABLE GAS HAZARD.** Alerts you to gases that are compressed, liquefied or dissolved under pressure and can ignite on contact with an ignition source. This symbol indicates this risk *could* or *might* cause physical injury.

	**GLOVES REQUIRED:** Indicates that you must wear gloves when performing a task or physical injury *could* or *might* occur.
	**CLOTHING REQUIRED.** Indicates that you should wear a work clothing when performing a task or else physical injury *could* or *might* occur.
	**BOOTS REQUIRED.** Indicates that you must wear boots when performing a task or else physical injury *could* or *might* occur.
	**MATERIAL AND EYE HAZARD.** Indicates you must wear eye protection when performing a task.
	**HAND AND CHEMICAL HAZARD:** Indicates that chemical damage or physical injury *could* or *might* occur.
	**HARMFUL.** Indicates that the presence of harmful material *will, could, or might* occur.
	**INSTRUMENT DAMAGE:** Indicates that damage to the instrument or component *might* occur. This damage might not be covered under the standard warranty.
	**LIFTING HAZARD.** Indicates that a physical injury *could* or *might* occur if two or more people do not lift an object.
	**MATERIAL AND EYE HAZARD:** Indicates that eye damage *could* or *might* occur.
	**READ MANUAL:** Alerts you to carefully read your instrument's documentation to ensure your safety and the instrument's operational ability. Failing to carefully read the documentation *could* or *might* put you at risk for a physical injury.
	**TOXIC SUBSTANCES HAZARD:** Indicates that exposure to a toxic substance could occur and that exposure *could* or *might* cause personal injury or death.
	**LASER HAZARD.** Indicates that exposure to a laser beam *will*, *could*, or *might* cause personal injury.
	**RADIOACTIVE HAZARD.** Indicates that the presence of radioactive material *could or might* occur.
	For the prevention of personal injury, this general warning symbol precedes the **WARNING** safety alert word and meets the ISO 3864-2 standard. In the vocabulary of ANSI Z535 signs, this symbol indicates a possible personal injury hazard exists if the instrument is improperly used or if unsafe actions occur. This symbol and another appropriate safety symbol alerts you to an imminent or potential hazard that *could cause personal injury*.

Instrument Markings and Symbols

Table 1 explains the symbols used on Thermo Scientific instruments. Only a few of them are used on the TRACE 1600/1610, which are annotated with an asterisk below.

Table 1. Instrument Marking and Symbols (Sheet 1 of 2)

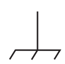
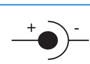
	Symbol	Description
	⎓	Direct Current
*	∼	Alternating Current
	≂	Both direct and alternating current
	3∼	Three-phase alternating current
	⏚	Earth (ground) terminal
		Protective conductor terminal
		Frame or chassis terminal
		Equipotentiality
*	|	On (Supply)
*	○	Off (Supply)
	⧈	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (Equivalent to Class II of IEC 536)
*		Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific **WARNING** or **CAUTION** information to avoid personal injury or damage to the product.
		Caution, risk of electric shock
*		Caution, hot surface
*		Caution, biohazard
		In-position of a bistable push control
		Out-position of a bistable push control
*		Jack socket

Table 1. Instrument Marking and Symbols (Sheet 2 of 2)

	Symbol	Description
*		Symbol in compliance to the Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) placed on the European market after August, 13, 2005.

Hydrogen Safety Precautions

Hydrogen is a colorless, odorless, highly flammable gas with the molecular formula H_2 and an atomic weight of 1.00794, making it the lightest element. Hydrogen gas presents a hazard, as it is combustible over a wide range of concentrations; at ambient temperature and pressure, the range is from about 4 to 74.2% by volume.

Hydrogen has a flash point of -423 °F (-253 °C) and an auto-ignition temperature of 1040 °F (560 °C). It has a very low ignition energy and the highest burning velocity of any gas. If hydrogen is allowed to expand rapidly from high pressure, it can self-ignite. Hydrogen burns with a flame that can be invisible in bright light.

WARNING - EXPLOSION HAZARD The use of hydrogen as a carrier gas is dangerous. Hydrogen is potentially explosive and must be used with extreme care. Any use of hydrogen gas must be reviewed by appropriate health and safety staff, and all installations of hydrogen systems must be performed to applicable codes and standards. Thermo Fisher Scientific assumes no liability for the improper use of hydrogen as a carrier gas.

Before you begin using hydrogen, conduct a risk assessment based on the quantity of hydrogen to be used and the conditions of your laboratory. Ask yourself:

“What hydrogen hazards associated with this project are most likely to occur?”

“What hydrogen hazards associated with this project have the potential to result in the worst consequences?”

- Try to reduce or eliminate the higher risks by using the proper ventilation to remove hydrogen gas before an ignitable concentration can accumulate. Also consider purging the hydrogen to further reduce hazards and ensure that anyone working with hydrogen has basic hydrogen safety training.
- As with laboratory safety in general, be sure to wear safety glasses, laboratory coats, gloves, and so on. Typically there are no specific requirements for gaseous hydrogen, other than eye protection when working with a compressed gas. If working with liquid (cryogenic) hydrogen, wear insulated gloves and protective shoes in addition to eye protection.
- Post “No Smoking” and “No Open Flames” signs to identify hydrogen sources and cylinders. Maintain, inspect, and leak-test all hydrogen sources regularly.

- Clearly mark all hydrogen shutoff valves and label permanent hydrogen piping as such at the supply or discharge point, and at regular intervals along its length. Where hydrogen gas piping passes through a wall, be sure to label both sides of the wall.
- Have contingency plans in place should an incident occur.
- Ensure that site emergency response team, as well as the local fire department, knows the location of all hydrogen storage tanks.

Using Hydrogen with TRACE 1600/1610

The use of hydrogen as a carrier gas, or as fuel gas for certain flame detectors, requires strict attention and compliance with special precautions due to the hazards involved.

WARNING - EXPLOSION HAZARD Hydrogen is a dangerous gas that, when mixed with air, might create an explosive mixture. Because of the risk of explosion, operators must take special precautions. Using hydrogen as a carrier gas requires the operator's extreme caution unless an SSL equipped with a Helium Saver-H_2 Safer™ device or a hydrogen sensor is installed in the GC oven.

When using hydrogen as a carrier gas, you must equip your gas chromatograph with a hydrogen sensor or Helium Saver-H_2 Safer device.

Never use hydrogen as a carrier gas in your TRACE 1600/1610 system unless your oven has a hydrogen sensor installed or you equip the system with the Helium Saver-H_2 Safer device. Thermo Fisher Scientific FSEs are not authorized to install or repair any instrument using hydrogen as a carrier gas unless equipped with the appropriate sensor or the Helium Saver-H_2 Safer device.

Contact your Thermo Fisher Scientific sales representative if you do not have a Helium Saver-H_2 Safer or a hydrogen sensor installed in your oven. To comply with instrument safety requirements, a Thermo Fisher Scientific FSE or authorized service personnel should install the sensor into your TRACE 1600/1610.

Hydrogen is a dangerous gas, particularly in an enclosed area when it reaches a concentration corresponding to its lower explosion level (4% in volume). An explosion hazard could develop in the oven when hydrogen is used as a carrier gas in the case oven elements are not perfectly connected to each other, or when the connection materials are worn out, broken, or otherwise faulty.

Use the following safety precautions when using hydrogen:

- Ensure that all hydrogen cylinders comply with the safety requirements for proper use and storage. Hydrogen cylinders and delivery systems must comply with local regulations.
- Make sure the gas supply is turned completely off when connecting hydrogen lines.
- Perform a leak test to ensure that the hydrogen lines are leak-tight before using the instrument. Repeat this test to eliminate all leaks.

Ensure your TRACE 1600/1610 has a Thermo Fisher Scientific hydrogen sensor or Helium Saver-H_2 Safer device installed. A hydrogen sensor continuously monitors the hydrogen level in the oven.

Hydrogen Connection Guidelines

Use the following guidelines to safely connect hydrogen to your system:

- **Piping—**Hydrogen must be delivered to equipment using appropriate piping and be done in such a way as to pose essentially no hazard to end-users. Piping systems for the delivery of hydrogen should be designed and installed by a person qualified by specific training and experience with hydrogen piping systems.

  Stainless steel is usually recommended because it is a safe, cost-effective material. Piping of *black iron* or copper must not be used, as the pipe can become brittle with age. Elastomeric/plastic tubing of various plastics and polymers should not be used, unless the tubing is approved for use with hydrogen. If elastomeric/plastic tubing is used for hydrogen gas delivery, the tubing should be tested for hydrogen permeability to minimize leakage.

  The hydrogen piping system must be flexible enough to endure routine thermal expansion and contraction. The system should also include considerations for the most severe condition of temperature and pressure expected during service. Piping and supports must be able to withstand static loading introduced by such things as ice and snow; and dynamic loading from high wind and earthquake.

  Caution should be used if burying hydrogen piping. Proper controls should be used to protect against damage and corrosion, and also to prevent Hydrogen from entering a building if there is any leakage.

- **Fittings—**All fittings must be of the proper type approved or designed for use with hydrogen gas. Use as few fittings as possible to minimize the potential for leaks. After installation, ensure that leak testing is carried out prior to system use, and on a regular basis.

  There must be no PTFE tape or other things like *plumber's putty* used to enhance a seal, as this actually is a detriment to a good seal. Ideally the best installation would use stainless steel tubing with appropriate gas-tight fittings.

  Welding is usually preferred for joints in hydrogen piping systems since welding provides a better connection and reduces the potential for leaks compared to mechanical fittings. Soft solder joints are not permitted for hydrogen systems (due to the low melting point of soft solder and its potential for brittle failure at cryogenic temperatures). Brazed joints are permitted, but such joints should be protected against the possibility of external fire.

  Tubing connections should be clamped to barbed or press-fit type connections. Hose clamps or *jubilee clamps* must not be used.

- **Valves**—All valves must be suitable for hydrogen service and for the specific operating conditions. Valves, including regulators, must not be used for hydrogen, unless they are designed and identified for such a use. Ball valves are often chosen because of their superior leak tightness through the valve seat. Pneumatic operators are usually chosen for remotely operated valves so that potential ignition sources (electricity) are remote from the valve.

  Manual shutoff valves should be provided near each point of use, within immediate reach. If a hydrogen cylinder or hydrogen generation system is located within immediate reach, a separate point-of-use shutoff valve is usually not necessary.

  Line regulators that have their source away from the point of use should have a manual shutoff valve near the point of use.

  An emergency gas shutoff device in an accessible location outside the use area should be provided in addition to the manual point-of-use valve in each educational and instructional laboratory space that has a piped gas supply system.

  If necessary, the piping system should have uninterruptible pressure relief. The pressure relief system should be designed to provide a discharge rate sufficient to avoid further pressure increase and should vent to a safe location outside or to a ventilation system exhaust.

Purchasing Hydrogen

Use the following guidelines when purchasing hydrogen:

- **Hydrogen Generator**—Because it minimizes the amount of hydrogen present and reduces the degree of hazard, a hydrogen generator (also called an electrolyzer) is the safest way to purchase hydrogen in the quantity used in gas chromatography/mass spectroscopy systems.

  However, to minimize the degree of hazard, operate the hydrogen generator only in a non-explosive environment because hydrogen buildup can be ignitable. Thus, your ventilation system for the room or lab hood where the hydrogen generator operates must maintain an air exchange rate at least two orders of magnitude greater than the maximum hydrogen production rate of the hydrogen generator. Follow the manufacturers' directions about proper use and maintenance of the regulator.

  To prevent the possibility of releasing hydrogen, set the hydrogen generator to shut down if:

  – There is a loss of flow to the ventilation system

  – A hydrogen detector alarms at 25% of the lower flammable limit of hydrogen in air. The lower flammable limit of hydrogen in air is 4%.

Vent the oxygen exhausted by the electrolyzer to the outside as well.

IMPORTANT Use a hydrogen generator that uses a palladium dryer or a proton-exchange membrane to create hydrogen gas from deionized water.
Use pressure swing adsorption and molecular sieve technology to remove moisture content down to trace levels.

- **Hydrogen Cylinder**—Hydrogen can be delivered in standard laboratory gas bottles or cylinders. These cylinders have a limited amount of hydrogen in them and are a safe way to transport and store hydrogen. Always secure, compressed hydrogen gas cylinders, like all compressed gas cylinders, in an upright position, ideally with a non-combustible chain or cable. If the cylinder falls over, the valve can fall off, causing the pressurized cylinder to take off like a rocket, leading to the release of hydrogen and possibly an explosion, severe injury, or death. Never crack a hydrogen cylinder valve to remove dust or dirt from fittings prior to attaching a regulator, as there is a risk of self-ignition.

Properly Storing Hydrogen

Storing and handling compressed hydrogen gas and cryogenic liquid hydrogen present potential health and safety hazards. Using proper storage and handling techniques is essential to maintaining a safe work environment.

Use the following guidelines when storing hydrogen:

- Store spare hydrogen gas cylinders outside and away from doors, windows, building air intake vents, structures, and vehicle routes. This precaution applies when the hydrogen is or is not in use. Indoor storage of spare hydrogen cylinders has special requirements, which are beyond the scope of this document. Documentation for each vessel should include a description of the vessel, a list of available drawings or other documents, the most recent inspection results, and the responsible person's name.
- Prevent spare cylinders from toppling by wrapping them with chains. The chains should also be protected against corrosion and excessive heat.
- Separate spare hydrogen cylinders from oxidizing gases (such as oxygen) with a 5 ft. (1.5 m) tall fire barrier with a half-hour fire rating or place the cylinders at least 20 ft. (6 m) apart.
- When moving hydrogen cylinders:
  - Remove the regulator and replace the cylinder valve cap before moving.
  - Move cylinders on cylinder carts or with other appropriate transport devices.
  - Never roll or drop a cylinder and never lift a cylinder by its protective cap.

- Bulk hydrogen systems include either gaseous or liquid hydrogen in fixed installations; in some gas systems a semi-permanent trailer (tube trailer) can be used. Storage vessels for compressed hydrogen gas or liquid hydrogen should be designed, constructed, tested, and maintained in accordance with applicable codes and standards. Bulk hydrogen systems represent a level of complexity again which is beyond the scope of this document; however some general guidelines are provided.
- The bulk hydrogen storage system should not be located beneath electric power lines, close to other flammable gases/liquids, or close to public areas. It should be readily accessible to authorized personnel and delivery equipment, but protected from physical damage or tampering.
- As liquid hydrogen systems also have a cryogenic hazard, additional safety considerations for the use of cryogenic liquids might be necessary.

Hydrogen Safety Codes, Standards and References

The following list of safety codes, standards, and references is in no way an exhaustive list. In fact, there may be federal, state, or local codes that apply to your specific location. Check with all appropriate agencies with jurisdiction before installing or using a hydrogen system.

- Air Products Safetygram #4 Gaseous Hydrogen
- ANSI/AIAA standard for hydrogen safety guidelines is AIAA G-095-2004, Guide to Safety of Hydrogen and Hydrogen Systems
- ASME B31.1, Power Piping Code
- ASME B31.3, Process Piping Code
- ASME B31.8, Gas Transmission and Distribution Systems
- BCGA Code Of Practice CP4 Industrial Gas Cylinder Manifolds and Gas Distribution Pipework
- BCGA Code Of Practice CP33 The Bulk Storage of Gaseous Hydrogen at Users' Premises
- CGA G-5, Hydrogen
- CGA G-5.4, Standard for Hydrogen Piping Systems at Consumer Locations
- CGA G-5.5, Hydrogen Vent Systems
- CGA G-5.6, Hydrogen Pipeline Systems
- CGA G-5.8, High Pressure Hydrogen Piping Systems at Consumer Locations.
- FM Global Property Loss Prevention Data Sheets 7-50: Compressed Gases in Cylinders
- FM Global Property Loss Prevention Data Sheets 7-91: Hydrogen
- IGC Doc 121/04/E, Hydrogen Transportation Pipelines System Design Features

- NASA
- NSS 1740.16 Safety Standard For Hydrogen And Hydrogen Systems Guidelines for Hydrogen System Design, Materials Selection, Operations, Storage, and Transportation
- NFPA 52, Vehicular Fuel Systems Code
- NFPA 55, Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks, 2005 Edition
- NFPA 68, Standard on Explosion Protection by Deflagration Venting
- NFPA 70, National Electrical Code
- NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 13, Standard for the Installation of Sprinkler Systems
- NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals
- NFPA 55, Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks
- NFPA 68, 2007 Standard on Explosion Protection by Deflagration Venting
- NFPA 69, Standard on Explosion Prevention Systems
- NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors
- NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials

OSHA 29CFR1910.103 1910.103 Hydrogen

Hazardous Substances Precautions

WARNING Before using hazardous substances (toxic, harmful, and so on), read the hazard indications and information reported in the applicable Material Safety Data Sheet (MSDS.) Use Personal protection according to the safety requirements.

Venting Toxic Gases

When analyzing toxic compounds be aware that during the normal operation of the GC some of the sample might be vented outside the instrument through the inlet and detector exits; therefore, make sure to vent the exhaust gases to a fume hood. Consult local Environmental and Safety Regulations for instructions in exhausting fumes from your system.

Liquid Nitrogen Safety Precautions

Liquid nitrogen is a colorless, odorless, extremely cold liquid and gas under pressure. It can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5%. A Self Contained Breathing Apparatus (SCBA) might be required. Contact with liquid or cold vapors can cause severe frostbite. Cold vapors in the air will appear as a white fog due to condensation of moisture. Oxygen concentrations must be monitored in the release area. All cryogenic liquids produce large volumes of gas when they vaporize.

WARNING Before using Liquid Nitrogen, read the hazard indications and the instructions reported in the Safety sheet supplied by the manufacturer, with reference to the CAS number (Chemical Abstract Service) 7727-37-9.

Use personal protection:

- **Protective gloves**: Loose fitting thermal-insulated or leather gloves.
- **Eye protection**: Full face shield and safety glasses are recommended.
- **Other protective equipment**: Safety shoes when handling containers. Long sleeved shirts and trousers without cuffs. Work clothing that sufficiently prevents skin contact should be worn.

Carbon Dioxide Safety Precautions

Carbon dioxide is a colorless, cryogenic liquid. At low concentrations, is odorless. At higher concentrations carbon dioxide will have a sharp, acidic odor. At concentrations between 2 and 10%, Carbon dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure, and increased respiratory rate. If the gas concentration reaches 10% or more, suffocation and death can occur within minutes. Contact with the cold gas can cause freezing of exposed tissue. Moisture in the air could lead to the formation of carbonic acid that can be irritating to the eyes. All forms of carbon dioxide are noncombustible. Carbon dioxide is heavier than air and should not be allowed to accumulate in low lying areas.

WARNING Before using carbon dioxide, read the indications of hazard and the instructions reported in the Safety sheet supplied by the manufacturer with reference to the CAS number (Chemical Abstract Service) 124-38-9.

Use personal protection:

- **Protective gloves**: Loose fitting thermal insulated or leather gloves.
- **Eye protection**: Full face shield and safety glasses are recommended.
- **Other protective equipment**: Safety shoes when handling containers. Long sleeved shirts and trousers without cuffs. Work clothing that sufficiently prevents skin contact should be worn.

1

Installation

This chapter provides instructions for installing and connecting the TRACE 1600/1610 GC system.

Contents

IMPORTANT Before you begin the installation process, your laboratory must be in compliance with the guidelines and requirements listed in the *TRACE 1600/1610 Preinstallation Requirements Guide*.

When you receive your TRACE 1600/1610 GC, an authorized Thermo Fisher Scientific Field Service Engineer (FSE) will configure the system for you. However, if you need to reconfigure your system, compete the following steps:

1. **Place the TRACE 1600/1610 on the workbench.**
   a. See "Positioning the TRACE 1600/1610" on page 3.
2. **Place and connect the external accessories.**
   a. See "Installing External Accessories" on page 3.
3. **Place and connect the Injector and Detector modules.**
   a. See "Installing the Injector and Detector Modules" on page 4.
4. **Plumb the gas supply and perform test for leaks.**
   a. See "Making the Gas Supply Plumbing Connections" on page 8.
   b. For system test information, refer to the *TRACE 1600/1610 User Guide* and to the *User Guide* of any accessories you have connected to your GC system.
5. **Connect coolant to cryogenic system (if present).**
   a. See "Connecting the Oven Cryogenic System" on page 13.
6. **Connect the PTV/PTVBKF to cryogenic system (if present).**
   a. See "Connecting the PTV/PTVBKF Cryogenic System" on page 19.
7. **Couple a TRACE 1600/1610 version for MS to a mass spectrometer.**
   a. Perform this step to couple a GC MS version with a Thermo Scientific mass spectrometer. See "Coupling to a Mass Spectrometer" on page 24.
8. **Install the autosampler (optional) on the GC.**
   a. See "Installing the Autosampler" on page 31.
9. **Install the Data System software.**
   a. See "Installing the Data System Software" on page 38
10. **Connecting Power to the GC and the External Modules.**
    a. See "Making Power Connections" on page 39.
11. **Set the LAN communication between TRACE 1600/1610 and computer.**
    a. See "Setting the LAN Communication" on page 41.
12. **Install the analytical column.**
    a. Install the column into GC as described in "Column Installation Requirements" on page 45 and "Installing the Column" on page 53.
13. **Perform column conditioning, leak test, and column evaluation.**
    a. Perform column conditioning, leak check, and carrier gas flow calibration (column evaluation) following the instruction reported in "Installing the Column" on page 53.

Positioning the TRACE 1600/1610

Your laboratory must already be prepared according to the space requirements, and the gas and power supplies must be accessible. Optional equipment should be placed near the TRACE 1600/1610 for easier connection.

❖ **To position the instrument**

WARNING The main unit of the GC, without injector/detector modules, weighs approximately **35 kg (77 lb)** when unpacked. Pay attention when lifting the instrument onto the work table.

1. Set the TRACE 1600/1610 on the work table. At least TWO people should perform this operation, each standing on one side of the instrument and putting their hands near its supporting feet.

WARNING The oven vents at the back of the GC discharge hot air up to 450 °C (842 °F) during cooling. Oven exhaust can cause severe burns. Avoid working behind the instrument oven vents during cool-down cycles. There should be at least 30 cm (12 in.) free space behind the instrument to allow the exhaust to dissipate. Do not expose gas tanks or bottles, chemicals, regulators, electrical cables, or other temperature-sensitive items to oven exhaust.

An optional **oven exhaust kit** can be installed to carry the hot air from the oven vents out of the working area. See "Installing the Oven Exhaust Kit" on page 362.

2. Look for the yellow label located on the back of the GC under the AC Input Connector. It indicates the power supply (120 Vac or 230 Vac) required by the GC and must be in compliance with your power source.

CAUTION To avoid contact with the hot air from the vents, gather the electrical cables into the cables holder.

ATTENTION Afin d'éviter tout contact avec l'air chaud produit par les évents, rassemblez les câbles électriques dans le porte-câbles.

Installing External Accessories

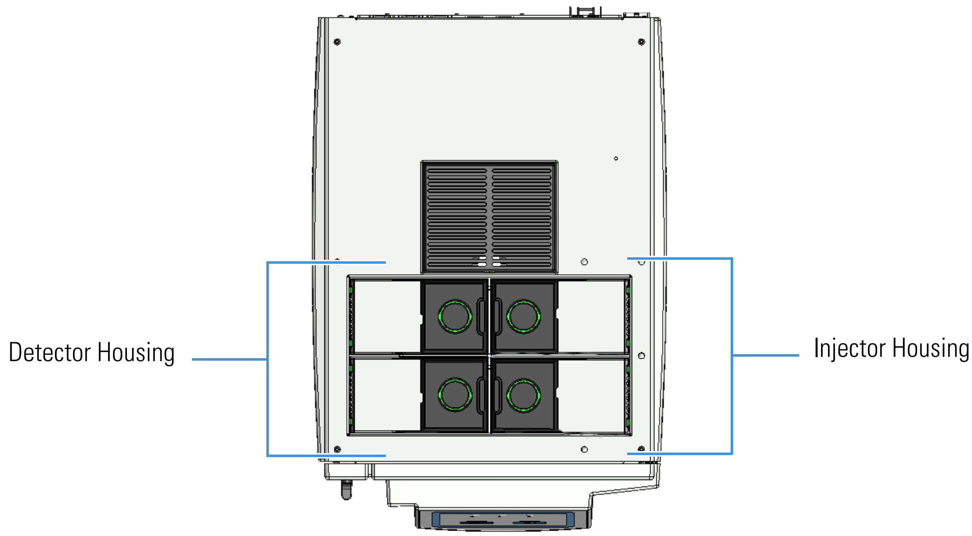
For additional information, refer to the *TRACE 1600/1610 User Guide* and to the documentation included with the accessories you purchased for your GC.

Installing the Injector and Detector Modules

This section provides the instructions for installing your front/back injector and detector modules into the relevant housing.

The GC is shipped with dummy modules installed into the injector/detector housings. See Figure 1.

Figure 1. Injector and Detector Housings and Dummy Modules



Note Where a dummy module is installed, the gas connection is blocked by a plug.

The dummy modules must be removed and replaced by the injector and detector modules as required by the configuration of your TRACE 1600/1610.

CAUTION Each housing must always be occupied by both modules. If the GC is configured with a single injector/detector module, a dummy module must remain inserted instead of the missing injector/detector module.

The injector and detector modules are shipped with a plug. Before installing the column, remove the plug.

ATTENTION Chaque boîtier doit toujours être occupé par les deux modules. Si le GC est configuré avec un seul module d'injecteur / détecteur, un module factice doit être inséré à la place du module injecteur / détecteur manquant.

Les modules d'injecteur et de détecteur sont fournis avec un bouchon. Avant d'installer la colonne, retirez le bouchon.

To install the injector and detector modules, see the following procedures:

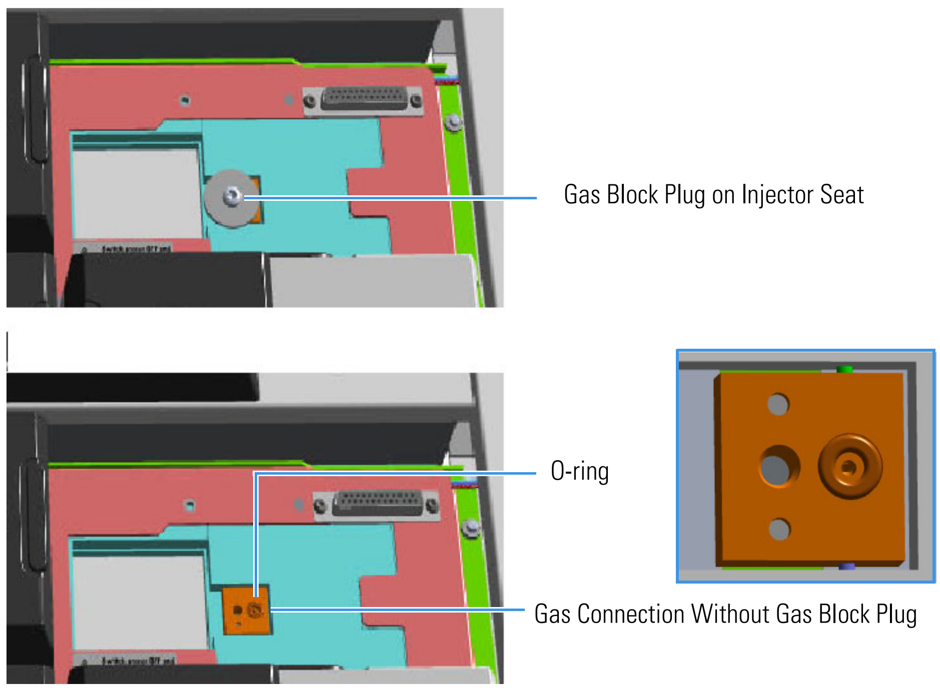
- Installing an Injector Module
- Installing a Detector Module

Installing an Injector Module

❖ **To install an injector module**

1. Remove the dummy module from the position where the injector module will be installed.
    a. Open the module flap cover.
    b. Using a T20 Torxhead screwdriver, unscrew the two captive fixing screws.
    c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector housing. Place the dummy module on a clean surface.
    d. Remove the gas block plug from the gas connection by unscrewing its fixing screw using a T20 Torxhead screwdriver.

Figure 2. Injector Gas Block Plug



WARNING Make sure the O-ring is placed into its seat on the gas connection. See Figure 2. **Do not install the module if the O-ring is missing**.

2. Plug the injector module into the main frame.
    a. Open the module flap cover.
    b. Keeping the module flap cover open, place it in its seat. Be sure to insert the 25-pin male connector on the bottom of the module into the 25-pin female connector on the injector seat of the injector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws evenly and carefully without overtightening.

CAUTION To maintain the correct alignment the screws must be tightened in turn, and each screw must be tightened only a small amount before moving to the next screw. Repeat until all are secure.

ATTENTION Afin de maintenir le bon alignement, les vis doivent être serrées tour à tour, et chaque vis ne doit être que très légèrement serrée avant de passer à la vis suivante. Répétez la procédure jusqu'à ce que toutes les vis soient bien serrées.

d. Close the module flap cover.

3. Continue the installation following the instructions reporting in the section "Making the Gas Supply Plumbing Connections" on page 8.

Installing a Detector Module

CAUTION If you are installing a **NPD detector module**, the installation of the NPD Thermionic Source Power Module is required. For the installation details see the section "Adding a NPD Detector Module" on page 477.

If you are installing a **Generic Detector Interface** see the section "Adding a Generic Detector Interface" on page 515.

ATTENTION Si vous installez un module détecteur NPD, l'installation du module d'alimentation de source thermo-ionique NPD est obligatoire. Pour les détails de l'installation, consultez la section "Ajout d'un module de détecteur NPD".

Si vous installez une interface de détecteur générique, consultez la section "Ajout d'une interface de détecteur générique".

❖ To install a detector module

1. Remove the dummy module from the position where the detector module will be installed.

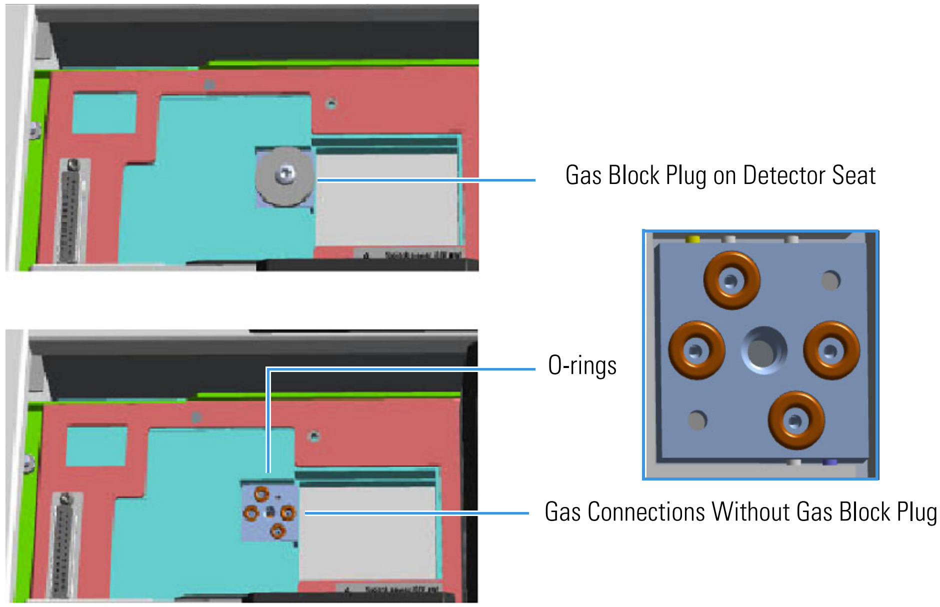
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew the two captive fixing screws.

   c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector/detector housing. Place the dummy module on a clean surface.

   d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver.

Figure 3. Detector Gas Block Plug



WARNING Make sure all the four O-rings are placed into their seats on the gas connection. See Figure 3. **Do not install the module if the O-rings are missing**.

2. Plug the detector module into the main frame.

   a. Open the module flap cover.

   b. Keeping the module flap cover open, place the module in its seat.
   Be sure to insert the 25-pin male connector on the bottom of the module into the 25-pin female connector on the detector seat of the detector housing.

   c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws evenly and carefully without overtightening.

CAUTION To maintain the correct alignment the screws must be tightened in turn, and each screw must be tightened only a small amount before moving to the next screw. Repeat until all are secure.

ATTENTION Pour maintenir le bon alignement, les vis doivent être serrées à tour de rôle, et chaque vis ne doit être serrée qu'un peu avant de passer à la vis suivante. Répétez jusqu'à ce que tous soient sécurisés.

   d. Close the module flap cover.

3. Continue the installation following the instructions in the section "Making the Gas Supply Plumbing Connections" on page 8.

Making the Gas Supply Plumbing Connections

Make plumbing connections between the gas supply lines and the GC gas inlets on the instrument back using the proper fittings

CAUTION DO NOT loosen or remove caps from the TRACE 1600/1610 until you have purged gas lines, and you are ready to connect them. Loosening or removing caps early will contaminate instruments and filters.

ATTENTION NE PAS desserrer ou retirer les capuchons du TRACE 1600/1610 avant d'avoir purgé les conduites de gaz et d'être prêt à les brancher. Desserrer ou retirer les capuchons trop tôt entraînera la contamination des instruments et des filtres.

WARNING Before using gases, carefully read the hazard indications and information reported in the Safety Sheet supplied by the manufacturer referring to the CAS (Chemical Abstract Service) number. It is the user's responsibility to see that all local safety regulations for the use of gases are obeyed.

All Thermo Fisher Scientific gas chromatographs use an inert gas as the carrier gas. If you wish to use hydrogen as a carrier gas, you must install a hydrogen sensor. Contact a Thermo Fisher Scientific sales representative if you plan to use hydrogen as the carrier gas in your new TRACE 1600/1610. If you don't have the hydrogen sensor, you **must** use an inert carrier gas.

Thermo Fisher Scientific FSEs are not authorized to install or repair any instrument using hydrogen as a carrier gas unless the instrument is equipped with the appropriate sensor.

❖ To plumb the gas supply

1. By now you must have done the following:

   a. Completely built your gas supply lines including any traps, tees, and extra tubing to allow about 40 cm (16 in.) of slack in the line.

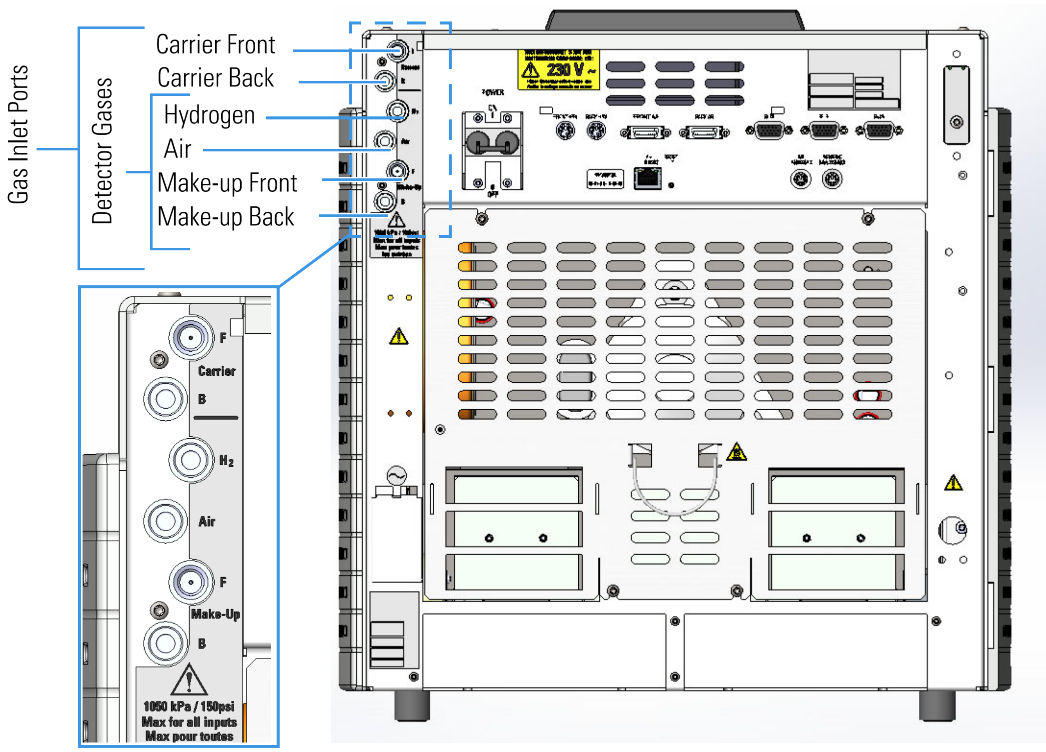
   b. Purged the gas line after every tube cut to remove any debris or contaminants.

   c. Ensured the gas supply is turned off.

2. Connect the gas lines.

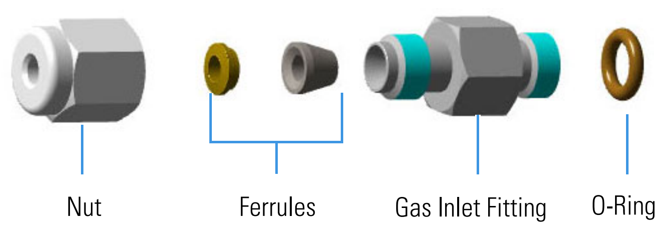
   a. TRACE 1600/1610 is provided with six gas inlet ports for the connection of carrier and detector gases. See Figure 4.

Figure 4. Gases Inlet Connections



Note Use the 1/8-in. Swagelok fittings provided on the gas inlet ports (see Figure 5) to connect the gas lines.

Figure 5. Fittings for Gas Inlets Connection

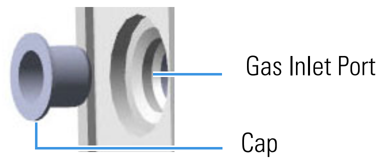


CAUTION Inside each 1/8-in. inlet manifold is a fritted filter. To keep the gas line from touching, and possibly damaging the filter, extend the tubing only 5 mm past the front ferrule. This ensures the tubing does not touch the filter.

ATTENTION Chaque collecteur d'admission de 3,17 mm contient un filtre fritté. Afin d'empêcher que la conduite de gaz ne touche et risque d'endommager le filtre, le tuyau ne doit dépasser de la ferrule avant que sur 5 mm. Ainsi, le tuyau ne touchera pas le filtre.

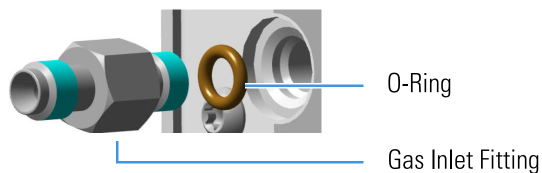
b. If present, remove the cap from the gas inlet port to connect. See Figure 6.

Figure 6. Cap Removal



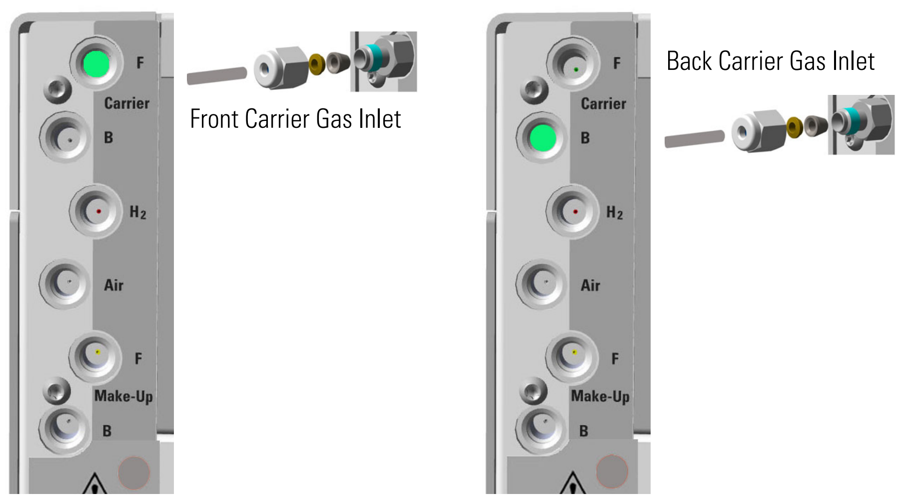
c. If not already installed, screw the gas inlet fitting provided into the gas inlet port interposing the O-ring. See Figure 7.

Figure 7. Gas Inlet Fitting Installation



d. Connect the gas line to the front/back carrier gas inlet. Use a 7/16-in. wrench for tightening the fittings. See Figure 8.

Figure 8. Carrier Gas Line Connection



e. Connect the gas line to the front/back detector gas inlet. Use a 7/16-in. wrench for tightening the fittings. See Figure 9, Figure 10, Figure 11, and Figure 12 to properly connect each detector.

Figure 9. FID/NPD Detector Gas Lines Connection

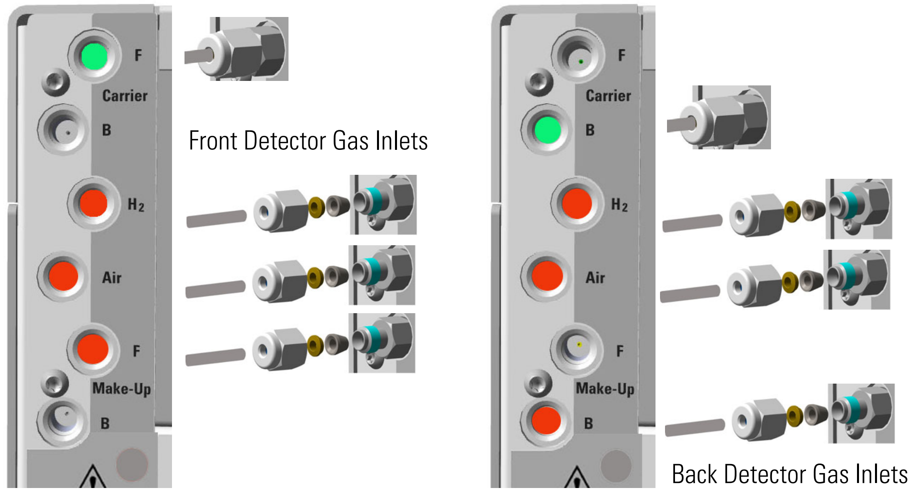


Figure 10. ECD Detector Gas Lines Connection

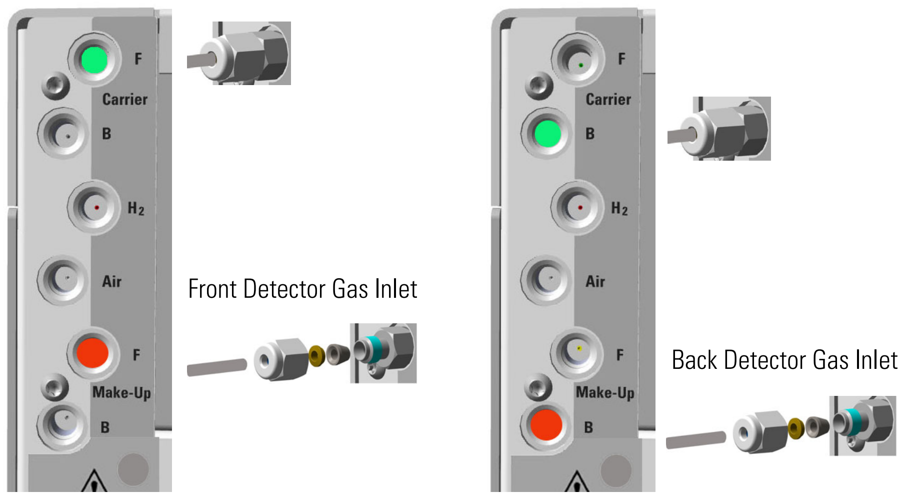


Figure 11. TCD Detector Gas Lines Connection

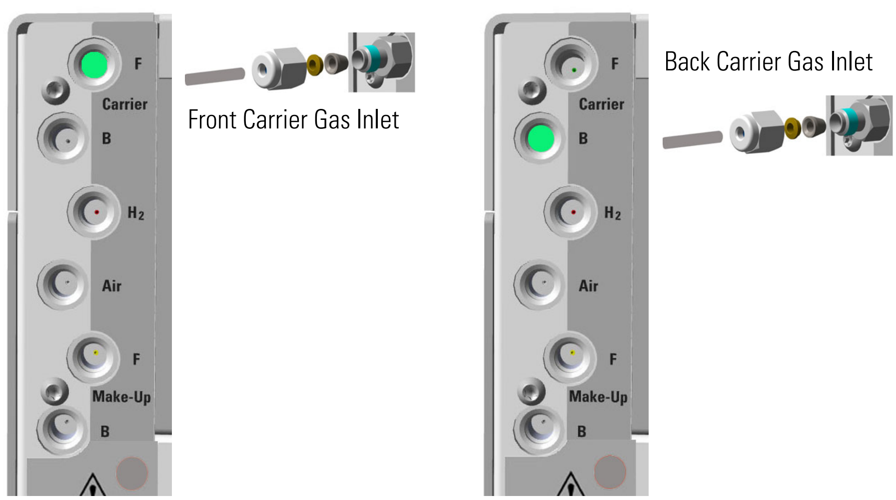
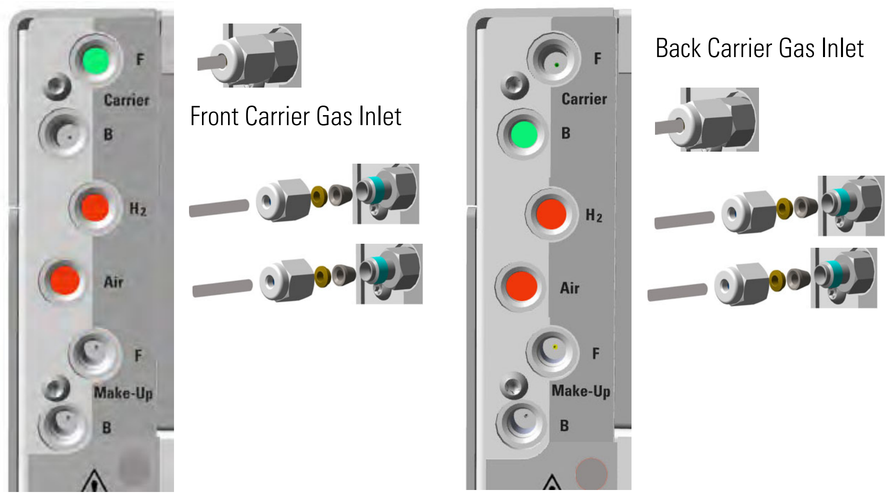


Figure 12. FPD Detector Gas Lines Connection



f. Be sure to complete all inlet and detector connections before turning on the gas supply.

3. Supply the gas lines.

IMPORTANT The maximum nominal inlet pressure for all the inputs is 1050 kPa (152 psig), as indicated on the label under the gas inlets ports on the back of the GC. The working inlet pressure range is from 400 kPa (58 psig) to 1050 kPa (152 psig).

Note If auxiliary carrier gases are required, the installation of the **Auxiliary Gas** module is required. For the installation details, see the section “Adding an Auxiliary Gas System” on page 566.

Testing for Leaks

Once you have connected the gas supplies to the GC, you need to test the gas supply lines for leaks.

CAUTION Before performing a leak test make sure that the GC is powered off and the power cable is unplugged from the AC Input connector (Mains socket) and from the wall outlet.

ATTENTION Avant d'effectuer un test d'étanchéité, assurez-vous que le GC est mis hors tension et que le câble d'alimentation est débranché du connecteur d'alimentation CA (prise secteur) et de la prise murale.

❖ **To perform a leak test**

1. Be sure that GC is powered off.
2. Open and set the gas supply.
   a. Open the gas supply.
   b. Set the carrier gas pressure to approximately 50 kPa (7 psi) higher than the maximum pressure of the GC regulator.
   c. Set the detector gas pressures to approximately 1050 kPa (152 psig) if available, otherwise set the maximum pressure allowed, for example 500 kPa (72.5 psi).
3. Check for leaks.
   a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.
   b. If you detect a leak, tighten the connection and retest it.
   c. Repeat this process until all connections are leak free.

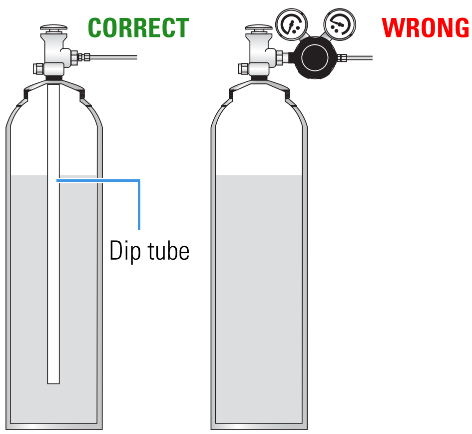
Connecting the Oven Cryogenic System

If the oven of your TRACE 1600/1610 is equipped with a cryogenic cooling option, you need a supply of coolant, such as carbon dioxide (CO_2) or liquid nitrogen (N_2).

Oven Cryo System with Carbon Dioxide Connection

This Oven cryo system consists of a tube for carbon dioxide inserted into the oven and fitted with a 1/8-in. solenoid valve for carbon dioxide mounted into the back of the GC. Carbon dioxide must be supplied in a high-pressure cylinder with a dip tube. It is your responsibility to ensure the delivery connection from the carbon dioxide cryogenic supply is adaptable to 1/8-in. tubing. Figure 13 shows the proper carbon dioxide container configuration.

Figure 13. Carbon Dioxide Container



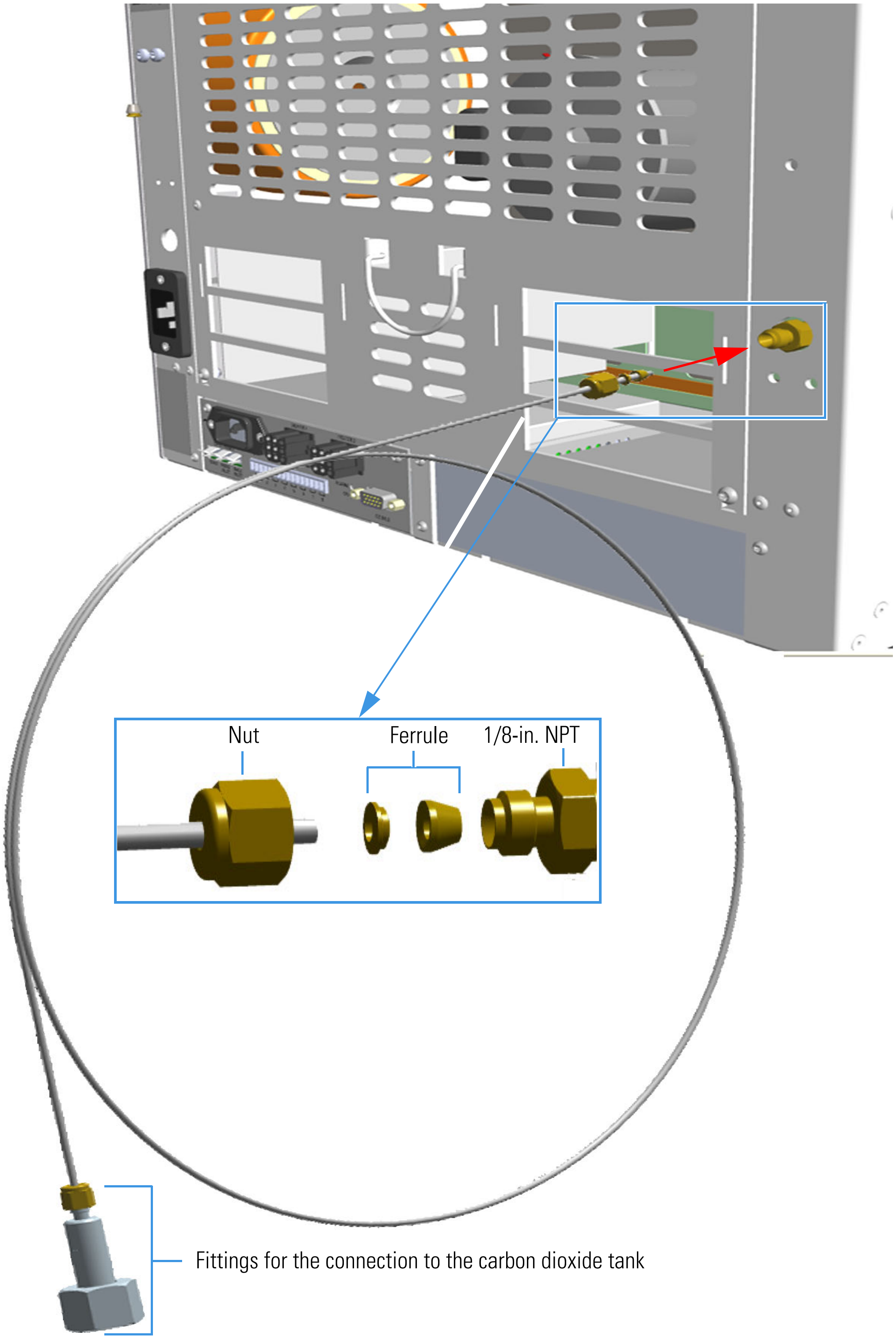
CAUTION High pressures and extremely low temperatures make pressurized carbon dioxide a hazardous material. High concentrations of carbon dioxide are dangerous. To avoid injury, always follow the safety precautions and delivery system design recommended by your gas supplier.

ATTENTION Le dioxyde de carbone sous pression est dangereux en cas de pression élevée ou de température extrêmement basse. Le dioxyde de carbone est dangereux à haute concentration. Afin d'éviter toute blessure, respectez les consignes de sécurité et la conception de système d'alimentation de votre fournisseur de gaz.

❖ To connect the cryogenic system to the carbon dioxide supply

1. Connect the proper end of the cryo supply tube to the 1/8-in. NPT connection of the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench to tighten the fittings. See Figure 14.

Figure 14. Oven Cryo Supply Tube for Carbon Dioxide Connection



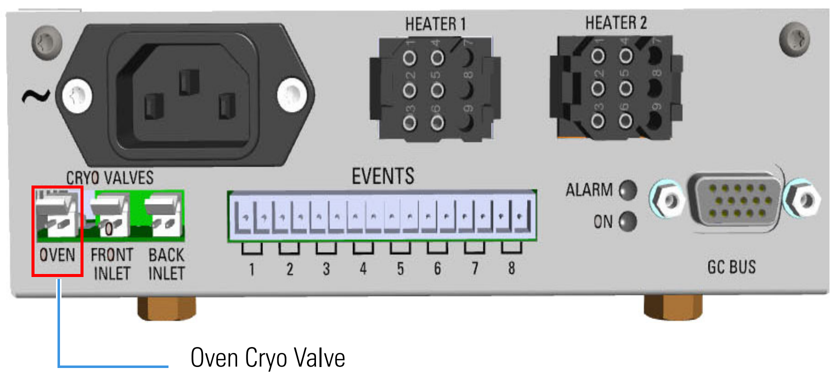
2. Connect the other end of the cryo supply tube to the coolant container using the appropriate nut and ferrule.

3. Connect the cryo valve to the **Aux Temperature/Cryo Module**.

IMPORTANT The Auxiliary Temperature/Cryo must be powered at the same line voltage of the main GC system.

a. Connect the cryo solenoid valve to the 2-pin connector marked **Cryo Valves - Oven** using the cable provided. See Figure 15.

Figure 15. Cryo Valves: Oven



b. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

c. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights up after the GC power on.

Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section "Adding an Aux Temperature/Cryo Module" on page 486.

Oven Cryo System with Liquid Nitrogen Connection

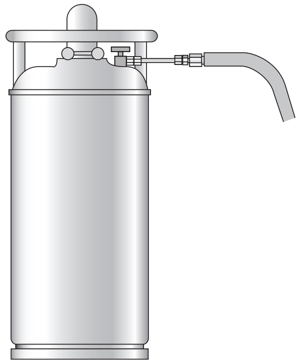
This Oven cryo system consists of a tube for liquid nitrogen inserted into the oven and fitted with a 1/8-in. solenoid valve for liquid nitrogen mounted into the back of the GC.

The tube for liquid nitrogen is covered with an insulating material tube.

Liquid Nitrogen must be supplied at a pressure of 1.5 bar (150 kPa; 21.75 psig). Plumbing to the GC should be 1/4-in. copper or stainless steel tubing with insulation. It is your responsibility to ensure the delivery connection from the liquid nitrogen cryogenic supply is adaptable to 1/4-in. tubing. The liquid nitrogen cryogenic valve on the GC is a 1/4-in. Swagelok fitting.

Figure 24 shows the proper configuration for a liquid nitrogen tank.

Figure 16. Liquid Nitrogen Tank Configuration

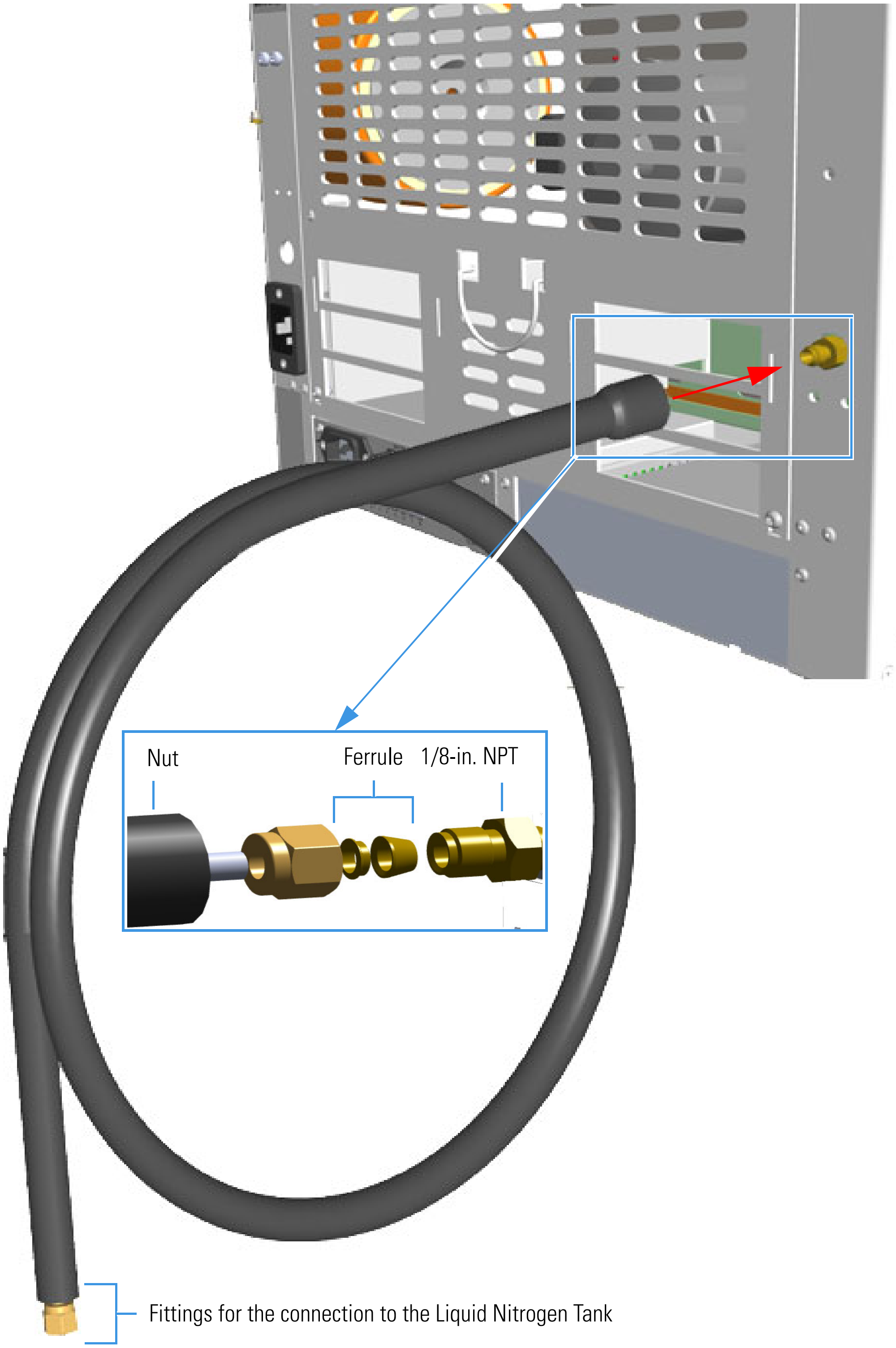


WARNING High pressures and extremely low temperatures make liquid nitrogen a hazardous material. High concentrations of liquid nitrogen in the air can be an asphyxiation hazard. To avoid injury, always follow the safety precautions and delivery system design recommended by your gas supplier.

❖ **To connect the cryogenic system to the liquid nitrogen supply**

1. Connect the proper end of the cryo supply tube to the 1/8-in. NPT connection of the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench to tighten the fittings. See Figure 17.

Figure 17. Oven Cryo Supply Tube for Liquid Nitrogen Connection



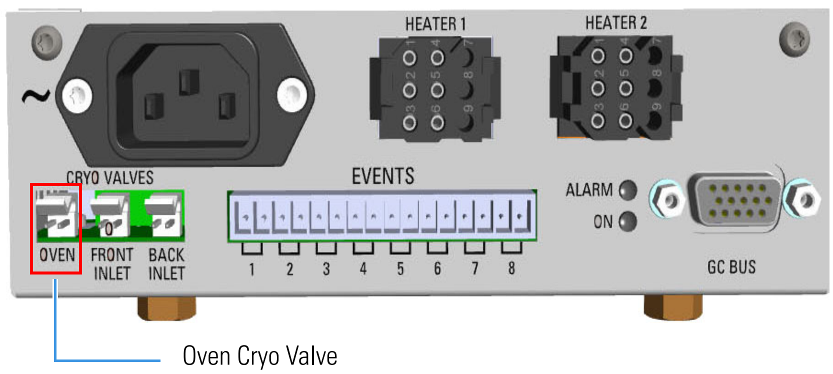
2. Connect the other end of the cryo supply tube to the coolant container using the appropriate nuts and ferrules.

3. Connect the cryo valve to the **Aux Temperature/Cryo Module**.

IMPORTANT The Auxiliary Temperature/Cryo must be powered at the same line voltage of the main GC system.

a. Connect the cryo solenoid valve to the 2-pin connector marked **Cryo Valves - Oven** using the cable provided. See Figure 18.

Figure 18. Cryo Valves: Oven



b. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

c. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights up after the GC power on.

Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section "Adding an Aux Temperature/Cryo Module" on page 486.

Connecting the PTV/PTVBKF Cryogenic System

If the PTV or PTVBKF injector of your TRACE 1600/1610 is equipped with a cryogenic cooling option, you need a supply of coolant, carbon dioxide (CO_2) or liquid nitrogen (LN_2).

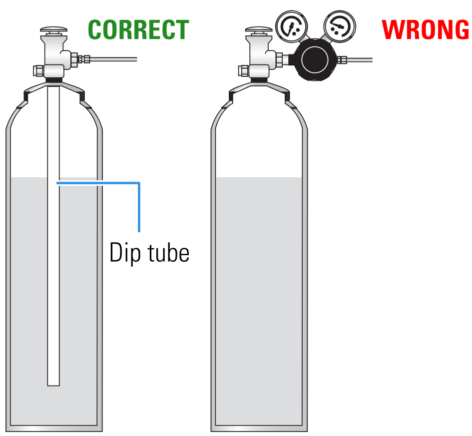
PTV/PTVBKF Cryo System with Carbon Dioxide Connection

This cryo system consists of a tube for Carbon Dioxide inserted into the PTV/PTVBKF module and fitted with a 1/8-in. solenoid valve for carbon dioxide mounted on a bracket fixed on the back of the GC. See Figure 19.

Figure 19. PTV Cryo System with CO_2

Carbon dioxide must be supplied by a high-pressure cylinder with a dip tube. It is your responsibility to ensure the delivery connection from the carbon dioxide cryogenic supply is adaptable to 1/8-in. tubing. Figure 20 shows the proper carbon dioxide container configuration.

Figure 20. Carbon Dioxide Container



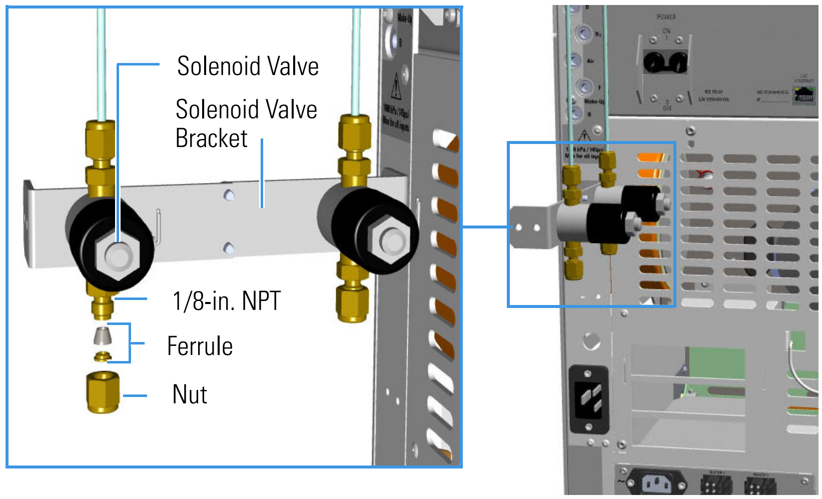
CAUTION High pressures and extremely low temperatures make pressurized CO_2 a hazardous material. High concentrations of CO_2 are dangerous. To avoid injury, always follow the safety precautions and delivery system design recommended by your gas supplier.

ATTENTION Le CO_2 sous pression est dangereux en cas de pression élevée ou de température extrêmement basse. Le CO_2 est dangereux à haute concentration. Afin d'éviter toute blessure, respectez les consignes de sécurité et la conception de système d'alimentation de votre fournisseur de gaz.

❖ To connect the cryogenic system to the carbon dioxide supply

1. Connect the proper end of the cryo supply tube to the 1/8-in. NPT connection of the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench to tighten the fittings. See Figure 21.

Figure 21. PTV/PTVBKF Cryo Supply Tube for Carbon Dioxide Connection



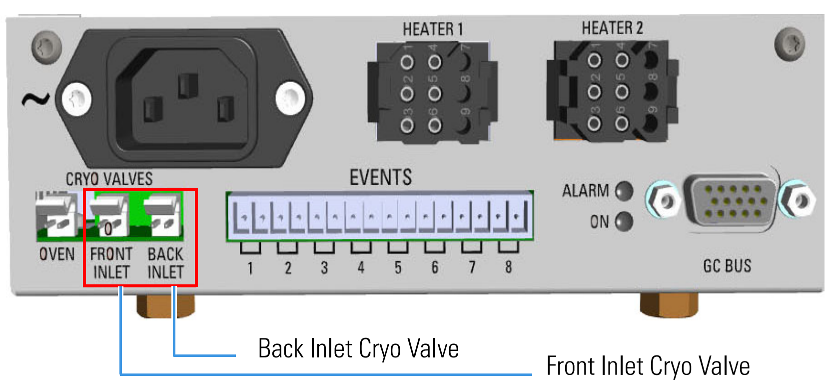
2. Connect the other end of the cryo supply tube to the coolant container using the appropriate nuts and ferrules.

3. Connect the cryo valve to the **Aux Temperature/Cryo Module**.

> **IMPORTANT** The Aux Temperature/Cryo module must be powered at the same line voltage of the main GC system.

   a. Connect the 2-pin connector marked **Cryo Valves - Front Inlet** or **Cryo Valves-Back Inlet** to the cryo solenoid valve using the cable provided. See Figure 22.

   Figure 22. Cryo Valves: Front/Back Inlet



   b. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

c. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights up after the GC power on.

Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section “Adding an Aux Temperature/Cryo Module” on page 486.

PTV/PTVBKF Cryo System with Liquid Nitrogen Connection

This cryo system consists of a tube for liquid nitrogen inserted into the PTV/PTVBKF module and fitted with a 1/8-in. solenoid valve for liquid nitrogen mounted on a bracket fixed on the back of the GC. The tube for liquid nitrogen is covered with an insulating material tube. See Figure 23.

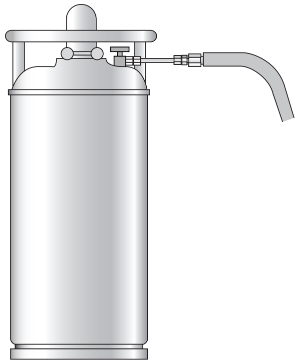
Figure 23. PTV Cryo System with Liquid Nitrogen

Liquid Nitrogen must be supplied at a pressure of 1.5 bar (150 kPa; 21.75 psig). Plumbing to the GC should be 1/4-in. copper or stainless steel tubing with insulation.

It is your responsibility to ensure the delivery connection from the Liquid Nitrogen cryogenic supply is adaptable to 1/4-in. tubing. The liquid nitrogen cryogenic valve on the GC is a 1/4-in. Swagelok fitting.

Figure 24 shows the proper configuration for a liquid nitrogen tank.

Figure 24. Liquid Nitrogen Tank Configuration

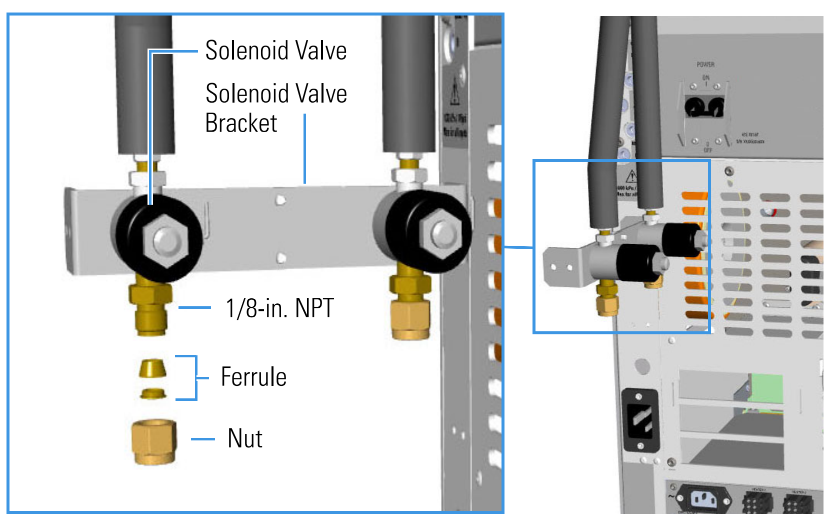


WARNING High pressures and extremely low temperatures make Liquid Nitrogen a hazardous material. High concentrations of liquid nitrogen in the air can be an asphyxiation hazard. To avoid injury, always follow the safety precautions and delivery system design recommended by your gas supplier.

❖ To connect the cryogenic system to the liquid nitrogen supply

1. Connect the proper end of the cryo supply tube to the 1/8-in. NPT connection of the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench to tighten the fittings. See Figure 21.

Figure 25. PTV/PTVBKF Cryo Supply Tube for LN_2 Connection



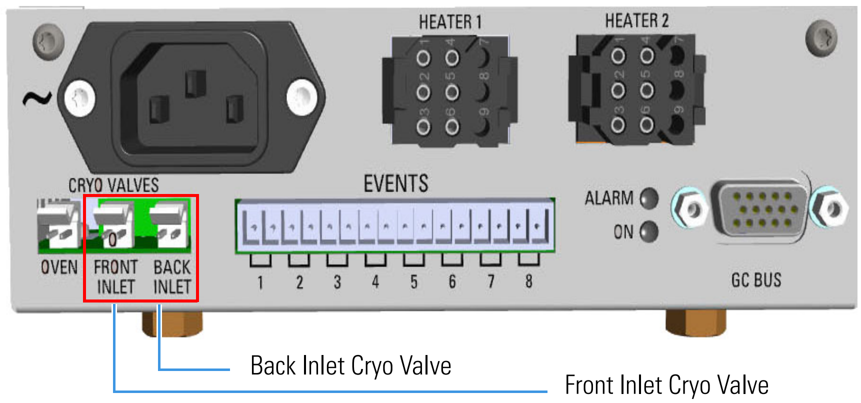
2. Connect the other end of the cryo supply tube to the coolant container using the appropriate nuts and ferrules.

3. Connect the cryo valve to the **Aux Temperature/Cryo Module**.

IMPORTANT The Auxiliary Temperature/Cryo must be powered at the same line voltage of the main GC system.

a. Connect the 2-pin connector marked **Cryo Valves - Front Inlet** or **Cryo Valves-Back Inlet** to the cryo solenoid valve using the cable provided. See Figure 26.

Figure 26. Cryo Valves: Front/Back Inlet



b. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

c. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights up after the GC power on.

Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section "Adding an Aux Temperature/Cryo Module" on page 486.

Coupling to a Mass Spectrometer

This section provides instruction for opening the duct to introduce the transfer line inner tube into the oven of your TRACE 1600/1610 version for MS.

According to the mass spectrometer unit to couple, see the following sections:

- "Making the Duct Couple with an ISQ Series or TSQ Series Mass Spectrometer" on page 24.
- "Making the Duct to Couple with a DFS, IRMS, or ICP-MS Mass Spectrometer" on page 27.

Making the Duct Couple with an ISQ Series or TSQ Series Mass Spectrometer

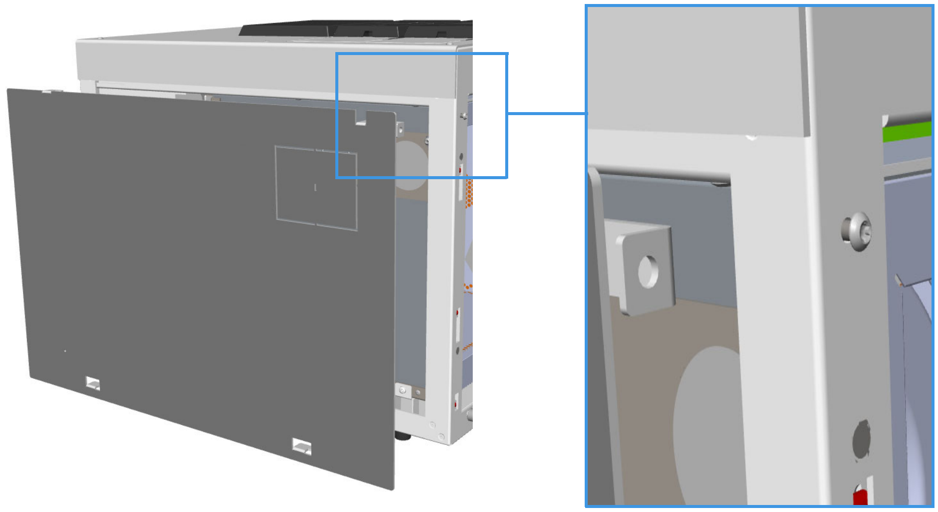
❖ **To make the duct for the transfer line**

1. Remove the left side panel.

   a. Open the front door of the GC.

   b. Use a T20 Torxhead screwdriver to loosen the left side panel screw from the interior front panel. See Figure 27. Save the screw because it will be reused later.

Figure 27. Left Side Panel Fixing Screw



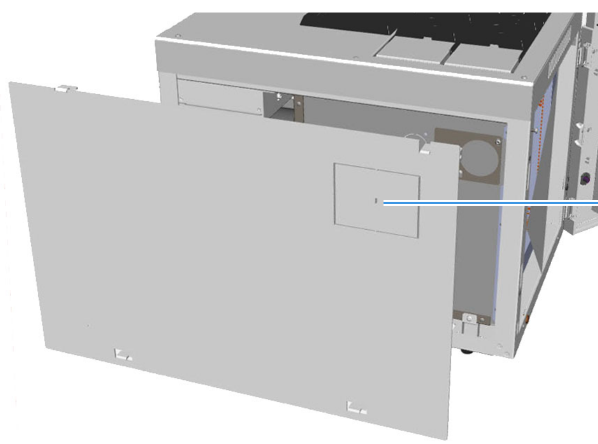
c. Slide the panel towards the back of the instrument up to the stop.

d. Remove the panel by pulling it outward. Be aware that the ground wire is attached to the panel.

2. Prepare the duct for the ISQ Series or TSQ Series transfer line inner tube.

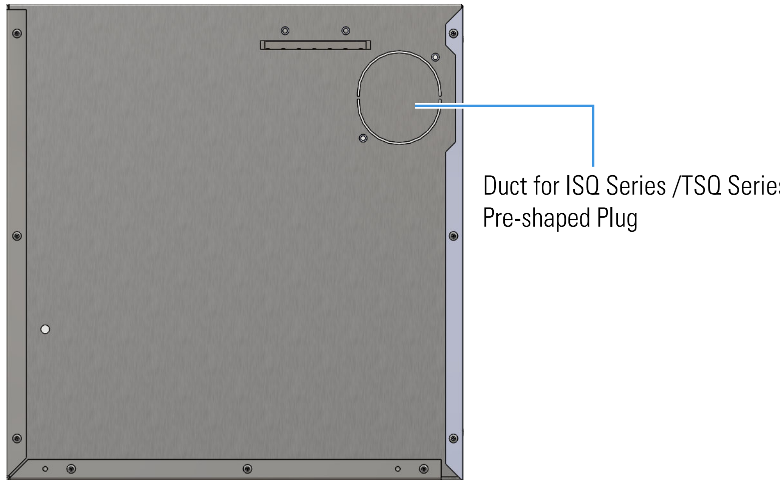
   a. Remove the partial cut plate on the left panel for that corresponds to your MS. See Figure 28.

Figure 28. Left Panel for MS Partial Cut Plate



   b. On the exterior wall of the oven box, remove the pre-shaped plug of insulating material from the duct provided. See Figure 29.

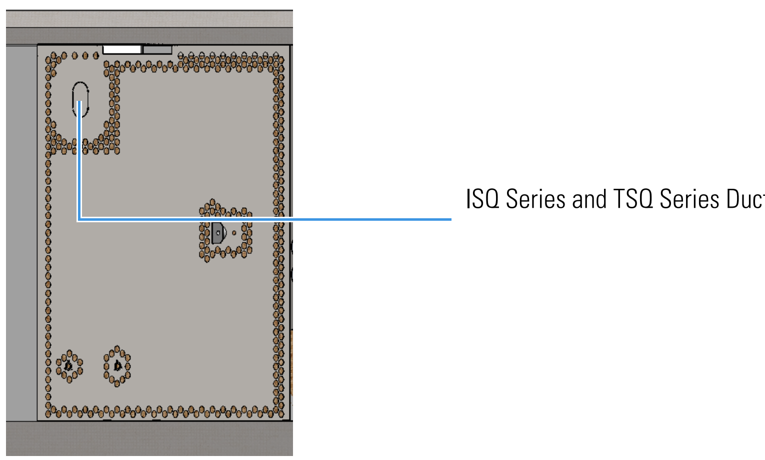
Figure 29. Pre-shaped Plug Removal



IMPORTANT Save the pre-shaped plug of insulating material in a safe place because it could be reused.

c. On the interior of the oven box remove the partial cut plate from the corresponding duct. See Figure 30.

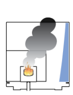
Figure 30. Duct for the Coupling with ISQ Series or TSQ Series Mass Spectrometer



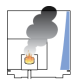
d. Place the left panel for your MS and attach the screw holding it in place.

3. Introduce the transfer line inner tube into the oven through the duct provided.

4. Attach the transfer line to the GC column using the proper nut and ferrule.



CAUTION - INSTRUMENT DAMAGE: Make sure that the GC column has been conditioned before connecting it to the transfer line. The material released from the column, (column bleed), during conditioning may contaminate the detector.



ATTENTION – RISQUE D'ENDOMMAGEMENT DE L'INSTRUMENT : veillez à ce que la colonne GC ait été conditionnée avant de la brancher sur la ligne de transfert. Le matériau libéré par la colonne (bleeding de la colonne) pendant le conditionnement risque de contaminer le détecteur.

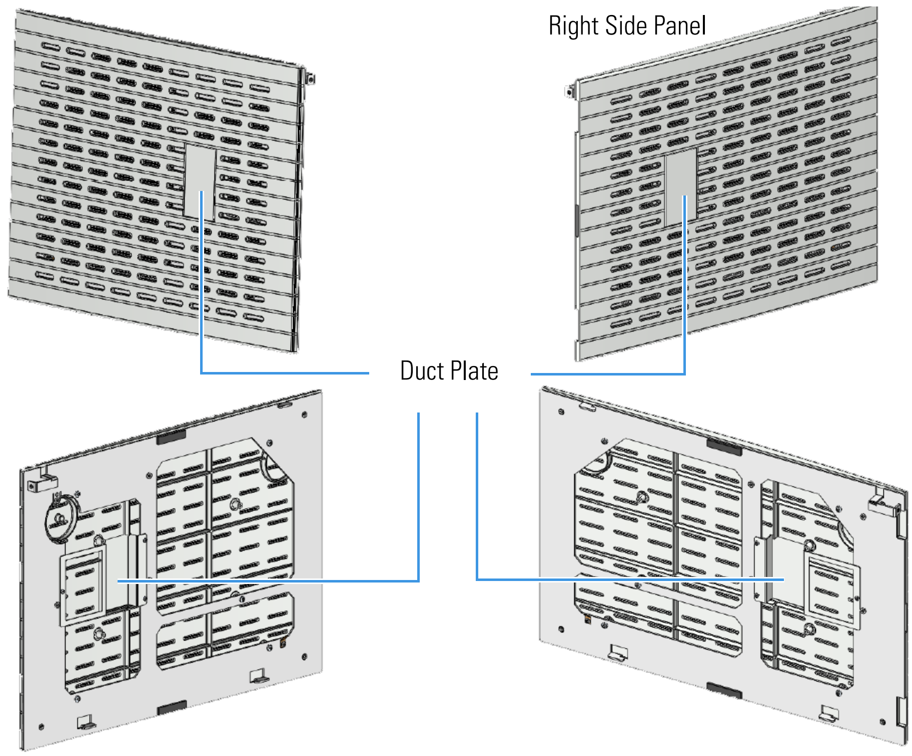
5. Close the front door of the GC.
6. To tune and set the ISQ Series or TSQ Series working conditions, refer to the relevant *User Guide* and *Hardware Manual*.

Making the Duct to Couple with a DFS, IRMS, or ICP-MS Mass Spectrometer

❖ **To make the duct for the transfer line**

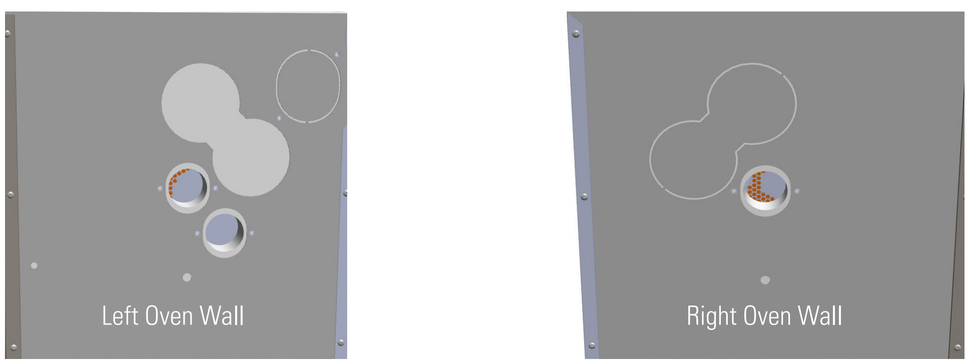
1. Remove the left/right side panel according to the high resolution mass spectrometer to couple.
   a. Open the front door of the GC.
   b. Use a T20 Torxhead screwdriver to loosen the left/right side panel screw from the interior front panel. Save the screw because it will be reused later.
   c. Slide the panel towards the back of the instrument up to the stop.
   d. Remove the panel by pulling it outward. Be aware that the ground wire is attached to the panel.
2. Prepare the proper duct for the transfer line inner tube.
   a. Use a T20 Torxhead screwdriver to loosen the duct plate screws from the left/right panel. See Figure 31.

Figure 31. Left/Right Side Panel



b. According to the configuration of your high resolution mass spectrometer, on the left/right exterior wall of the oven box, remove the partial cut plate of the duct of interest, and then the pre-shaped plug of insulating material from the duct provided. See Figure 32.

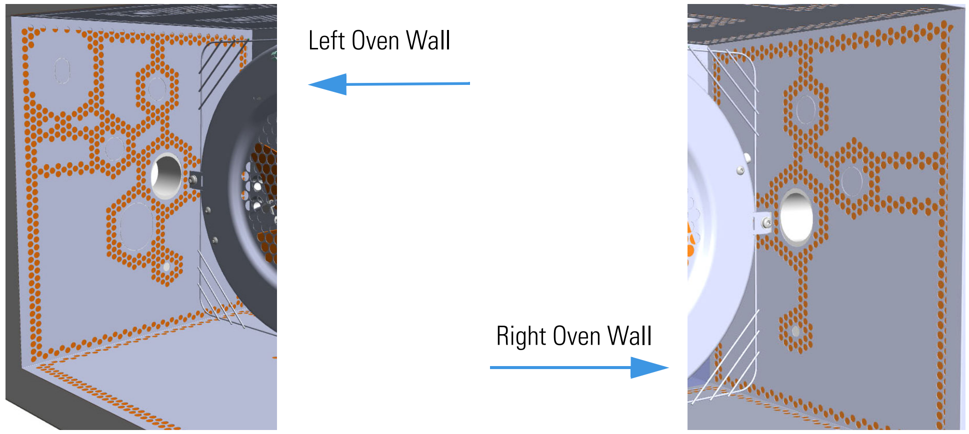
Figure 32. Left/Right Exterior Oven Wall Box View



IMPORTANT Save the pre-shaped plug of insulating material in a safe place because it could be reused.

c. On the interior of the oven box remove the partial cut plate from the corresponding duct. See Figure 33.

Figure 33. Left/Right Interior Oven Wall Box View



   d. Place the left/right panel for MS and attach the screw holding it in place.

3. Introduce the transfer line inner tube into the oven through the duct provided.

4. Attach the transfer line to the GC column using the proper nut and ferrule.

CAUTION - INSTRUMENT DAMAGE: Make sure that the GC column has been conditioned before connecting it to the transfer line. The material released from the column (column bleed) during conditioning may contaminate the detector.

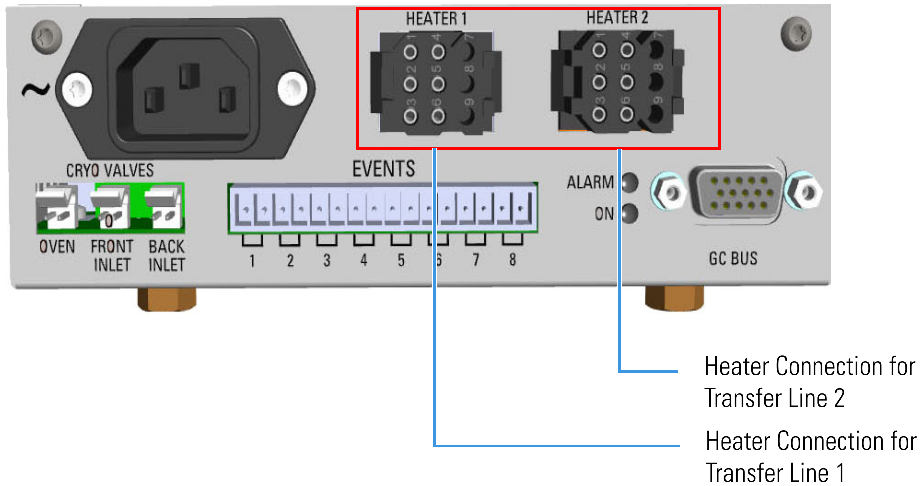
ATTENTION – RISQUE D'ENDOMMAGEMENT DE L'INSTRUMENT : veillez à ce que la colonne GC ait été conditionnée avant de la brancher sur la ligne de transfert. Le matériau libéré par la colonne (bleeding de la colonne) pendant le conditionnement risque de contaminer le détecteur.

5. Close the front door of the GC.

6. Connect the transfer line heater if required.

   a. Connect the transfer line heater to the **Aux Temperature/Cryo Module**. See Figure 34.

Figure 34. Transfer Line MS Heaters



7. Tune and set the DFS, IRMS, and ICP-MS working conditions of the high resolution mass spectrometer, referring to the relevant manuals.

Setting Handshake Parameters

When your GC is connected to a mass spectrometer, set the handshaking parameters as shown in Table 1.

Table 1. GC Handshaking Parameters When A Mass Spectrometer is Connected

Parameter	Set To:
Remote Start In	High to Low
Inhibit Ready In	When High
End of Run Out	High to Low
Start of Run Out	High to Low
GC Ready Out	When Low
Prep Run Out	When Low

❖ **To configure handshaking parameters through the touch screen**

1. In the main menu select the **Configuration** icon, the Configuration menu appears.
2. In the Configuration menu, select the **Handshake** icon to open the relevant submenu.
3. Set the **Handshaking parameters** as required, then return to main menu.

❖ **To configure handshaking parameters through the Chromatography Data System**

1. Launch the Data System. In the relevant Configuration page specify the handshaking parameters.

Installing the Autosampler

This section provides instruction for installing and connecting a TriPlus RSH, a TriPlus 100 Liquid Sampler, a TriPlus, an AI/AS 1610, or two AI/AS 1610 in Gemini configuration.

Related Topics

- "Mounting an Autosampler on the GC" on page 31
- "Connecting the AI/AS 1610 in Standard Configuration" on page 33

Mounting an Autosampler on the GC

To mount the autosampler use the appropriate support and fix it to the installation holes provided on the top of the GC. See Figure 35 and Figure 36.

For further details please refer to the manuals of your sampling system.

Figure 35. Installation Holes and Sampler Supports for TriPlus RSH and TriPlus 100 Liquid Sampler

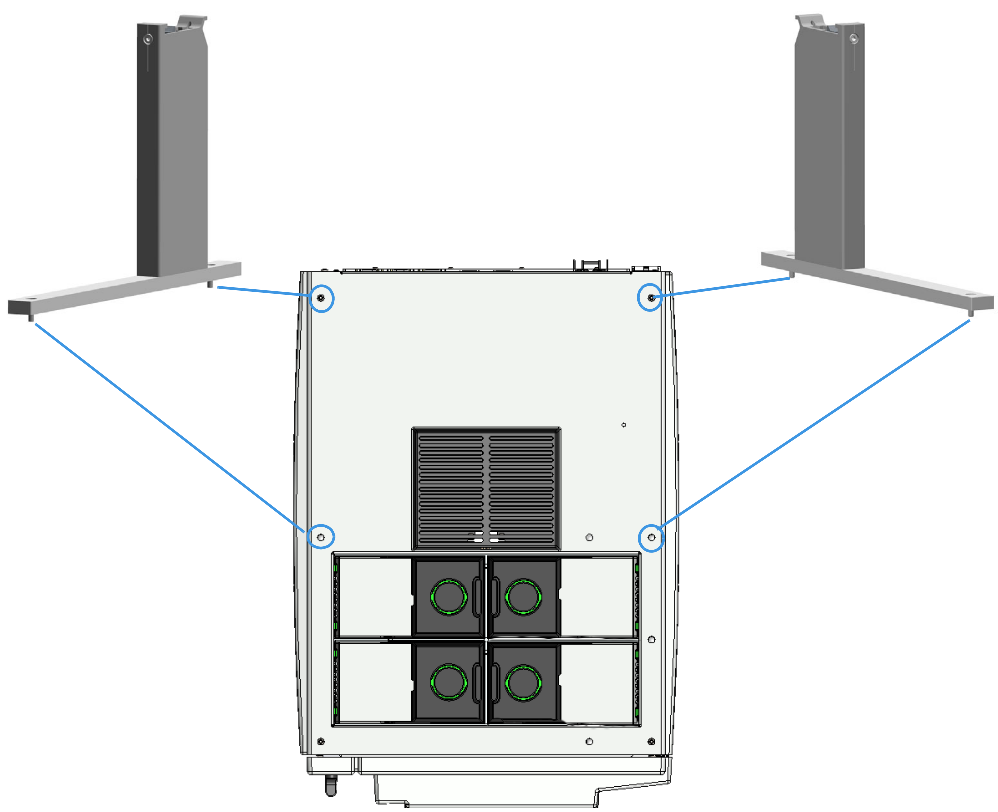
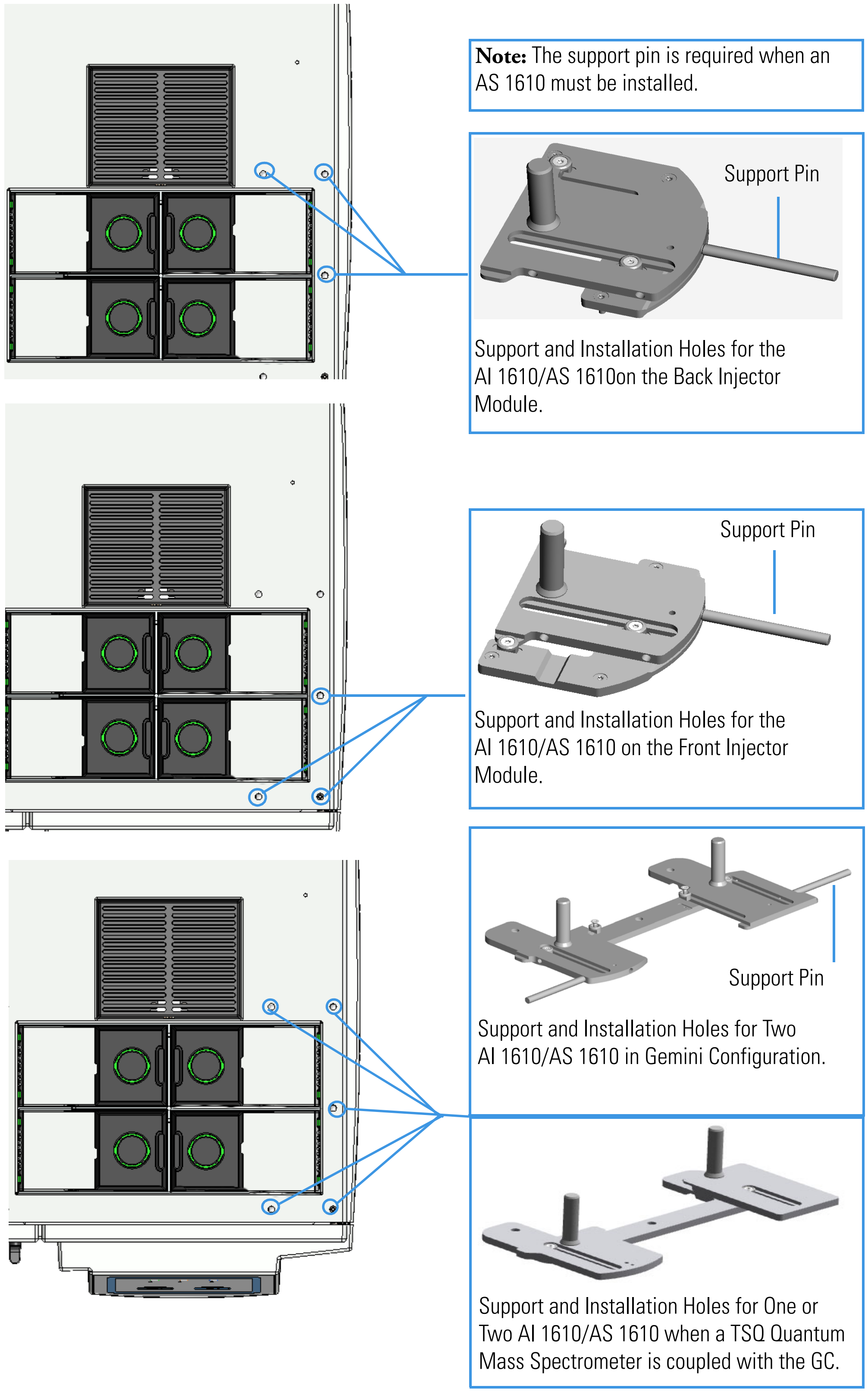


Figure 36. Installation Holes and Sampler Supports for AI/AS 1610 - AI/AS 3000 II Autosampler

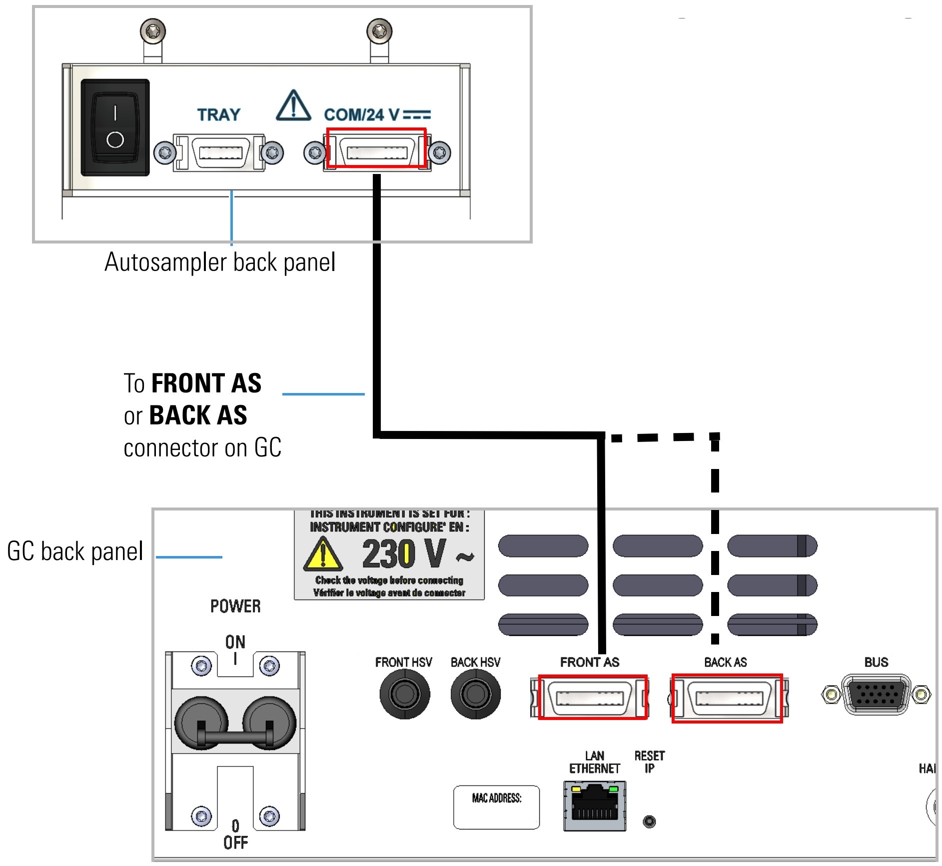


Connecting the AI/AS 1610 in Standard Configuration

❖ **To connect a front or back sampling unit to the GC in standard configuration**

1. Using the cable provided, connect the Mini Delta connector from the AI 1610 sampler to the Mini Delta connector on the back of the Trace 1600 Series GC.

Figure 37. Connections Between Front or Back Autosampler and GC



Configuration

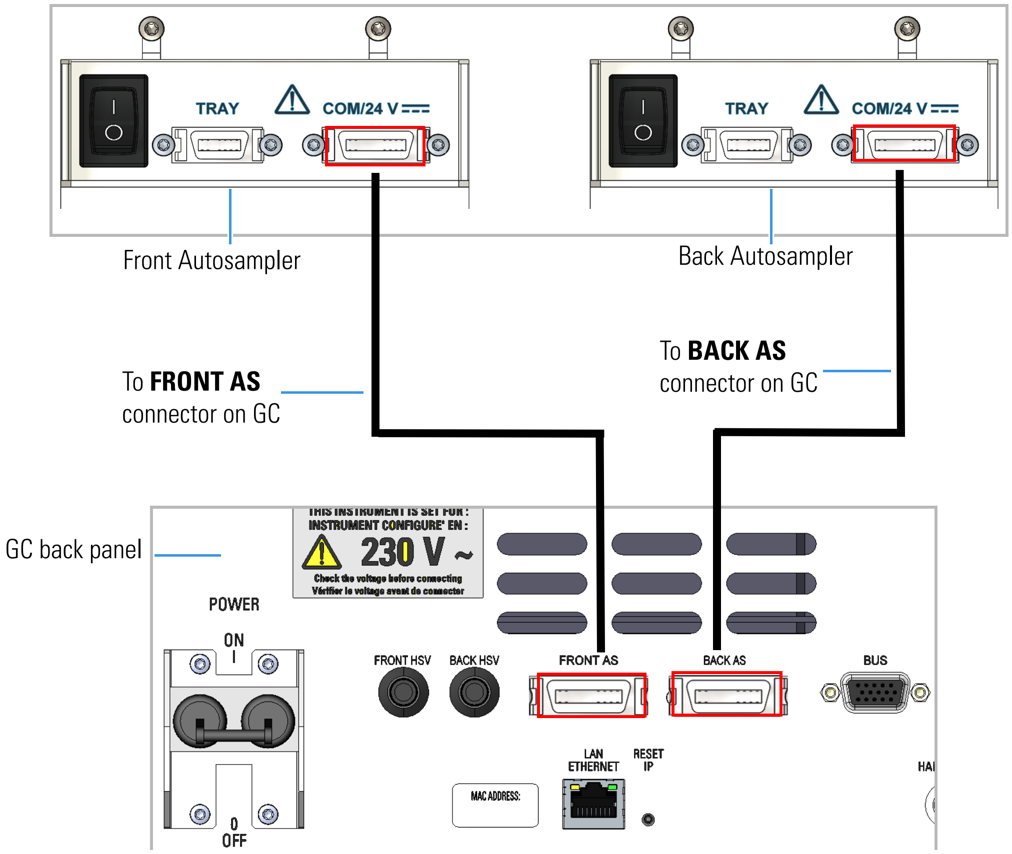
This section provides instructions to connect two AI/AS 1610 sampling units to a Trace 1600 Series GC. See Figure 38 for connector locations.

❖ **To connect two sampling units to a GC in Gemini configuration**

1. On the front autosampler use the provided cable to connect the **COM 24 V** connector to the **FRONT AS** connector on the rear panel of the GC.

2. On the back autosampler use the provided cable to connect the **COM 24 V** connector to the **BACK AS** connector on the rear panel of the GC.

Figure 38. Gemini Connections Between Front and Back Autosamplers and GC



In Gemini configuration, the AI/AS 1610 autosampler can work in three operating modes:

- **High Throughput Mode** — Processes large batches of samples with the same analytical conditions and double the system productivity.

  Typically, the same type of column and detector are used on both channels; the samples are injected in the two channels and analyses acquired simultaneously with the same GC method. The vial sequence is not necessarily the same. Each injection will contain the data from one data channel.

- **Single Mode** — One AI/AS 1610 autosampler is operating.

- **Confirmation Mode** — Typically, two columns with different stationary phases are installed in parallel and use the same or a different detector. The same samples are placed in the same positions on the two sample carousels. The same vial sequence and the same GC method are requested for the two autosamplers. The samples are injected in the two channels and analyses acquired simultaneously. In this case the data acquired by each channel is saved in the same data file.

Instrument Start-up

1. Connect the Mini Delta port on the AI/AS 1610 to the relevant Mini Delta port on the Trace 1600 Series GC.
2. Turn on the Trace 1600 Series GC and switch on the AI 1610 autosampler.
3. The AI/AS 1610 will automatically run a self-test routine and carry out the following automatic checks and settings:
    - alignment between AI/AS 1610 and the GC injector
    - recognize the installed sample tray
    - calculation of the syringe zero

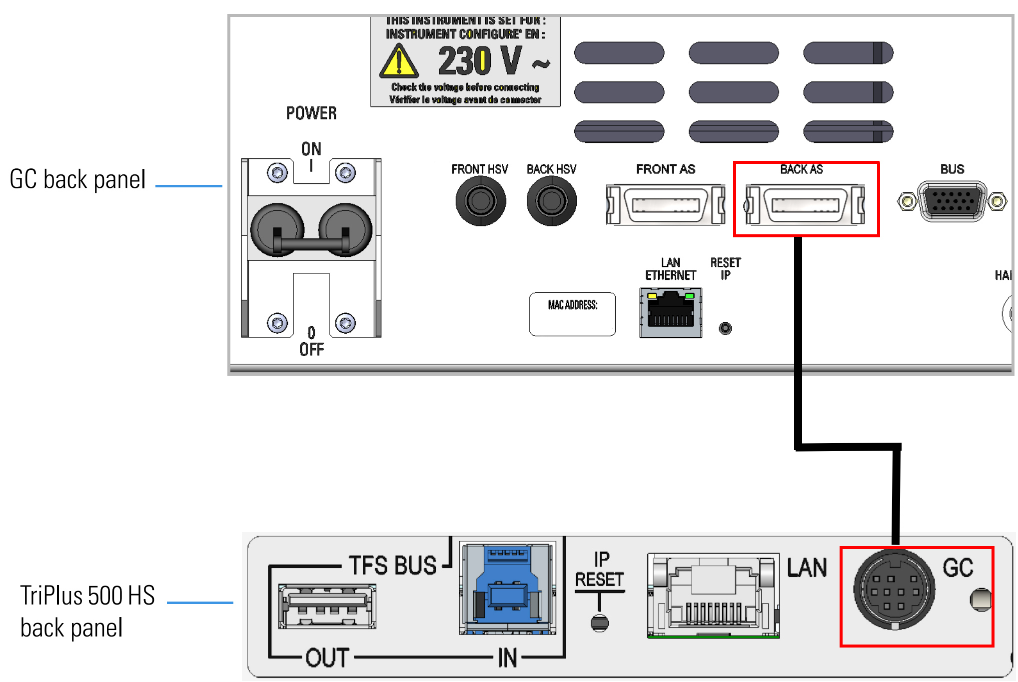
> **Note** The self-test routine is carried out every time the safety door on the turret is closed.

Connecting TriPlus 500 HS, TriPlus RSH SMART, or TriPlus 100 Autosampler

❖ To connect the TriPlus 500 HS to a TRACE 1600/1610

1. Connect the Mini Delta connector to the **BACK AS** Mini Delta connector on the GC.
2. Connect the 9-pin connector to the **GC** connector on the TriPlus 500 HS.

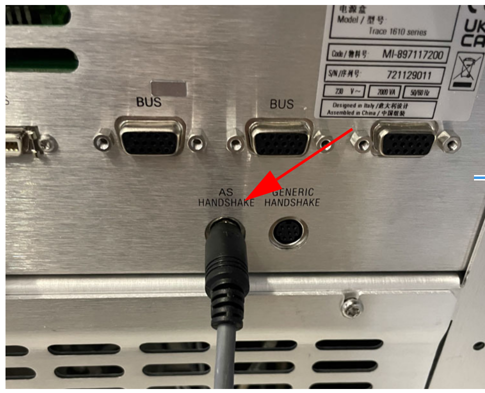
Figure 39. TriPlus 500 HS Connection to TRACE 1600/1610



❖ To connect the TriPlus RSH SMART or TriPlus 100 to a TRACE 1600/1610

1. Connect the **AS HANDSHAKE** connector on the TRACE 1600/1610.

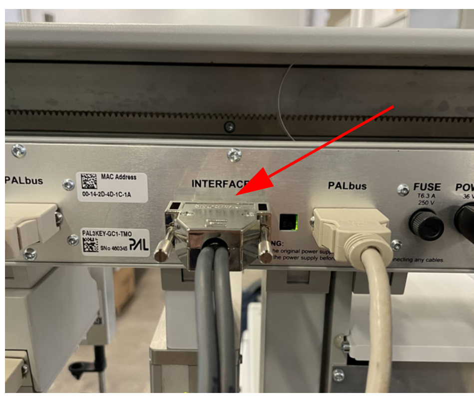
   Figure 40. GC Handshake Connection



GC back panel

2. Connect to the **INTERFACE** connector on the TriPlus RSH SMART or TriPlus 100.

   Figure 41. Interface Connection on the Autosampler



Autosampler back panel

Setting Autosampler Handshake Parameters

When your GC is connected to an AI/AS 1610, TriPlus 500 HS, TriPlus RSH, or TriPlus 100 Liquid Sampler set the handshaking parameters as shown in Table 2.

Table 2. Handshaking Parameters When An Autosampler is Connected

Parameter	Set To:
Remote Start In	High to Low
Inhibit Ready In	Neither
End of Run Out	High to Low
Start of Run Out	High to Low
GC Ready Out	When Low
Prep Run Out	When Low

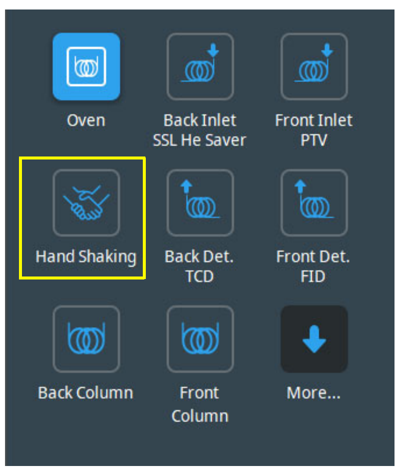
❖ To configure handshaking parameters through the touch screen

1. In the main menu select the **Configuration** icon, the Configuration menu appears.

Figure 42. Configuration Icon

2. In the Configuration menu, select the **Handshake** icon to open the relevant submenu.

Figure 43. Handshaking Icon



3. Set the **Handshaking parameters** as listed in Table 2, then return to main menu.

❖ To configure handshaking parameters through the Chromatography Data System

1. Launch the Data System. In the Configuration page specify the handshaking parameters as listed in Table 2.

Installing the Data System Software

The Chromeleon and SII for Xcalibur data systems are designed to be compatible with commercially available computers and requiring the use of Windows™ 10 operating system.

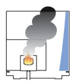
IMPORTANT Before installing the Data System, please make sure that any previous version is removed from the PC hard drive.

❖ **To install the data system software**

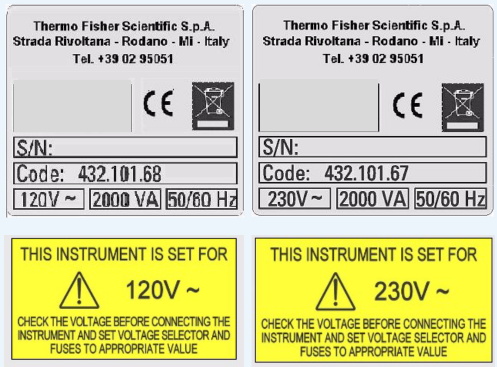
1. Remove the current version.
   a. Select **Control Panel > Add/Remove Programs**.
   b. In the dialog window displayed, select the current Data System software version to remove.
   c. Click **Add/Remove**.
2. Install the new version.
   a. Insert the CD/DVD provided and start **Setup.exe**. Click **Next** several times.
   b. Continue the installation by following the instructions displayed.
   c. At the end of the installation, reboot the computer if required.
   d. Start the Data System you installed selecting it in the page **Start-Program** of the desktop.
   e. The **Main Page** of the data system will be displayed.

   For details about the data system in use, please refer to the relevant *User Guide*.

Making Power Connections



INSTRUMENT DAMAGE A label on the electronic module indicates a 120 Vac or 230 Vac power supply. If your power supply line does not match the power supply required, DO NOT CONNECT AND DO NOT POWER ON THE GC.

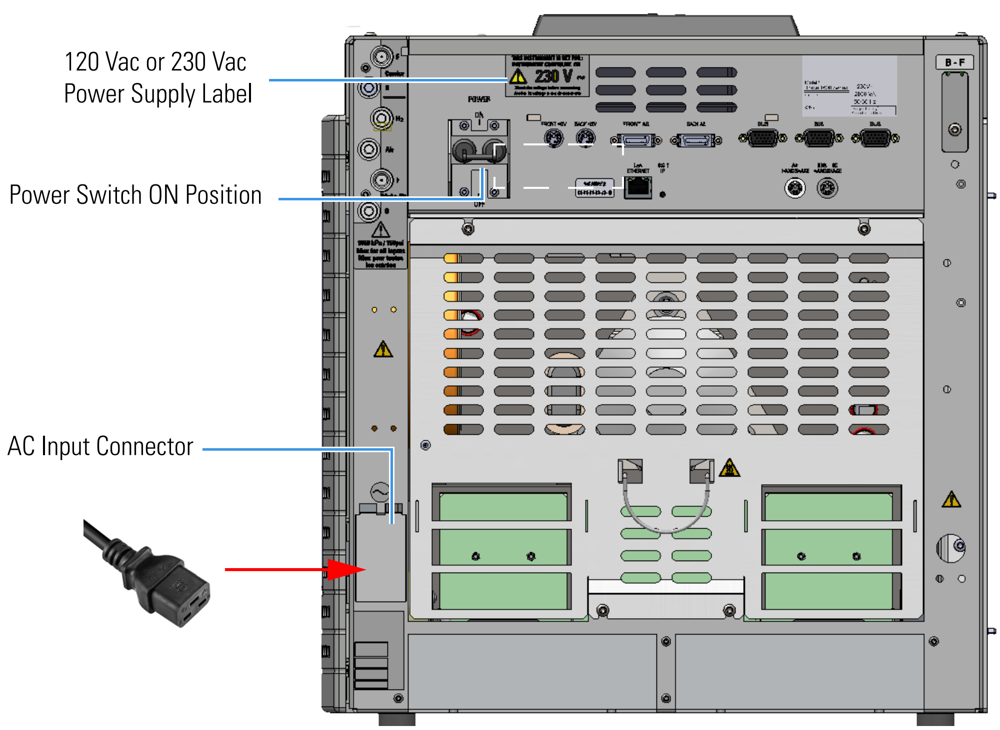


IMPORTANT The external modules must be powered at the same line voltage of the main GC system.

❖ To connect the power to the GC

1. Connect the power cable to the AC Input connector (Main socket) on the GC, and to the wall outlet. See Figure 44.

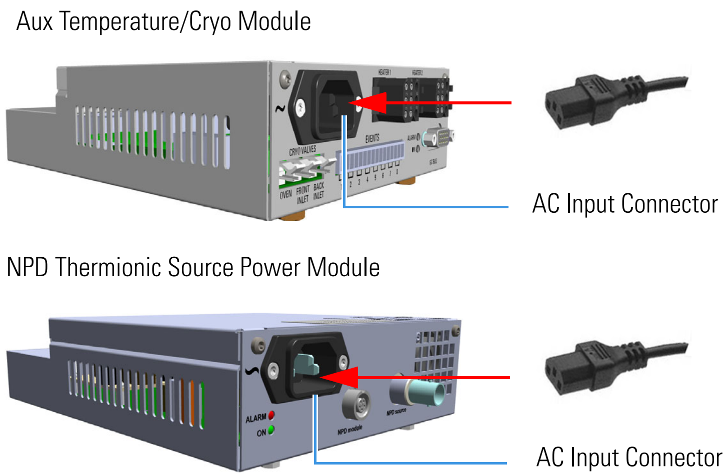
Figure 44. GC Power Connection



2. If external modules, such as the **Aux Temperature/Cryo Module**, **NPD Thermionic Source Power Module**, or both are present, connect the power cable to the AC Input connector on the front of each external module, and to the wall outlet. See Figure 45.

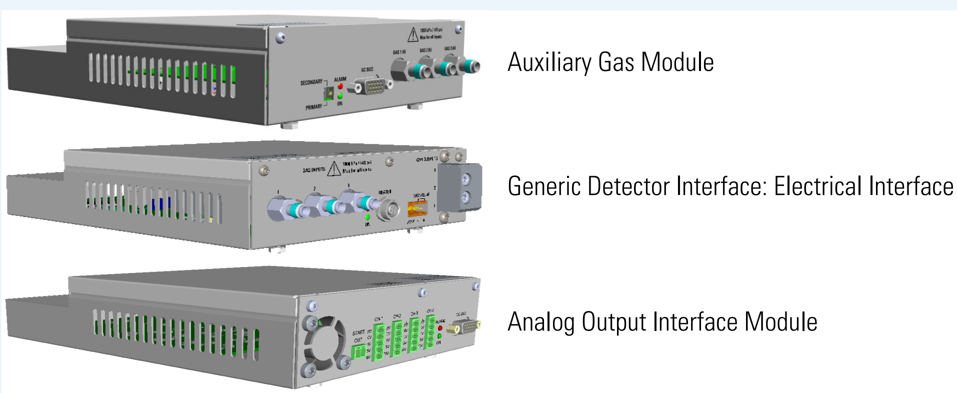
> **IMPORTANT** The external modules must be powered at the same line voltage of the main GC system.

Figure 45. External Module Power Connection



- **Aux Temperature/Cryo Module** — The LED marked **On** lights up solid green after the GC power on.
- **NPD Thermionic Source Power Module** — The LED marked **On** blinks green at the plug-in of the power cable and becomes solid green at the power on of the thermionic source.

> **Note** The modules **Auxiliary Gas**, **Generic Detector Interface**, and **Analog Outputs Interface**, receive the power supply from the electronic module of the GC through the **GC Bus** connection.



The LED marked **On** lights up solid green after the GC power on.

Setting the LAN Communication

This section provides instructions for setting the desired IP and the LAN communication port for the TRACE 1600/1610. See "Making the LAN Setup" on page 42.

Before making the LAN setup, please read the following note.

Note The TRACE 1600/1610 allows LAN (Local Area Network) capabilities by the presence of an RJ45 connector on the Electronic Module, and two LEDs for LAN activity.

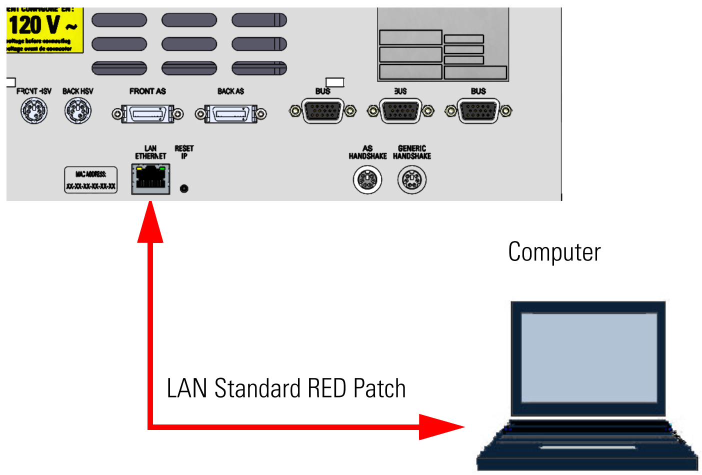
- **IP Address** —The GC is shipped with a factory IP address, which may not match the LAN needs of the sites where the instrument will be installed. To change the default values, contact your LAN administrator and ask for the IP address to be assigned, the netmask, and eventually the port.
  - The IP address is a 3 digits x 4 fields number given by the network administrator - e.g. 192.168.127.10.
  - The netmask is a 3 digits x 4 fields number given by the network administrator - e.g. 255.255.255.0.
  - The port number is 2551 and cannot be changed.
- **Reset Button** — To reset the LAN parameters (IP address, communication port, and so on) to the default values, insert a small screwdriver into the hole, then push the reset button for at least five seconds.
- **Network Cables** — Two network cables are included in the standard outfit:
  - a reversed **RED** patch for the computer to TRACE 1600/1610 direct connection. This is used for the initial setup operation and when the instrument is not connected in remote mode.
  - a standard **GREY** patch for the TRACE 1600/1610 to local area network connection.

Making the LAN Setup

❖ To set the LAN communication

1. Using the LAN RED patch, connect a desktop or laptop PC directly to the RJ45 connector marked **LAN/Ethernet** on the Electronic Module of the GC. See Figure 46.

Figure 46. GC/PC LAN Connection



2. Power on the GC by placing the power switch in the On (up) position marked **I**.

3. Power on the PC.

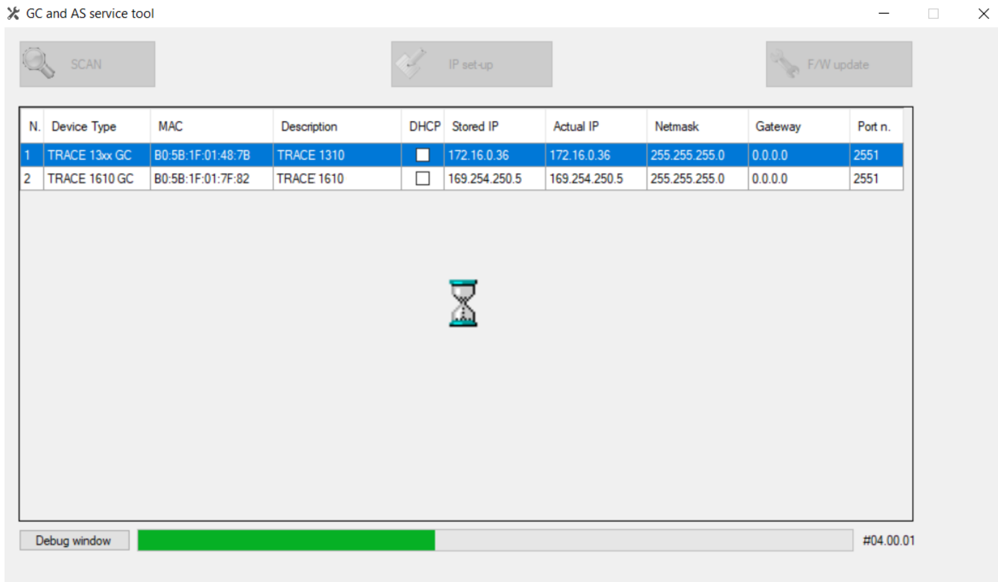
4. Start the **GC and AS Service Tools** program to begin the installation on the PC. Follow the instructions step by step to complete the installation.

> **Note** Use the **GC and AS Service Tools** program to set the **LAN** Communication parameters, and updating the **Firmware** version on the GC.
>
> Updating the **Firmware** version on the GC must be carried out by a Thermo Fisher Scientific authorized technical personnel.
>
> Visit http://www.gc-gcms-customersupport.com/WebPage/Share/Default.aspx to contact your local Thermo Fisher Scientific office or affiliate GC-GC/MS Customer Support

5. Run the **GC and AS Service Tools** program. Click the icon on your desktop or select **Start > Program > GC and AS Service Tool**.

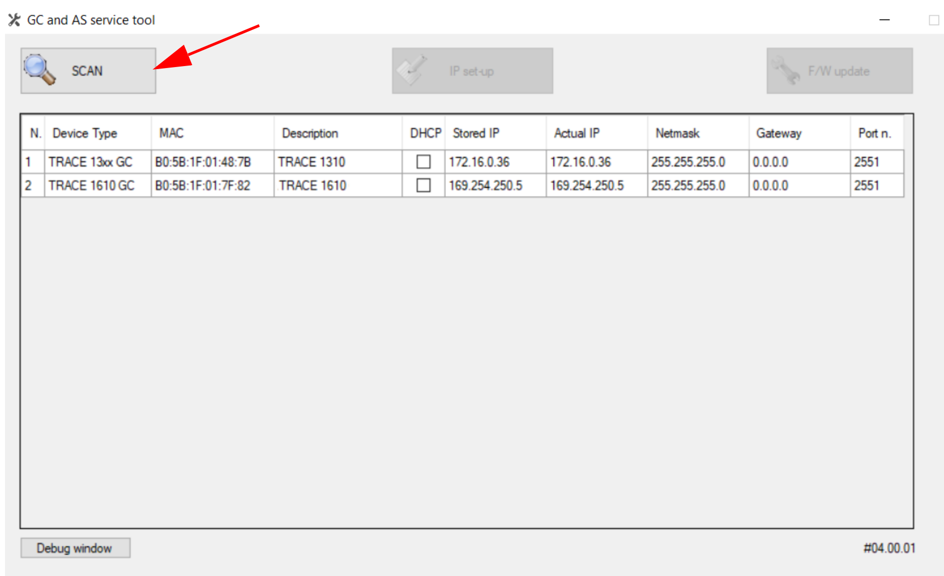
6. The system starts scanning the equipment powered on and connected to the LAN. During this stage, the three buttons on the top of the page are disabled. See Figure 47.

Figure 47. Scanning for Instruments



7. At the end of the scan, all the equipment powered on and connected to the LAN is displayed. Only the **SCAN** button is enabled. See the example in Figure 48.

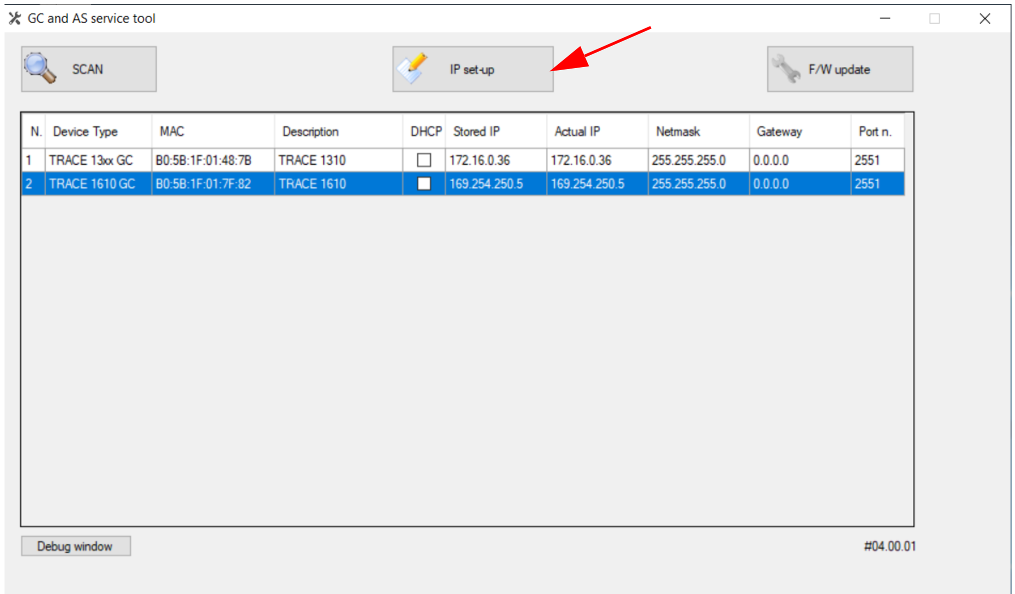
Figure 48. Equipment Connected to the LAN



Note To repeat the scan, click **SCAN**.

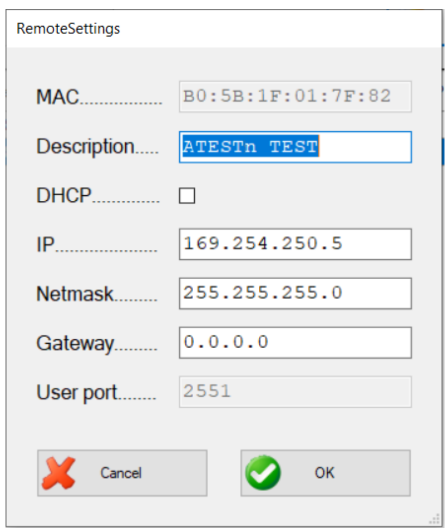
8. Select the GC to set up. All the three buttons on the top of the page are enabled. See the example in Figure 49.

Figure 49. Selecting an Instrument to Configure



9. Click **IP set-up**. The **Remote Settings** page is displayed. See the example in Figure 50.

Figure 50. Remote Settings Page



The editable parameters are: **Description**, **DHCP**, **IP**, **Netmask**, and **Gateway**.

After changing parameters, press **OK** to confirm the new settings.

10. Close the **GC and AS Service Tools** program.

11. Configure the Data System (SII Xcalibur or Chromeleon) in use. See the section "Configuring the Data System" on page 45.

Configuring the Data System

You can use the self-adhesive labels found in the standard outfit of the Data System to note the IP address of the instrument. Stick the label where it can be easily found when configuring the data system.

1. Launch the Data System.
2. Enter the IP address of the GC.

IMPORTANT If you connect through hubs over a 10 Mbit/s network, it is recommended that no more than five GC units be connected on the same network trunk. If you have a switched network, this does not apply.

Column Installation Requirements

The column is where the separation takes place. It should be positioned inside the oven on the column rack. The column ends should align correctly with the injector and the detector bottom fittings. The GC oven controller accurately controls the column temperature.
Each column has a maximum recommended operating temperature. To protect the column from excessively high temperatures, remember to set the **Maximum temperature** parameter for the oven.

Note For detailed information on maximum operating temperature, refer to the *column manufacturer's instructions* provided with the column.

Related Topics

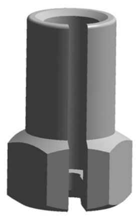
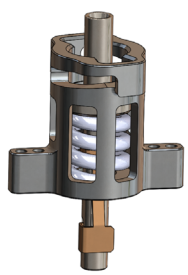
- "Using the Correct Fittings" on page 45
- "Installing the Adapters for Encapsulated Graphite Ferrules" on page 48
- "Installing the Column Rack" on page 52

Using the Correct Fittings

To connect a capillary column to the injector and detector base body, you must use the proper column ferrules and retaining nuts.

- **Retaining Nut** — Dedicated retaining nuts are required to connect capillary columns to injector and detector base bodies, and the **Tee** connector. See Table 3.

Table 3. Column Retaining Nuts for Injectors and Detectors

Retaining Nut Type		Injector/Tee Connector	Detector
	1/4” Hexagonal retaining nut	SSL, SSLBKF	FID, NPD, TCD, ECD, FPD
	M4 Split retaining nut	PTV, PTVBKF	
	iConnect	SSL, SSLBKF, GSV	ECD, FID, FPD, NPD, TCD

- **Ferrules** — Graphite ferrules, graphite Vespel® ferrules, and encapsulated graphite ferrules are used for many column connections. See Table 4.

Table 4. Ferrules for Injectors and Detectors

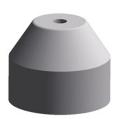
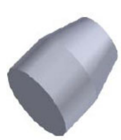
Ferrule Type		Injector/Tee Connector	Detector	Temperature Limit
	Graphite ferrule	SSL, SSLBKF	FID, NPD, TCD, ECD, FPD	450 °C
	Graphite Vespel® ferrule	SSL, SSLBKF	FID, NPD, TCD, ECD, FPD	350 °C

Table 4. Ferrules for Injectors and Detectors

Ferrule Type		Injector/Tee Connector	Detector	Temperature Limit
	Encapsulated graphite ferrule See the **Note** below.	PTV, PTVBKF		450 °C

Graphite ferrules are a soft material that is porous to oxygen, making them suitable for most applications except GC/MS interface connections. These easy-to-use ferrules form a soft grip with the column and provide a stable seal. Graphite ferrule are re-usable.

Graphite/Vespel® ferrules have a long lifetime and are compatible with GC/MS. These ferrules form a strong grip with the column and cannot be reused as they form a permanent seal with the column. They have a temperature limit of 350 °C, but must be re-tightened after initial temperature cycles.

Note An optional adapter kit must be installed if you want to connect the column to the injector and detector by using the encapsulated graphite ferrule. See "Installing the Adapters for Encapsulated Graphite Ferrules" on page 48.

Table 5, Table 6, and Table 7 list the size of the ferrule to use depending on the internal diameter of precolumn and capillary column.

Table 5. Graphite Ferrules Size ID

Ferrules Size ID	Required for:
0.4 mm	0.1 - 0.32 mm ID capillary column
0.8 mm	0.45 - 0.53 mm ID capillary column

Table 6. Graphite Vespel Ferrules Size ID

Ferrules Size ID	Required for:
0.4 mm	0.1/0.2/0.25 mm ID capillary column
0.5 mm	0.32 mm ID capillary column
0.8 mm	0.53 mm ID capillary column

Table 7. Encapsulated Graphite Ferrules Size ID

Ferrules Size ID	Required for:
0.4 mm	0.25 mm ID capillary column
0.5 mm	0.32 mm ID capillary column
0.8 mm	0.45/0.53 mm ID capillary column

CAUTION Using the wrong size ferrules causes leaks and contamination.

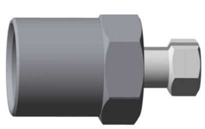
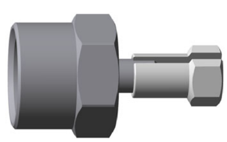
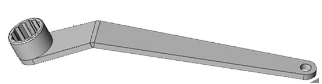
ATTENTION L'utilisation de ferrules de taille appropriée entraînera des problèmes de fuite et de contamination.

When connecting columns, consider that overtightening compression ferrules does not necessarily produce a stronger, leak-free joint. In fact, very often the reverse is true. Too much pressure can cause a leak in the joint and make it very difficult to reseal the joint when changing columns.

Installing the Adapters for Encapsulated Graphite Ferrules

This section provides instructions for installing the optional adapters for connecting the capillary column to the SSL injector and FID, NPD, TCD, ECD, and FPD detector by using the encapsulated graphite ferrules. The adapters are provided with the kit PN 19050759. The kit includes the parts listed in Table 8.

Table 8. Adapters and 1/2-in. Wrench

Part	Description
	Adapter for connection to the SSL injector
	Adapter for connection to the FID, NPD, ECD, TCD, or FPD detector
	1/2-in. wrench

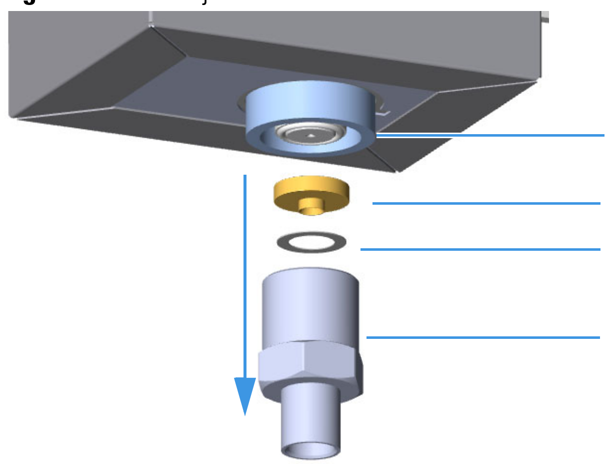
❖ To install the adapters for encapsulated graphite ferrules

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Remove the analytical column.
   a. Open the front door of the GC.
   b. Loosen the retaining nut from the injector and detector fitting on the upper interior wall of the GC oven.
   c. Remove the analytical column with its nut and ferrule from the bottom of the injector and the detector.
5. Remove the bottom parts of the SSL injector. See Figure 51.

Figure 51. SSL Injector Bottom Parts Removal



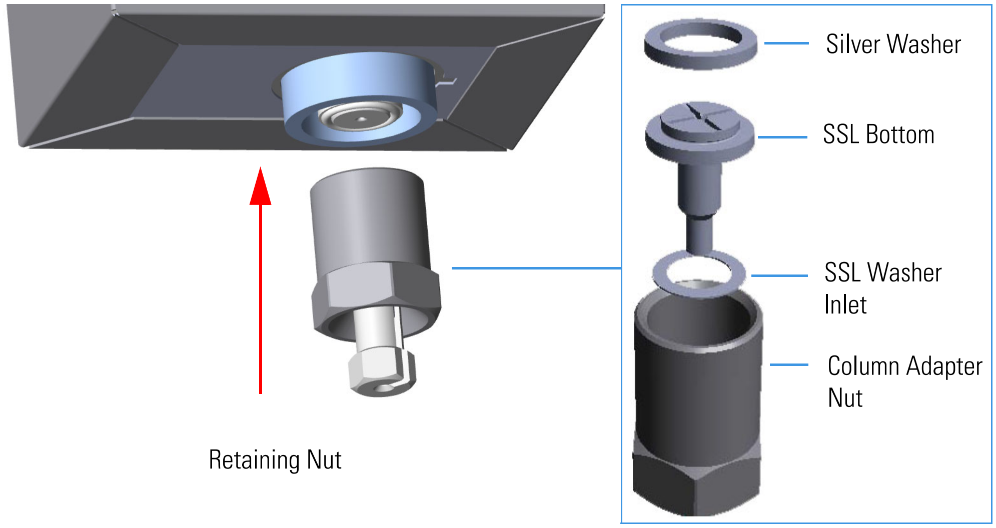
   a. Using the 1/2-in. wrench provided, unscrew the retaining nut with the base seal and the silver seal from the bottom of the injector.

CAUTION Make sure that the liner does not come from the bottom of the injector. Save the bottom parts of the SSL injector in a safe place because will be reused when you restore the original configuration.

ATTENTION Assurez-vous que le liner ne sorte pas par le bas de l'injecteur. Conservez les pièces inférieures de l'injecteur SSL en lieu sûr, car elles seront réutilisées pendant la restauration de la configuration d'origine.

6. Install the adapter on the bottom the injector. See Figure 52.

Figure 52. Adapter Installation on SSL Injector Bottom

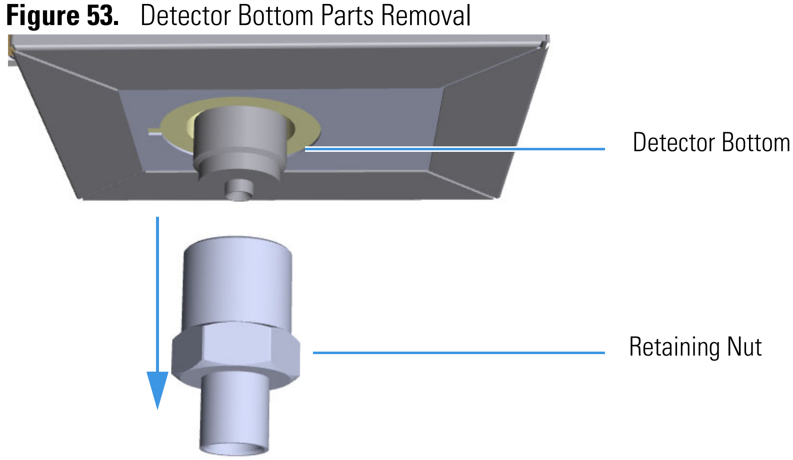


a. Finger tighten the retaining nut of the adapter until it starts to grip the bottom of the injector.

b. Use the 1/2-in. wrench to firmly tighten the retaining nut of the adapter with the base seal and the silver seal from the bottom of the injector.

7. Remove the bottom parts of the FID, NPD, ECD, TCD, or FPD detector. See Figure 53.

Figure 53. Detector Bottom Parts Removal

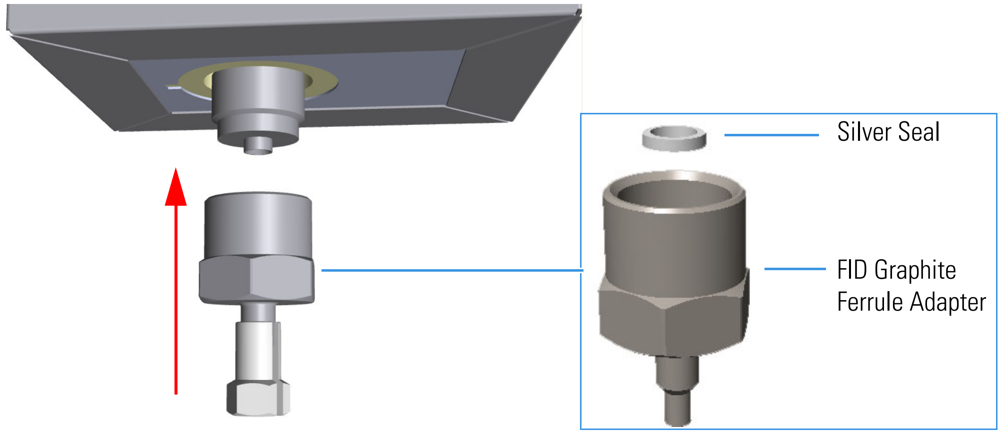


> **Note** Save the bottom parts of the detector in a safe place because they will be reused when you restore the original configuration.

a. Using the 1/2-in. wrench provided, unscrew the retaining nut from the bottom of the detector.

8. Install the adapter on the bottom the detector. See Figure 54.

Figure 54. Adapter Installation on the Bottom of the Detector



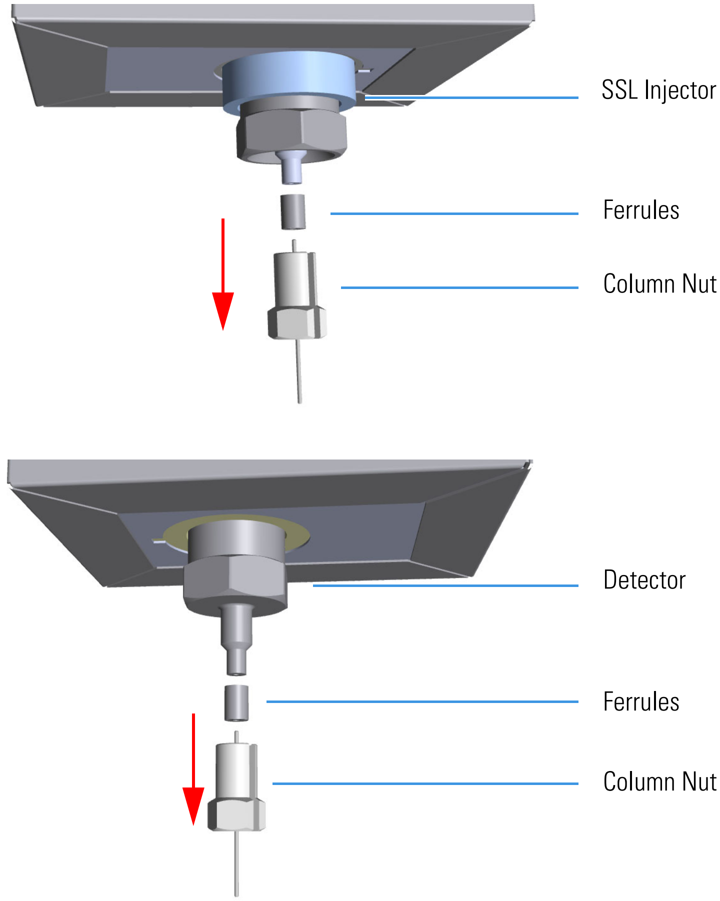
a. Finger tighten the retaining nut of the adapter until it starts to grip the bottom of the detector.

b. Use the 1/2-in. wrench to firmly tighten the retaining nut of the adapter with the base seal and the silver seal from the bottom of the injector.

9. Connect the column.

a. Before starting, use a 1/4-5/16-in. wrench to remove the column nuts and ferrules from the base of the injector and detector adapters. See Figure 55.

Figure 55. Column Nut and Ferrules



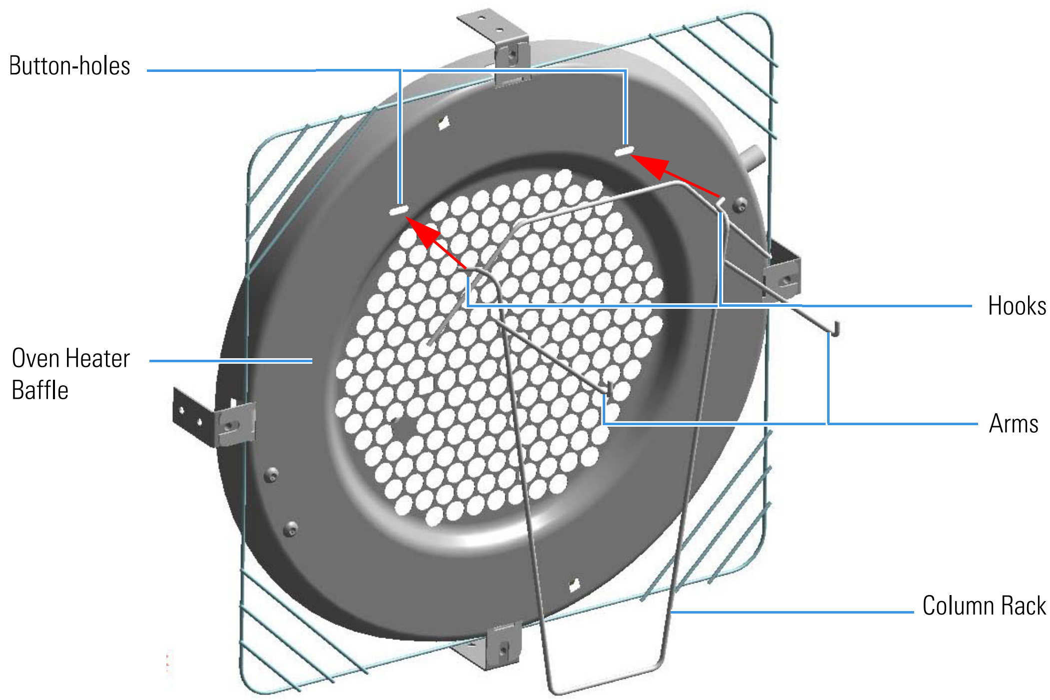
b. Continue the installation of the capillary column following the instructions in the section "Installing the Column" on page 53.

Installing the Column Rack

WARNING Before starting the installation, make sure that the GC is powered off and the power cable is disconnected.

Before connecting the capillary column, make sure that the column rack is installed in the oven. See Figure 56.

Figure 56. Column Rack



❖ **To install a column rack**

1. Open the front door of the GC.
2. Slightly press the sides of the column rack and insert the two hooks into the corresponding button-holes on the oven heater baffle.

Installing the Column

This section contains instruction for installing the capillary column into the GC oven, for connecting the column ends to the injector and the detector and for carrying out the **column conditioning**, the **leak test** and the **column evaluation**.

CAUTION The injector and detector modules are shipped with a plug. Before installing the column, remove the plug from the injector and detector modules. Unscrew the column retaining nut from the bottom of the injector and the detector modules, then remove the blind ferrule.

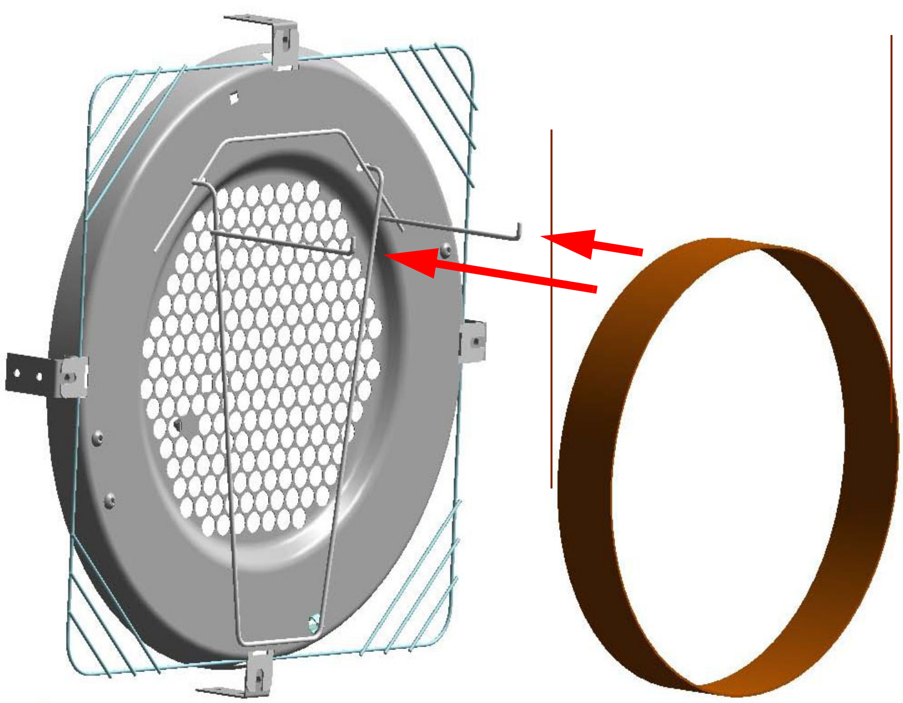
ATTENTION Les modules d’injecteur et de détecteur sont fournis avec un bouchon. Avant d’installer la colonne, retirez le bouchon des modules d’injecteur et de détecteur. Dévissez l’écrou de fixation de la colonne du bas des modules d’injecteur et de détecteur, puis retirez la ferrule aveugle.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that can contaminate the GC-MS system.

❖ To install a new column the first time

1. Install the column into the GC oven.
   a. Open the front door of the GC.
   b. Place the column on the two arms of the rack. See Figure 57.

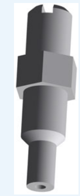
Figure 57. Column Installation



2. Connect the column to the injector inside the oven.
   a. Unwind the column enough to easily connect its ends to the injector and the detector.

   Note Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

   b. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.
   c. Insert the column through the injector retaining nut and the proper ferrule (open end up). Wipe the column again with a tissue soaked in methanol.



Note PTV and PTVBKF injectors mount as standard the 0.55 mm ID terminal bottom fitting for the 0.25 mm/0.32 mm ID capillary columns (P/N 35008428). For connecting a 0.53 mm ID capillary column, replace the standard terminal bottom fitting with the 1.0 mm ID terminal bottom fitting (P/N 35008429) provided in the PTV/PTVBKF standard outfit.

d. Use a scoring wafer to score and break the column about 1 cm (0.4 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

Tip Slide a notched septum on the column before the injector retaining nut to make it easier to measure the proper distance between the nut and end of the column.

e. Position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 9.

Table 9. Column Insertion Depth For SSL, SSLBKF, HeS-S/SL, PTV, PTVBKF, and GSV Injectors

Injector	Column Insertion Depth
SSL* and HeS-S/SL	• 5 mm (splitless) • 5 mm (Helium saver) • 10 mm (split)
SSLBKF	• 5 mm (splitless) • 10 mm (split)
PTV	• 30 mm • As far as possible into the bottom when the PTV is used as an On-Column injector.
PTVBKF	• 30 mm
GSV	• Insert the column as far as goes and withdrawn about 2 -3 mm

* When the adapters for encapsulated graphite ferrules are used, it is necessary to add 9 mm to the column insertion depth for the standard SSL injector.

f. Insert the notched septum on the column to hold the retaining nut at this position. Thread the retaining nut into the injector but do not tighten.

g. Adjust the column position so that the septum contacts the bottom of the retaining nut.

h. Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.

i. Remove the notched septum from the column.

3. Open the gas supplies.

4. Power on the GC.

a. Connect the power cable to the AC Input connector on the back of the GC and to the wall outlet.

b. Flip up the power switch (breaker) to the position I.

5. Setup the GC.

a. Set the oven and injector temperature to 50 °C.

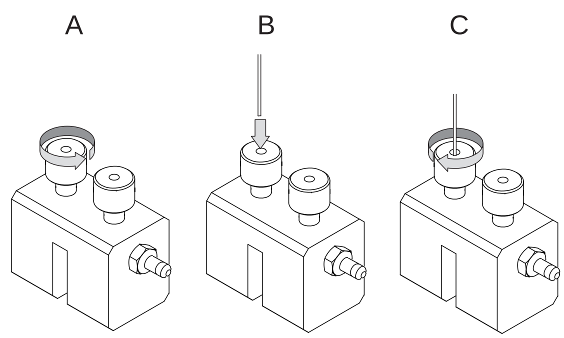
b. Use the column-flowmeter connector to verify that there is flow through the column. If you do not have a flowmeter, dip the column outlet in a small vial of methanol. Bubbles indicate there is flow through the column. If there is no flow, check that the carrier gas is on, the GC inlet is pressurized, and the column is not plugged. If there is still no flow, consult the section **Analytical Troubleshooting** in the *TRACE 1600/1610 User Guide*, or contact the Technical Support.

c. Allow the column to purge for few minutes.

6. Perform a column leak check.

a. Carefully push the capillary column end into the column section of the column-flowmeter connector. See Figure 58.

Figure 58. Using a Flowmeter for Leak Check



b. If your GC is equipped with the touch screen as user interface, select the **Leak Check** icon in the **Maintenance** menu, otherwise perform the Leak Check through the Chromatography Data System by selecting the proper function.

c. Start the leak check to begin operation. The split and purge valves of the selected channel are automatically closed, and the channel is pressurized with carrier gas to the leak check setpoint.

d. The system monitors the pressure for one minute. If the pressure does not drop more than the maximum allowed sensitivity value, then the leak check will pass.

e. If the leak check did not pass, you should use the leak detector to find and fix the leaks.

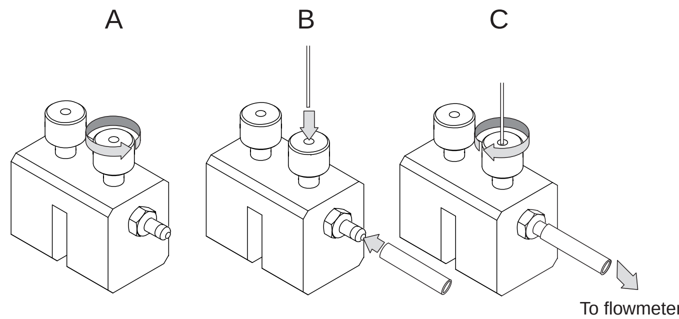
> **Tip** Leaks can be caused by not tightening the fitting on the column-flowmeter connector. We recommend that you check that fitting before looking elsewhere.

f. Repeat the leak check until no leaks are indicated.

7. Calibrate the carrier gas flow (column evaluation).

   a. Carefully push the capillary column end into the flow meter section of the column-flowmeter connector. See Figure 59.

   Figure 59. Column Flowmeter Connector

   b. Connect the flowmeter to the dedicated fitting on the column-flowmeter connector.

   c. If your GC is equipped with the touch screen as user interface, select **Back** or **Front Column** icon in the **Configuration** menu, otherwise perform the Column Evaluation through the Chromatography Data System by selecting the proper function.

   d. Select the column and input the physical characteristics of the column.

   e. If a pre-/post-column is present, set the length and nominal internal diameter of the pre-/post-column in the same valid ranges for the column. The following two lines are added to the menu.

   f. According to the physical characteristics of the column, the system calculates and displays the relevant Column K-factor.

   Note For the most reproducible results, you should conduct a more detailed column evaluation. However, the following steps, while recommended, are not required.

   g. Start column evaluation. At the end of the routine, a message will indicate that evaluation was successful.

   h. Expect a K-factor of approximately 0.7 – 0.9 for a 15 m, 0.25 mm ID column (1.3 – 2.0 for a 30 m, 0.25 mm ID column). If the column does not report a K-factor within this range or within 0.1 units of the previous stored value, check for a leak or broken column using the leak detector. The K-factor is a measured resistance for the column. A K-factor that is too low may indicate a leak in the system, while a K-factor that is too high may indicate a blockage.

8. Disconnect the column-flowmeter.

   a. Disconnect the column from the column-flowmeter connector.

   b. Remove the clear plastic component, including its fittings, from the oven and set it aside.

c. Close the GC door.

9. Condition the column.

   The column must be conditioned before inserting it into the detector.
   Column conditioning consists of passing a carrier gas flow through the column heated at a programmed temperatures as described in the *column manufacturer's instructions*.
   In case the column does not have any column conditioning instructions, perform the column conditioning by setting a final temperature up to 10 °C - 20 °C below its recommended maximum temperature.

CAUTION When performing column conditioning, the column should be connected only to the injector leaving the column outlet disconnected to avoid the possibility of contamination of the detector. Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

ATTENTION Pendant le conditionnement de la colonne, celle-ci ne doit être branchée qu'à l'injecteur. La sortie de colonne ne doit pas être branchée, afin d'éviter toute contamination du détecteur. N'utilisez pas l'hydrogène comme gaz vecteur pour le conditionnement ! Il risquerait de s'échapper dans le four et de présenter un risque d'explosion.

a. Run the temperature program that is recommended by the manufacturer.

INSTRUMENT DAMAGE: Never exceed the column manufacturer's maximum operating temperature.

D'ENDOMMAGEMENT DE L'INSTRUMENT : la température de fonctionnement maximale définie par le fabricant de la colonne ne doit jamais être dépassée.

10. Connect the column to the detector inside the GC.

a. Lower the oven temperature to 30 °C and allow it to cool.

WARNING-BURN HAZARD: The injector, detector, oven, and transfer line may be hot. Allow them to cool to room temperature before touching them.

b. Unwind the column enough to easily connect its ends to the injector and the detector.

   Note Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

c. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.

d. Use a scoring wafer to score and break the column outlet about 2.5cm (1 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

e. Insert the column through the proper detector retaining nut and ferrule (open end up). Wipe the column again with a tissue soaked in methanol.

> **Tip** Slide a notched septum on the column before the detector retaining nut to make it easier to measure the proper distance between the bottom nut and end of the column.

f. For **FID**, **NPD**, **TCD**, **ECD**, and **FPD**, position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 10. For **PDD** see the instruction described at the step g on page 59.

Table 10. Column Insertion Depth For FID, NPD, TCD, ECD, FPD, and PDD Detectors

Detector	Column Insertion Depth
FID, NPD, and TCD	Insert the column as far as goes and withdrawn about 2 -3 mm
ECD*	23 mm
FPD[1]	125 mm
PDD[1]	136 mm

* When the adapters for encapsulated graphite ferrules are used, it is necessary to add 11 mm to the column insertion depth for ECD, FPD and PDD detectors.

i. For **FID**, **NPD**, and **TCD,** insert the column into the detector, paying attention to not force it further. Finger-tighten the retaining nut, then withdraw the column **2-3 mm**. Tighten the retaining nut an additional a quarter turn.

ii. For **ECD** and **FPD**, insert the notched septum on the column to hold the retaining nut in this position. Thread the retaining nut into the detector but do not tighten. Adjust the column position so that the septum contact the bottom of the retaining nut.
Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.

iii. Remove the notched septum from the column.

g. For **PDD** the capillary column must enter **136 mm** into the pre-installed capillary column adapter.

i. Make a mark on the column 136 mm from the end.

ii. Remove the knurled nut column inlet at the bottom of the detector. Slide the nut overt the end of the column, followed by the appropriate column ferrule.

iii. Seat the ferrule in the detail of the column adapter and begin sliding the column through the capillary column adapter and into the column inlet.

iv. Get the nut started on the threads and tighten it until you feel it contact the ferrule, then back off half a turn.

v. Slide the column into the column inlet until the mark is flush with the surface of the knurled nut, and secure the column in the adapter by tightening the knurled nut finger tight only.

Note When inserting the capillary column into the PDD detector it might rarely happen to feel a slight resistance. In this case, for proper column installation, pull the column out slightly and adjust the angle before inserting it further.

IMPORTANT To install a packed column, the pre-installed capillary column adapter must be replaced with the **packed columns adapter** that enters into the PDD cell for the correct length.

11. End of the column installation.

    a. Close the front door of the GC.

iConnect Column Lock

Complete the following steps to install the iConnect™ Column Lock.

Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

CAUTION The iConnect Column Lock has a maximum operating temperature of 350 °C. Do not use the iConnect Column Lock with an oven, inlet, or detector set to temperatures exceeding 350 °C.

ATTENTION Le verrou de colonne iConnect présente une température de fonctionnement maximale de 350 °C. N'utilisez pas le verrou de colonne iConnect avec un four, un injecteur ou un détecteur réglé à des températures supérieures à 350 °C.

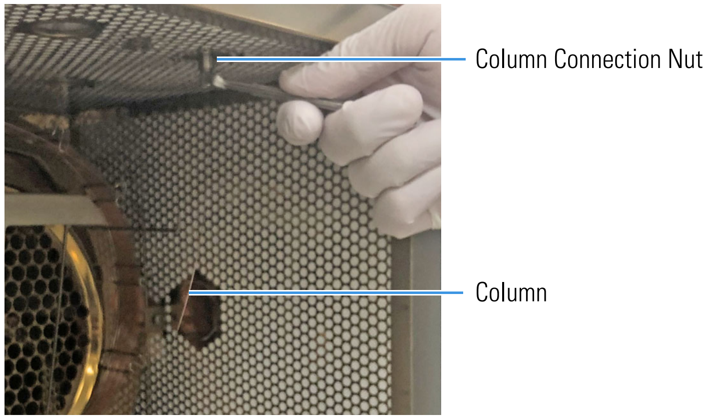
❖ To install in the iConnect Column Lock

1. Put the GC in standby condition.
2. Cool the oven and injector to 40 °C or less.

   Note Press the **Maintenance** button to cool down the GC automatically.

3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.
4. Remove the standard bottom column connection retaining nut from the injector or detector body.

Figure 60. Removing the Retaining Nut



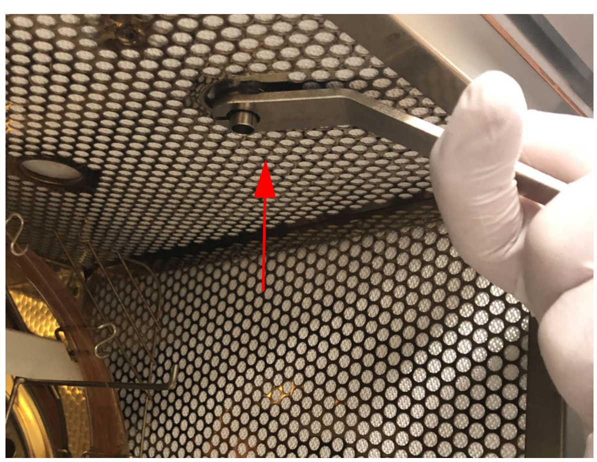
5. Use a 1/2 in. offset wrench to remove the retaining nut. See Figure 61.

CAUTION Save the bottom parts of the injector or detector in a safe place because they will be reused when you restore the original configuration.

ATTENTION Conservez en lieu sûr les parties inférieures de l'injecteur ou du détecteur car elles seront réutilisées lors de la restauration de la configuration d'origine.

Figure 61. 1/2 in. Offset Wrench

Figure 62. Removing the Retaining Nut with an Offset Wrench

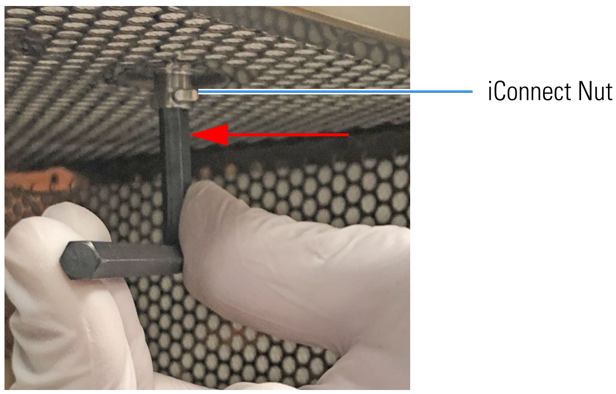


- When installing an iConnect on a SSL inlet, replace the base seal with a new one.

WARNING Always use the provided washer with the iConnect Nut (packed together with the SSL base seal). You must also use this washer when using the iConnect with a detector base.

6. Finger tighten the iConnect nut.
7. Tighten the iConnect nut with a clean 6 mm Allen wrench. See Figure 63.

Figure 63. 6 mm Allen Wrench Tightening the iConnect Nut



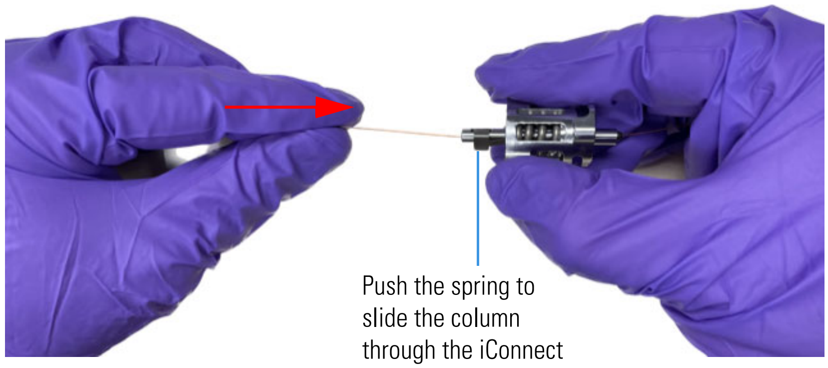
8. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.
9. Slide the column through the iConnect Column Lock. Pinch the spring at the base of the iConnect to allow the column to slide through. See Figure 64 and Figure 65.

CAUTION When you push the spring to slide the column through the iConnect, keep the spring pushed. If the spring is in contact with the column while sliding the column, it might score the protective coating, and affect the seal to the ferrule or cause the column to break later.

ATTENTION Quand vous enfoncez le ressort pour faire glisser la colonne à travers l'iConnect, maintenez la pression sur le ressort. Si le ressort entre en contact avec la colonne pendant le glissement de celle-ci, le revêtement de protection risque d'être endommagé, avec pour conséquence possible une perte d'étanchéité de la ferrule ou la casse future de la colonne.

Figure 64. Spring Location

Figure 65. Inserting the Column into the iConnect Column Lock



10. Insert the column through the iConnect nut and ferrule (open end up).
11. Set the column length according to the injector or detector type. See Table 11 and Table 12 for column insertion depths.

> **Note** Detector and injector insertion depths are measured from the top of the ferrule. See Figure 66 for an example of the SSL and SSLBKF insertion depths.
>
> It is recommended to insert the column a few extra mm and then trim to the correct depth.

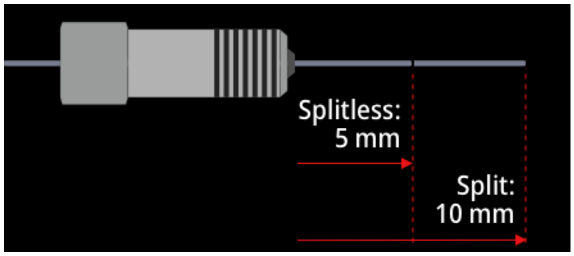
Table 11. Column Insertion Depth for SSL, SSLBKF, and GSV Injectors

Injector	Column Insertion Depth
SSL	5 mm (splitless) 10 mm (split)
SSLBKF	5 mm (splitless) 10 mm (split)
GSV	23 mm

Table 12. Column Insertion Depth for ECD, FID, FPD, NPD, and TCD Detectors

Detector	Column Insertion Depth
ECD	23 mm
FID	36 mm
FPD	125 mm
NPD	32 mm
TCD	10 mm

Figure 66. SSL and SSLBKF Column Depths



CAUTION Use the type of Graphite/Vespel® ferrules provided in the connector outfits. Ensure ferrules are the appropriate size for the type of capillary column in use.

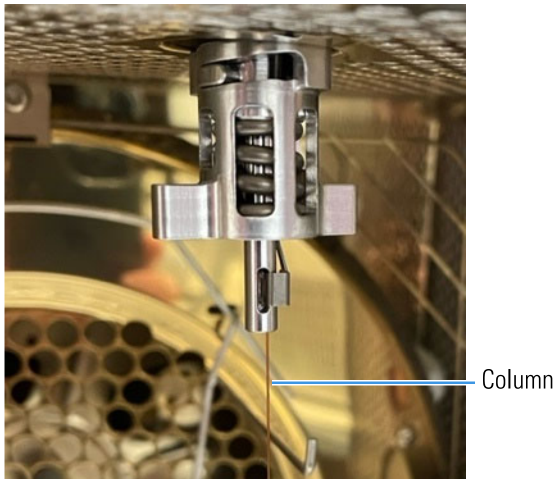
ATTENTION Utilisez le type de ferrules Graphite / Vespel™ fourni dans les raccords de branchement. Veillez à ce que les ferrules soient d'une taille appropriée pour le type de colonne capillaire utilisé.

Note For typical 0.1 to 0.25 mm inner diameter columns with a 0.36 mm outer diameter, ferrule packages are required with P/N 290VA191 to seal properly. These ferrules have a hole size of 0.37 mm and a label with "r2" after Pk 10.

12. Turn the iConnect Column Lock a quarter turn until it stops. See Figure 67.

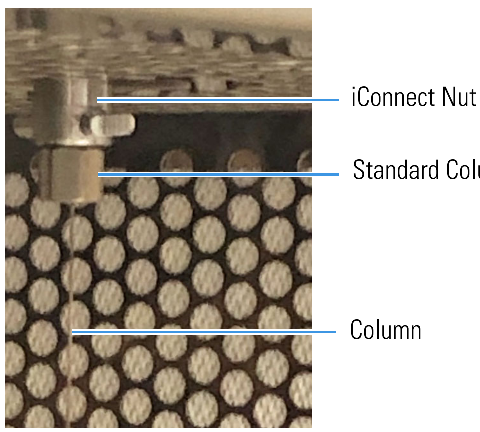
Figure 67. Connecting the iConnect Column Lock to the iConnect Nut

Figure 68. iConnect Column Lock Installed



Note The standard column nut can also be connected to the iConnect nut as well. See Figure 69.

Figure 69. Standard Column Nut Connected to the iConnect Nut



Note For information about column conditioning and performing a leak check, refer to the *Replacing a Column* section of Chapter 2, *Performing Routine Maintenance,* in the *TRACE 1600/1610 Hardware Manual*.

2

Performing Routine Maintenance

This chapter provides instructions for performing routine maintenance on the TRACE 1600/1610 gas chromatographs.

Contents

Read Me First

The instrument will be generally serviced by Thermo Fisher Scientific authorized technical personnel for all the warranty period or, after warranty, possibly according to a Programmed Service Contract. For more information contact your local Thermo Fisher Scientific office.

WARNING If, for technical reasons, it is necessary to work on parts of the machine that may involve hazardous operations (moving parts, components under voltage, and so on).Thermo Fisher Scientific authorized Technical Support must be called.

This situation can be identified because the access to these moving parts is possible only using a particular tool, and because the concerned removable protective covers bear a warning symbol that draws the operator's attention to the specific warnings included in the documentation accompanying the instrument. In case the work must be carried out by the operator, the latter must prove to be adequately trained to perform the specific maintenance operation.

There are only a few TRACE 1600/1610 components that require routine maintenance, depending on the quantity and types of samples you are running. A frequently used instrument will, of course, require more maintenance than an instrument that is rarely used.

- **External Cleaning** — The GC needs to be cleaned when it gets dirty. See the section "Cleaning the Instrument Externally" on page 74.
- **Column** — You may need to replace the column when performance degrades, and troubleshooting indicates that the column needs maintenance. That may mean that end of the column needs to be trimmed or the column needs to be replaced.
  See "Replacing a Column" on page 75.
- **Injector modules** — You may need to install, replace or maintain an injector module.
  See Chapter 3, "Performing Injectors Routine Maintenance."
- **Detector modules** — You may need to install, replace or maintain a detector module.
  See Chapter 4, "Performing Detectors Routine Maintenance."

There are many more components in the TRACE 1600/1610 that do not require routine maintenance but may need to be replaced if there is a problem with the instrument. To replace any component not listed in this chapter, see the following chapters:

- Chapter 6, "Injectors Advanced Maintenance."
- Chapter 7, "Detectors Advanced Maintenance."

IMPORTANT All the maintenance operations must be carried out at low temperature to avoid burns. Therefore, before beginning the sequence, the GC oven, injectors and detectors must be cooled to room temperature, and then the gases supply must be closed.

You can carry out these operations manually, or by pressing the **Maintenance** key. For details refer to the *TRACE 1600/1610 User Guide*.

At the end of the maintenance operations, restore the GC normal working conditions.

Maintenance of an injector

Before opening the injector for maintenance, turn the carrier gas off, and wait for the carrier pressure to go to zero.

When an autosampler is present:

Move the autosampler away from the injector module to create free space around it:

- If an AI 1610/AS 1610 or AI/AS 1310 is installed, pull the sampler support plate outwards.
- If a TriPlus RSH, TriPlus 100 Liquid Sampler, or TriPlus is installed, make sure that the standby turret position does not obstruct the injector or detector module. If yes, change the position of the turret/head.

Maintenance Supplies and Tools

To perform routine maintenance on the TRACE 1600/1610, you will need the following supplies and tools.

- Wrench, open-end, 1/4-in. and 5/16-in., 1/8-in.
- Flathead screwdriver
- 5.5 x 25 mm Slotted Stubby Driver
- Column cutter, wafer (5181-8836, 4/pk)
- T20 Torxhead screwdriver
- T10 Torxhead screwdriver
- T6 Torxhead screwdriver
- 3-mm Allen key wrench
- Electronic flowmeter (Thermo Scientific GFM Pro Flowmeter, or equivalent)
- Electronic leak detector (Thermo Scientific GLD Pro, or equivalent)
- Tweezers (or thin needle-nose pliers) or forceps

- Gloves, heat-resistant (for handling hot parts)

Cleaning Stainless Steel Components

To clean stainless steel components, you will need:

- Acetone, reagent grade (or other suitable polar solvent)
- Applicators, cotton-tipped
- De-ionized water
- Detergent (Alconox™, Micro®, or equivalent)
- Gas, clean and dry (N_2 or He)
- Gloves, clean, lint- and powder-free, latex or nitrile
- Lint-free cloth
- Ultrasonic cleaner

Maintenance Button

When pressed, the **Maintenance** button allows cooling at 60 °C of the selected heated zones, which allows the required maintenance. Carrier and detector gases must be closed manually. This function also performs the following actions automatically:

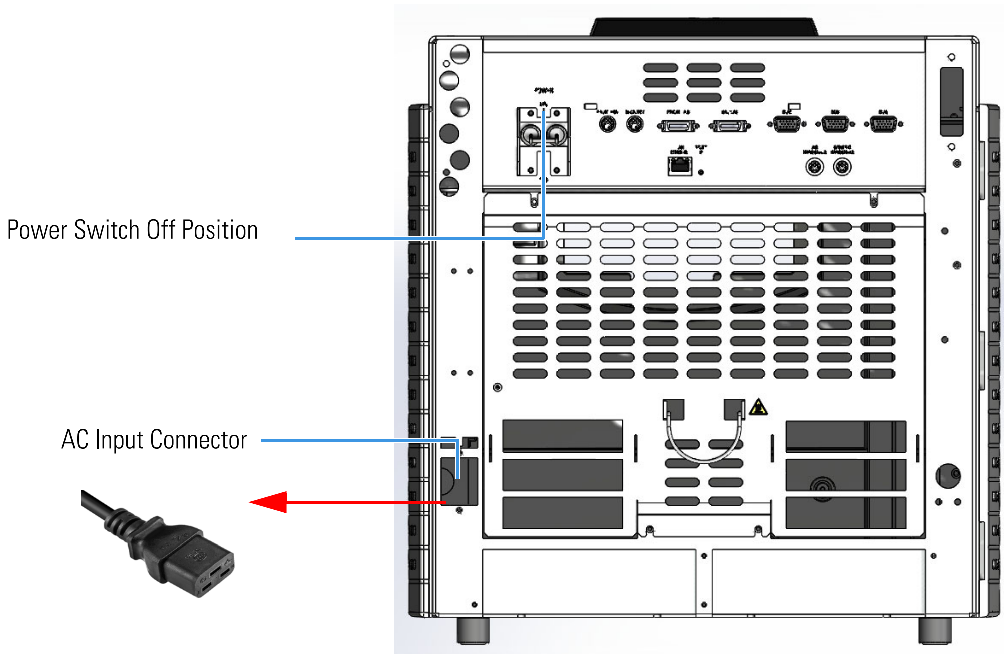
- turns off the flame and the fuel gases of the FID and FPD detectors.
- turns off the thermionic source, the hydrogen, and the air flows of the NPD detector.
- turns off the filaments of the TCD detector.

Powering On the TRACE 1600/1610

❖ **To power on the GC**

1. Install the GC column (see “Replacing a Column” on page 75).
2. Open the supply gases.
3. Plug the power cable to the AC Input connector (Main socket) on the GC, and to the wall outlet. See Figure 70.
4. Be sure the carrier gas flowing through the column and the detector gases flowing through the detector.

Figure 70. GC Power On

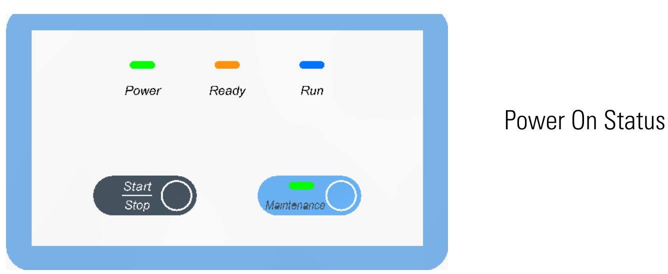


5. If external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

6. Flip up the power switch, located on the back side of the GC, to the On (up) position marked **I**.

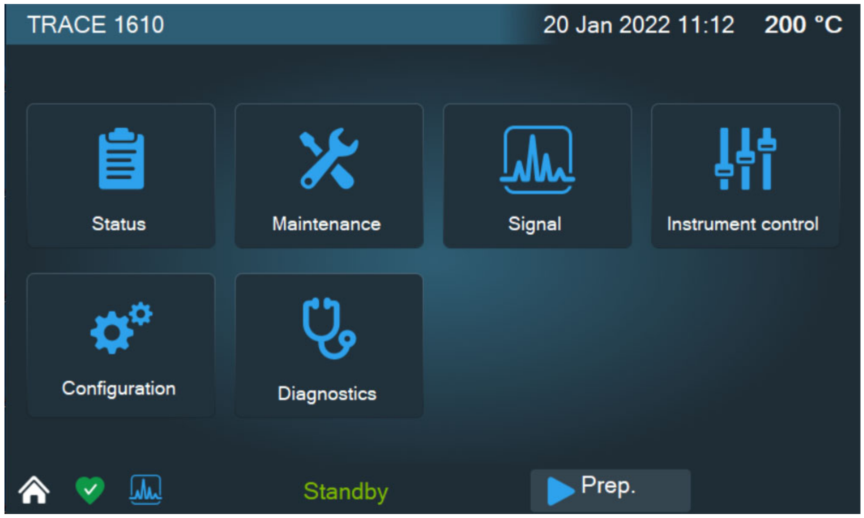
   a. **TRACE 1600** — When the GC powers on, all the LEDs on the status panel light up simultaneously, afterward the **Power** light becomes a solid green while all the other lights turn off. The GC is now in stand-by status. See Figure 71.

   Figure 71. TRACE 1600 Status Panel at the GC Power On

   b. **TRACE 1610** — Check the main menu appears on the touch screen. See Figure 72.

Figure 72. TRACE 1610 Touch Screen



7. Open the Thermo Scientific Chromatography Data System installed on the computer.
8. Set the analytical parameters.

Powering Off the TRACE 1600/1610

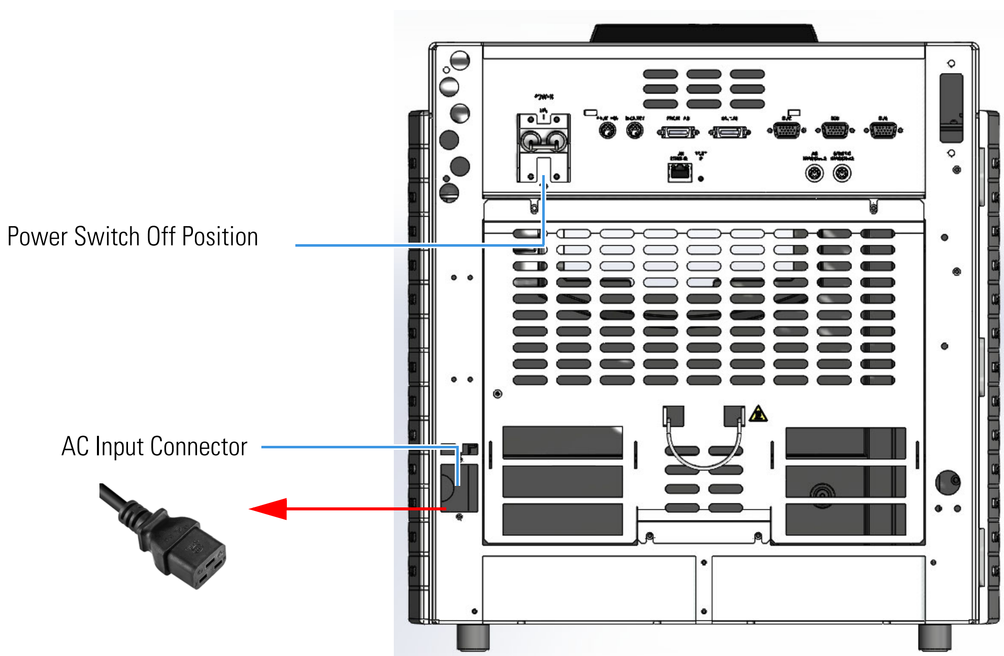
❖ To shut down the GC

1. Cool down the GC.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

2. If you do not plan to replace the column or perform maintenance on the GC, you do not have to lower the injector temperature.
3. Turn off the carrier gas supply at the tank.
4. Push down the power switch (breaker), located at the back of the instrument, to the position **O** (down). See Figure 73.

Figure 73. GC Power Off



5. If external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
6. If present, power-off the autosampler by switching off the main power switch, or by unplugging the power cable from the AC input connector, and from the wall outlet.
7. Power-off all the remaining instruments.

Cleaning the Instrument Externally

Normal usage of the TRACE 1600/1610 can cause the exterior to get dirty.

WARNING It is your responsibility to avoid that dangerous liquids, materials or both, seeping inside the GC during operation and maintenance.

Solvents must not be used. Do not spray on electrical parts.

❖ **To clean the instrument externally**

1. Place the GC in stand-by condition.
2. Press the **Maintenance** button to cool down the GC, or switch off the heated zones manually.
3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector on the back of the GC, and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
5. Externally clean the instrument with a soap and water solution, or with a household non-abrasive product.
   - Pay special attention when cleaning the back side of the instrument. Do not spray, but clean using a cloth imbued with the same substance.
   - Carefully avoid seeping of the products used inside the instrument, particularly when cleaning the grid of the back panel.
   - If you just suspect that a substance used for cleaning or a product submitted to analysis has penetrated inside the instrument, immediately shut down the instrument, and call an authorized customer support engineer for proper actions. The service engineer must be fully informed on the nature of the concerned substance.
     In the event that a hazardous material is spilled on or in the instrument, clean the spill according to the procedures reported in the Material Data Sheet for that substance.
6. Dry with a clean cloth.
7. If external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.
8. Power on the GC.

a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

b. Flip up the power switch (breaker) to the position I.

c. Set the normal injector, detector and GC working conditions.

Replacing a Column

You might need to replace the column when performance degrades and troubleshooting indicates that the column needs maintenance. That might mean that the end of the column needs to be trimmed, or the column needs to be replaced.

WARNING-BURN HAZARD: The injector and the oven could be hot. Cool to room temperature before touching them.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To replace a column

Note If you are running samples, stop the acquisition.

1. Remove the current column.

   a. Press the **Maintenance** button to cool down the GC.

   b. Set off the carrier and detector gases of the channel of interest, and wait for the carrier pressure to go to zero.

   c. Open the front door of the GC.

   d. Unscrew the injector and detector nuts, and remove the column.

   e. Remove the column from the column rack, and from the GC.

2. Install the new column.

   a. Place the new column on the two arms of the column rack inside the oven.

3. Connect the new column to the injector inside the GC.

Note PTV and PTVBKF injectors mount as standard the 0.55 mm ID terminal bottom fitting for the 0.25 mm/0.32 mm ID capillary columns (P/N 35008428). For connecting a 0.53 mm ID capillary column, replace the standard terminal bottom fitting with the 1.0 mm ID terminal bottom fitting (P/N 35008429) provided in the PTV/PTVBKF standard outfit.

a. Unwind the column enough to easily connect its ends to the injector and the detector.

> **Note** Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

b. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.

c. Insert the column through the proper injector retaining nut and ferrule (open end up). If the M4 retaining nut is used, slide it on the column through the side cut. Wipe the column again with a tissue soaked in methanol.

d. Use a scoring wafer to score and break the column about 1 cm (0.4 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

> **Tip** Slide a notched septum on the column before the injector retaining nut to make it easier to measure the proper distance between the nut and end of the column.

e. Position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 13.

Table 13. Column Insertion Depth For SSL, SSLBKF, HeS-S/SL, PTV, PTVBKF, and GSV Injectors

Injector	Column Insertion Depth
SSL and HeS-S/SL	• 5 mm (splitless) • 5 mm (He saver • 10 mm (split)
SSLBKF	• 5 mm (splitless) • 10 mm (split)
PTV	• 30 mm • As far as possible into the bottom when the PTV is used as an On-Column injector.
PTVBKF	• 30 mm
GSV	• Insert the column as far as goes and withdrawn about 2 -3 mm

f. Insert the notched septum on the column to hold the retaining nut at this position. Thread the retaining nut into the injector but do not tighten.

g. Adjust the column position so that the septum contacts the bottom of the retaining nut.

h. Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.

i. Remove the notched septum from the column.

4. Setup the GC parameters.

a. Set the oven and injector temperature to 50 °C.

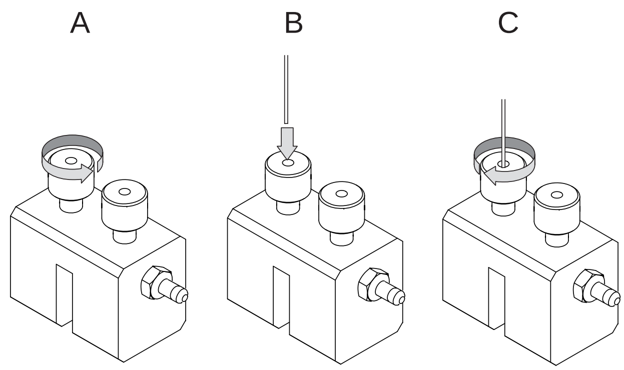
b. Use the column flowmeter connector to verify that there is flow through the column. If you do not have a flowmeter, dip the column outlet in a small vial of methanol. Bubbles indicate there is flow through the column. If there is no flow, check that the carrier gas is on, the GC inlet is pressurized, and the column is not plugged. If there is still no flow, consult the Troubleshooting section or contact Technical Support.

c. Allow the column to purge for at least 10 minutes.

5. Perform a column leak check.

a. Carefully push the capillary column end into the column section of the column-flowmeter connector. See Figure 74.

Figure 74. Using a Flowmeter for Leak Check



b. If your GC is equipped with the touch screen user interface, select the **Leak Check** icon in the **Maintenance** menu, otherwise perform the Leak Check through the Chromatography Data System by selecting the proper function.

c. Start the leak check to begin operation. The split and purge valves of the selected channel are automatically closed and the channel is pressurized with carrier gas to the leak check setpoint.

d. The system monitors the pressure for one minute. If the pressure does not drop more than the maximum allowed sensitivity value, then the leak check will pass.

If the leak check did not pass, you should use the leak detector to find and fix the leaks.

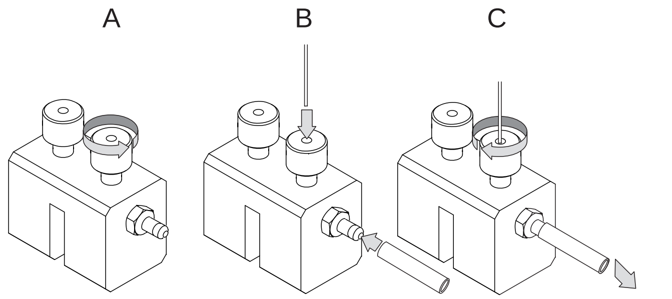
> **Tip** Leaks can be caused by not tightening the fitting on the column flowmeter connector. We recommend that you check that fitting before looking elsewhere.

e. Repeat the leak check until no leaks are indicated.

6. Calibrate the carrier gas flow (column evaluation).

a. Carefully push the capillary column end into the flow meter section of the column flowmeter connector. See Figure 75.

Figure 75. Column Flowmeter Connector



b. Connect the flowmeter to the dedicated fitting on the column flow meter connector.

c. If your GC is equipped with the touch screen as user interface, select **Back** or F**ront Column** icon in the **Configuration** menu, otherwise perform the Column Evaluation through the Chromatography Data System by selecting the proper function.

d. Select the column and input the physical characteristics of the column.

e. If a pre-/post-column is present, set the length and nominal internal diameter of the pre-/post-column in the same valid ranges for the column. The following two lines are added to the menu.

f. According to the physical characteristics of the column, the system calculates and displays the relevant Column K-factor.

> **Note** For the most reproducible results, you should conduct a more detailed column evaluation. However, the following steps, while recommended, are not required.

g. Start column evaluation. At the end of the routine, a message will indicate that evaluation was successful.

h. Expect a K-factor of approximately 0.7 – 0.9 for a 15 m, 0.25 mm ID column (1.3 – 2.0 for a 30 m, 0.25 mm ID column). If the column does not report a K-factor within this range or within 0.1 units of the previous stored value, check for a leak or broken column using the leak detector. The K-factor is a measured resistance for the column. A K-factor that is too low may indicate a leak in the system, while a K-factor that is too high may indicate a blockage.

7. Disconnect the column flowmeter.

   a. Disconnect the column from the column flowmeter connector.

   b. Remove the clear plastic component, including its fittings, from the oven and set it aside.

   c. Close the GC door.

8. Condition the column.

   The column must be conditioned before inserting it into the detector.

Column conditioning consists of passing a carrier gas flow through the column heated at a programmed temperatures as described in the *column manufacturer's instructions*.

In case the column does not have any column conditioning instructions, perform the column conditioning by setting a final temperature up to 10 °C - 20 °C below its recommended maximum temperature.

CAUTION When performing column conditioning, connect the column only to the injector leaving the column outlet disconnected to avoid the possibility of contamination of the detector.

Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

ATTENTION Pendant le conditionnement de la colonne, branchez uniquement cette dernière à l'injecteur. La sortie de colonne ne doit pas être branchée, afin d'éviter toute contamination du détecteur.

N'utilisez pas l'hydrogène comme gaz vecteur pour le conditionnement ! Il risquerait de s'échapper dans le four et de présenter un risque d'explosion.

a. Run the slow temperature program that is recommended by the manufacturer.

INSTRUMENT DAMAGE: Never exceed the column manufacturer's maximum operating temperature.

9. Connect the column to the detector inside the GC.

a. Lower the oven temperature to 30 °C and allow it to cool.

WARNING-BURN HAZARD: The injector, detectors, oven, and transfer line may be hot. Allow them to cool to room temperature before touching them.

b. Unwind the column enough to easily connect its ends to the injector and the detector.

Note Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

c. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.

d. Use a scoring wafer to score and break the column outlet about 2.5 cm (1 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

e. Insert the column through the proper detector retaining nut and ferrule (open end up). Wipe the column again with a tissue soaked in methanol.

Tip Slide a notched septum on the column before the detector retaining nut to make it easier to measure the proper distance between the bottom nut and end of the column.

f. For **FID**, **NPD**, **TCD**, **ECD**, and **FPD**, position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 14. For **PDD** see the instruction described at the step g on page 80.

Table 14. Column Insertion Depth For FID, NPD, TCD, ECD, FPD, and PDD Detectors

Detector	Column Insertion Depth
FID, NPD, and TCD	Insert the column as far as goes and withdrawn about 2 -3 mm
ECD	23 mm
FPD	125 mm
PDD	136 mm

i. For **FID**, **NPD**, and **TCD**, insert the column into the detector, paying attention to not force it further. Finger-tighten the retaining nut, then withdraw the column **2-3 mm**. Tighten the retaining nut an additional a quarter turn.

ii. For **ECD** and **FPD**, insert the notched septum on the column to hold the retaining nut in this position. Thread the retaining nut into the detector but do not tighten. Adjust the column position so that the septum contacts the bottom of the retaining nut. Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.

iii. Remove the notched septum from the column.

g. For **PDD** the column must enter **136 mm** into the pre-installed capillary column adapter.

i. Make a mark on the column 136 mm from the end.

ii. Remove the knurled nut column inlet at the bottom of the detector. Slide the nut overt the end of the column, followed by the appropriate column ferrule.

iii. Seat the ferrule in the detail of the column adapter and begin sliding the column through the capillary column adapter and into the column inlet.

iv. Get the nut started on the threads and tighten it until you feel it contact the ferrule, then back off half a turn.

v. Slide the column into the column inlet until the mark is flush with the surface of the knurled nut, and secure the column in the adapter by tightening the knurled nut finger tight only.

Note When inserting the capillary column into the PDD detector it might rarely happen to feel a slight resistance. In this case, for proper column installation, pull the column out slightly and adjust the angle before inserting it further.

IMPORTANT To install a packed column, the pre-installed capillary column adapter must be replaced with the **packed columns adapter** that enters into the PDD cell for the correct length.

10. End of the column installation.
    a. Close the front door of the GC.

3

Performing Injectors Routine Maintenance

This chapter provides instructions for performing routine maintenance on the TRACE 1600/1610 injector modules.

Contents

Maintaining a Split/Splitless Injector (SSL)

This section provides instructions for maintaining an Instant Connect Split/Splitless injector (SSL).

The module and injector components are shown in Figure 76 and Figure 77.

Figure 76. SSL Module Components

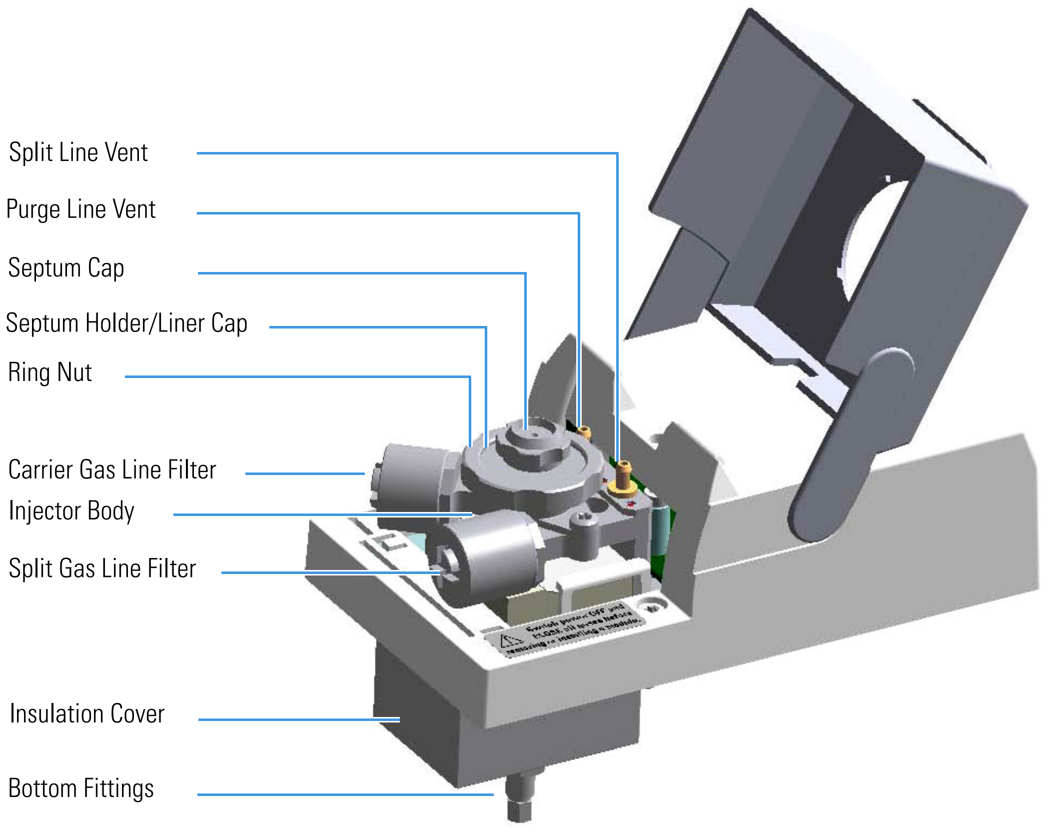
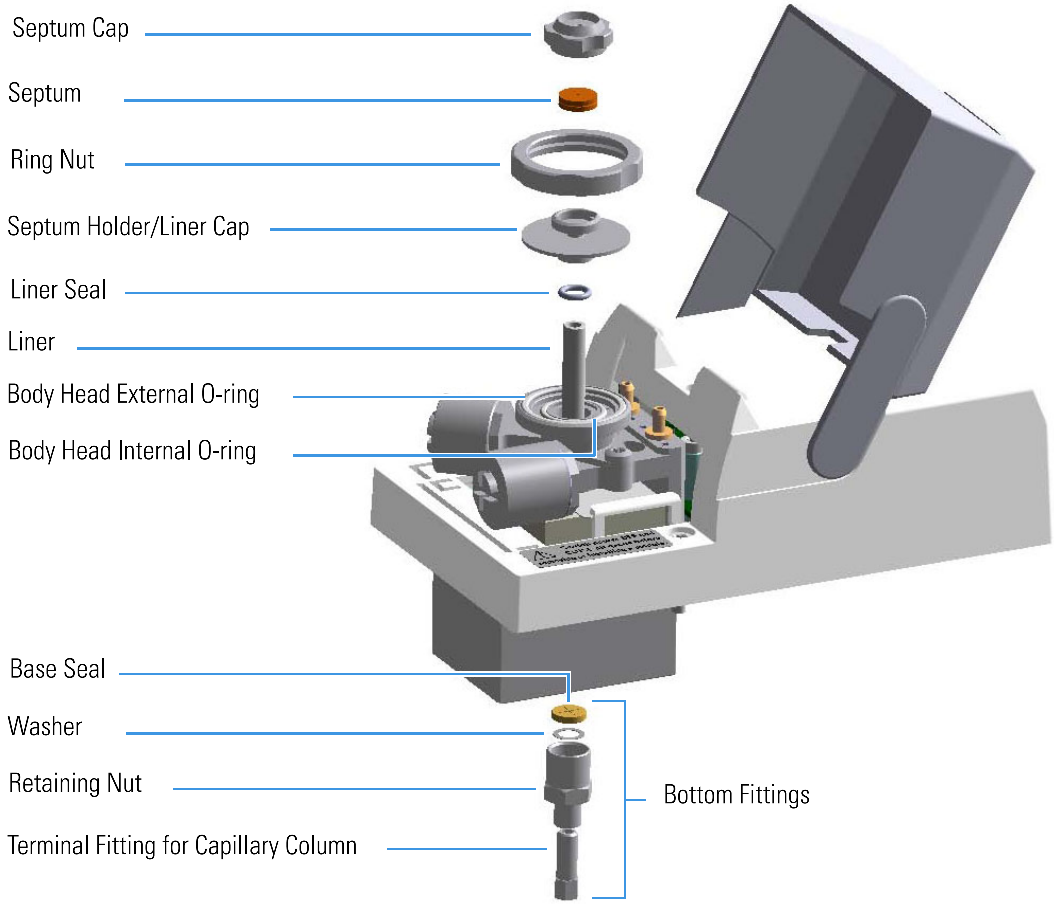


Figure 77. SSL Injector: Components



The SSL injector periodic maintenance includes:

- **Replacing the SSL septum**

  Replace the septum at least after every 200 injections, or every time a problem related to septum damage, or wear occurs.

  See "Replacing the SSL Septum" on page 87.

- **Cleaning or replacing the SSL liner**

  Check the liner for contaminants, debris, breakage, and proper installation.
  The liner must be replaced depending on the number of injections performed, and the characteristics of the samples injected. Typical symptoms will indicate that the liner must be replaced. The most common is the appearance of tailing peaks in the chromatogram, particularly for polar compounds.

  See "Cleaning or Replacing the SSL Glass Liner" on page 89.

Tip It is good practice to replace the septum every time you replace the glass liner.

When replacing or removing a glass liner, it might break inside the injector. In this case the broken parts of the liner must be removed from the injector, including the glass splinters that might fall into the lower part of the vaporization chamber.

See "Replacing a SSL Broken Liner" on page 91.

- **Replacing the active carbon filters on the carrier gas line and split line**

  The active carbon filters must be replaced depending on the volume of solvent injected in the time.

  See "Replacing the SSL Carrier and Split Lines Filters" on page 93.

- **Replacing the body head O-rings**

  The internal (carrier line) and external (purge line) O-rings of the body head must be replaced when in presence of leaks.

  See "Replacing the SSL Body Head O-rings" on page 95.

Before maintaining the injector, read the following warning:

WARNING The injector fittings could be hot. Carry out all the operation at low temperature to avoid burns. Therefore, before beginning the sequence, the injector must be cooled to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a SSL injector
Septum
Tweezers
Glass liner
Liner seal (O-ring)
Ultrasonic cleaner
Mixture 1:1 methanol/acetone
Base Seal (if necessary)
Carrier gas line and/or split gas line active carbon filters
Body head internal O-ring
Body head external O-ring
T20 screwdriver

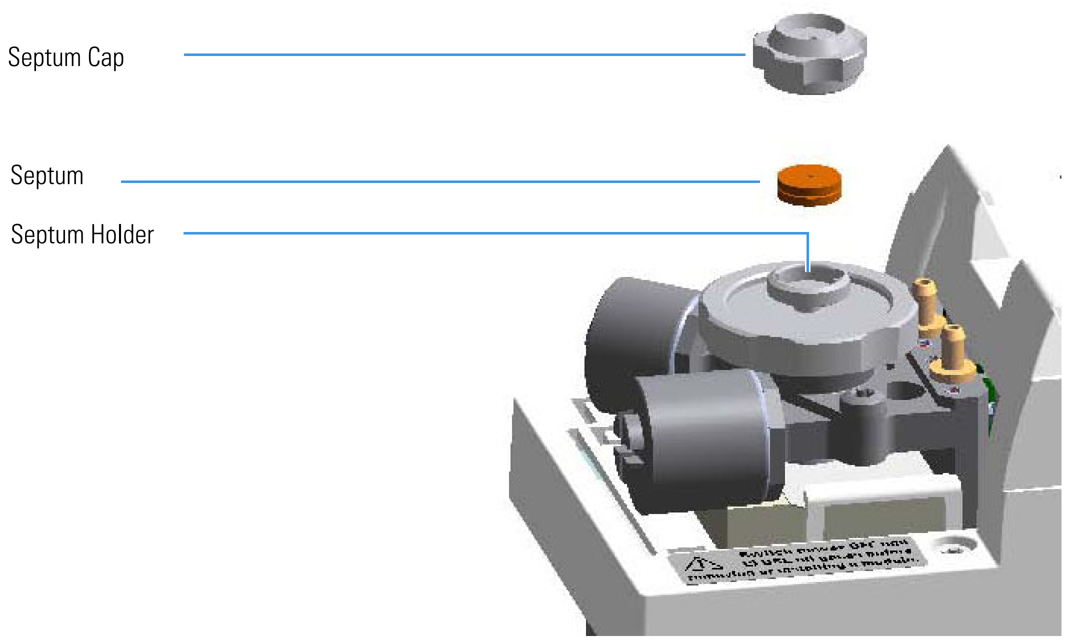
Note For maintaining or replacing any other component not listed in this section, see Chapter 6, "Injectors Advanced Maintenance."

- "Baking-out Contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF Injectors" on page 248
- "Removing/Replacing an Injector Module" on page 249
- "Cleaning the SSL Injector Body" on page 252

Replacing the SSL Septum

❖ To replace the septum

Figure 78. SSL Injector: Septum Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the septum.
   a. Unscrew and remove the septum cap.

b. Using tweezers, remove the septum from the septum holder.

c. Avoid touching the septum with your fingers. Insert a new septum into the septum holder using tweezers.

d. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

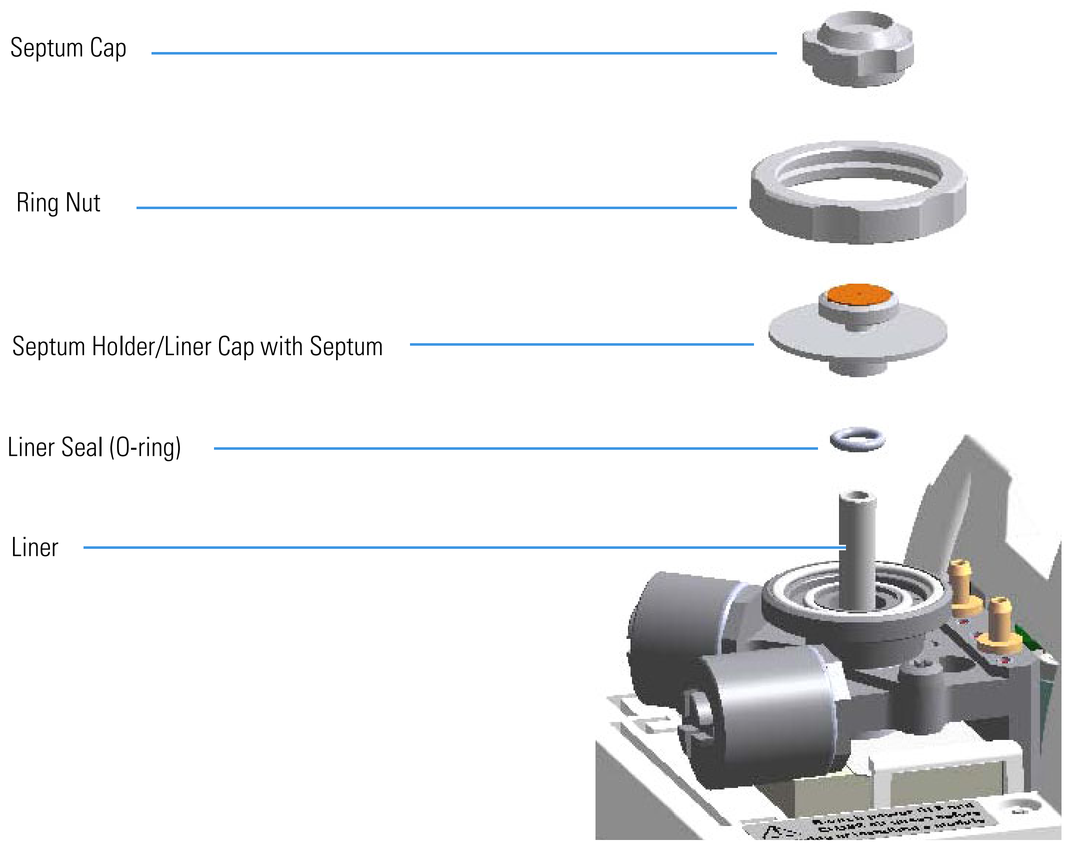
7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Cleaning or Replacing the SSL Glass Liner

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ **To clean or replace the glass liner**

Figure 79. SSL Injector: Glass Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector.

a. Unscrew the septum cap of the injector.

b. Unscrew the ring nut.

c. Remove the septum holder/liner cap with septum from the injector body head.

7. Remove the liner.

a. Using tweezers, remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, see “Replacing a SSL Broken Liner” on page 91.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez “Remplacement d’un liner SSL cassé”.

8. Replace or clean the liner.

- If you are going to use a new liner, go directly to step 10.
- If you are going to clean the dirty liner, go to step 9.

9. Clean the liner.

a. Put the liner into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).

b. Sonicate the liner for about half an hour.

c. Using tweezers, remove the liner from the bath and dry it with compressed clean air.

10. Install the liner.

a. Holding the new (or cleaned) liner with tweezers place a new liner seal over the liner.

b. Insert the liner into the injector, and push it gently towards the bottom of the injector.

11. Reinstall the top parts of the injector.

a. Place the septum holder/ liner cap with the septum on the body head of the injector, and fix it by screwing the ring nut.

b. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

12. Close the module flap cover.

13. If present, move the autosampler towards the module to restore the original alignment.

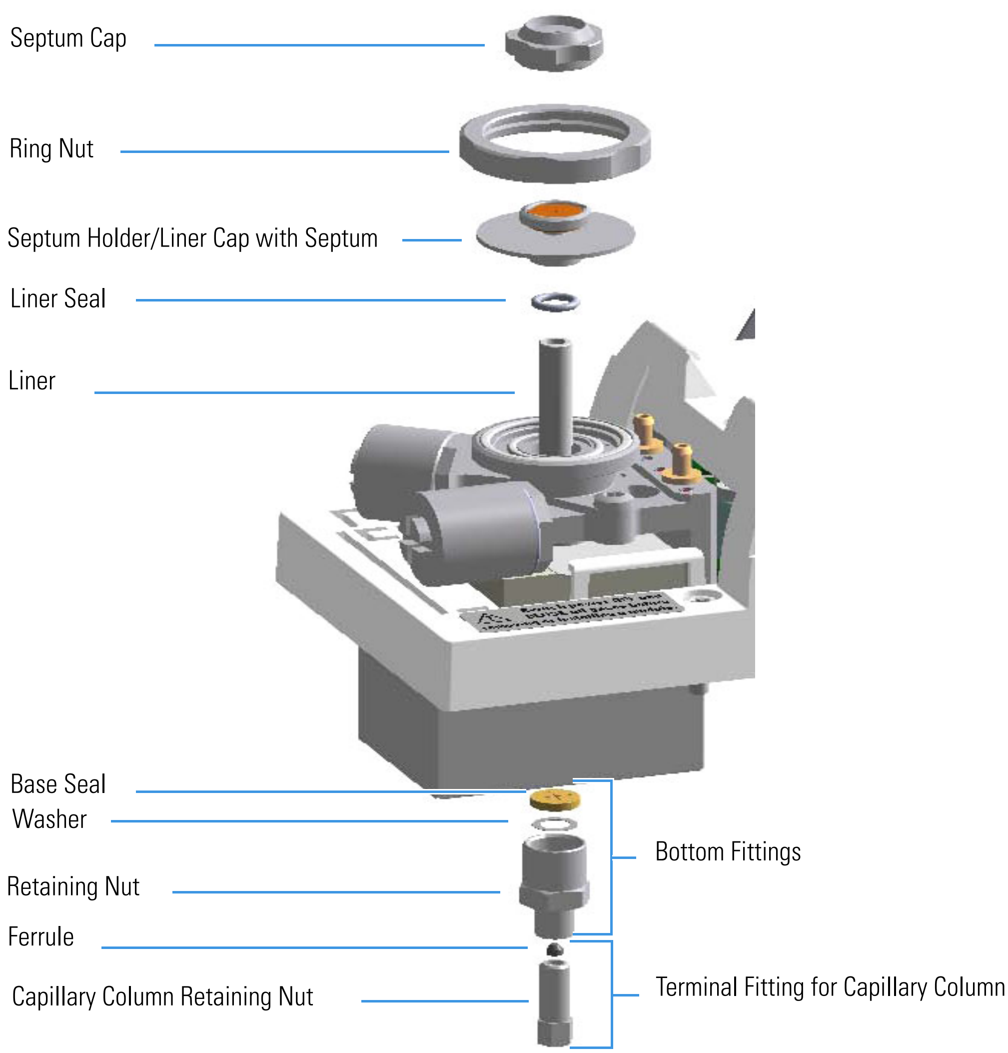
14. Turn the carrier gas on.

15. Set the normal injector, detector, and GC working conditions.

Replacing a SSL Broken Liner

❖ **To replace a broken liner**

Figure 80. SSL Injector: Broken Liner Replacement



1. Put the GC in standby condition.

2. Cool the oven and injector to room temperature.

3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Remove the broken liner.
   a. Using tweezers, remove the upper part of broken liner with the liner seal from the injector.
8. Remove the bottom parts of the injector.
   a. Inside the oven, unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.
   b. From the bottom of the injector, unscrew the retaining nut with the washer and the base seal. Glass splinters from the broken liner will fall from the injector.
   c. With the aid of a pipe cleaner, remove the possible glass fragments from the vaporization chamber.
9. Reinstall the bottom parts of the injector.
   a. Reinstall the analytical column.
   b. Reinstall the retaining nut with the new washer and the base seal. If necessary, replace the base seal with a new one.
10. Install a new liner.
    a. Holding the new liner with tweezers, place a new liner seal over the liner.
    b. Insert the liner into the injector, and push it gently towards the bottom of the injector.
11. Reinstall the top parts of the injector.
    a. Place the septum holder/liner cap with the septum on the body head of the injector and fix them by screwing the ring nut.
    b. Screw and tighten the injector cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector and GC working conditions.

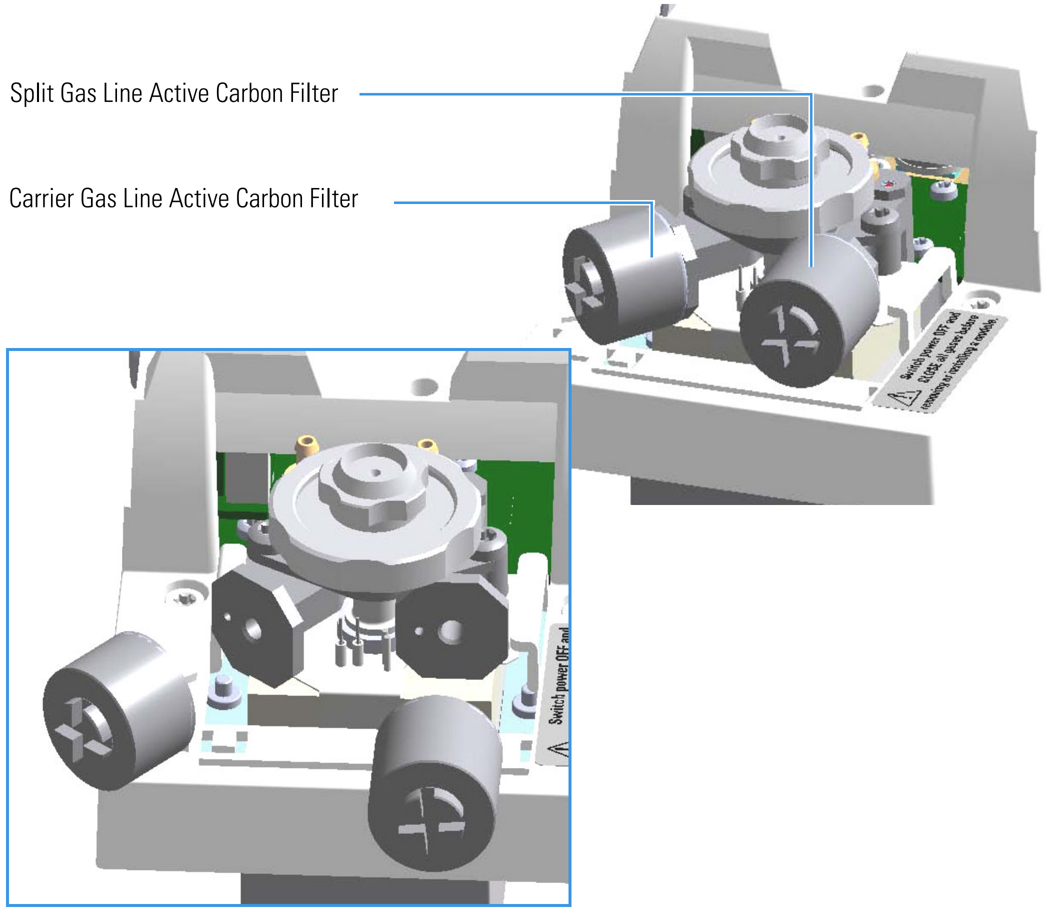
Replacing the SSL Carrier and Split Lines Filters

CAUTION The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

ATTENTION Les dimensions des filtres sont différentes. Le filtre sur la conduite de gaz à débit divisé est plus grand que le filtre sur la conduite de gaz vecteur. N'inversez pas leur position pendant leur remplacement. Il n'est pas nécessaire de remplacer les filtres en même temps.

❖ **To replace the active carbon filters on carrier gas line and split line**

Figure 81. SSL Injector: Active Filters Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

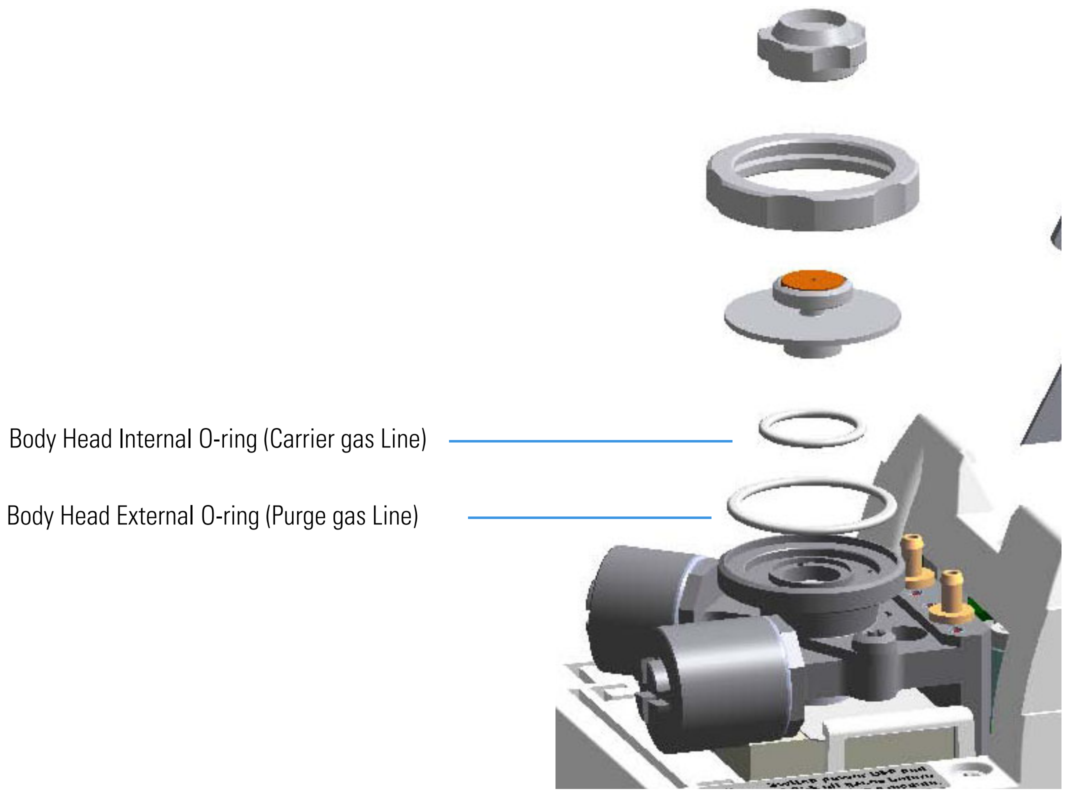
4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counter-clockwise.
   b. Install the new filter, with O-rings, in its seat by turning it clockwise.
7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.

9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Replacing the SSL Body Head O-rings

❖ **To replace the body head O-rings**

Figure 82. SSL Injector: Body Head O-rings Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.

c. Remove the septum holder/liner cap with septum from the injector body head.

7. Replace the head body O-rings.

    a. Use tweezer to remove the body head internal and external O-rings, and replace them with new O-rings.

8. Reinstall the top parts of the injector.

    a. Place the septum holder/liner cap with the septum on the body head of the injector and fix it by screwing the ring nut.

    b. Screw and tighten the injector cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

9. Close the module flap cover.

10. If present, move the autosampler towards the module to restore the original alignment.

11. Turn the carrier gas on.

12. Set the normal injector, detector, and GC working conditions.

Maintaining a Split/Splitless Injector with Backflush (SSLBKF)

This section provides instructions for maintaining an Instant Connect Split/Splitless injector for Backflush (SSLBKF) applications.

The module and injector components are shown in Figure 83 and Figure 84.

Figure 83. SSLBKF Module Components

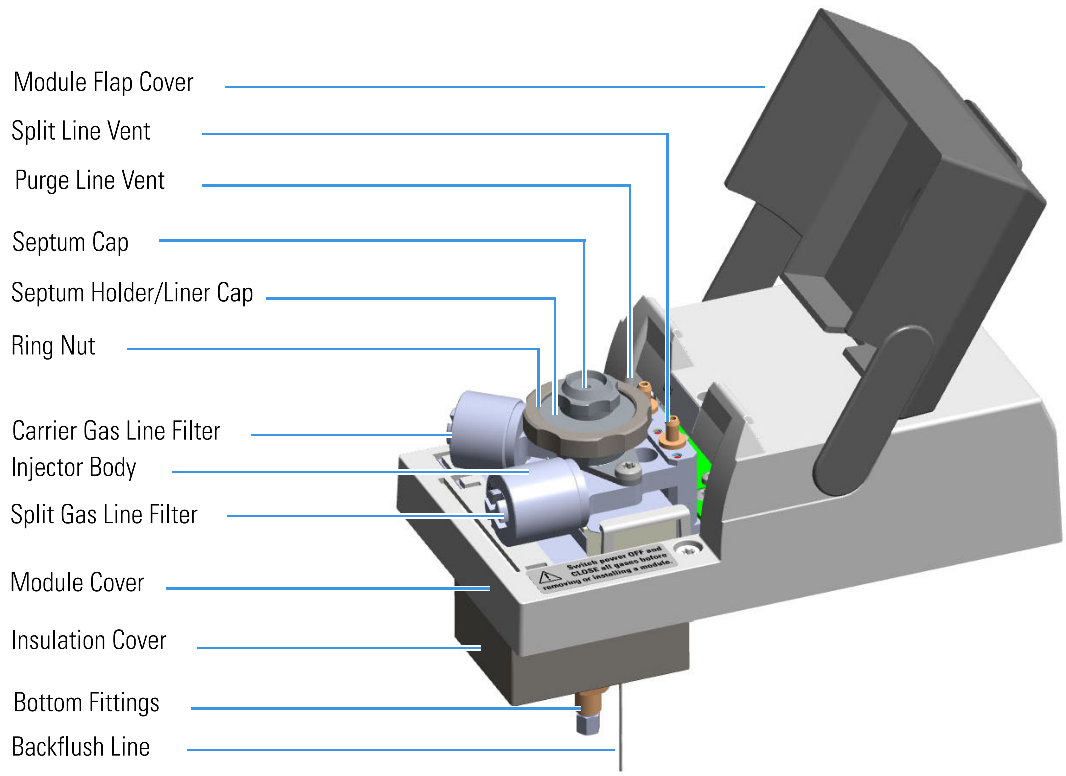
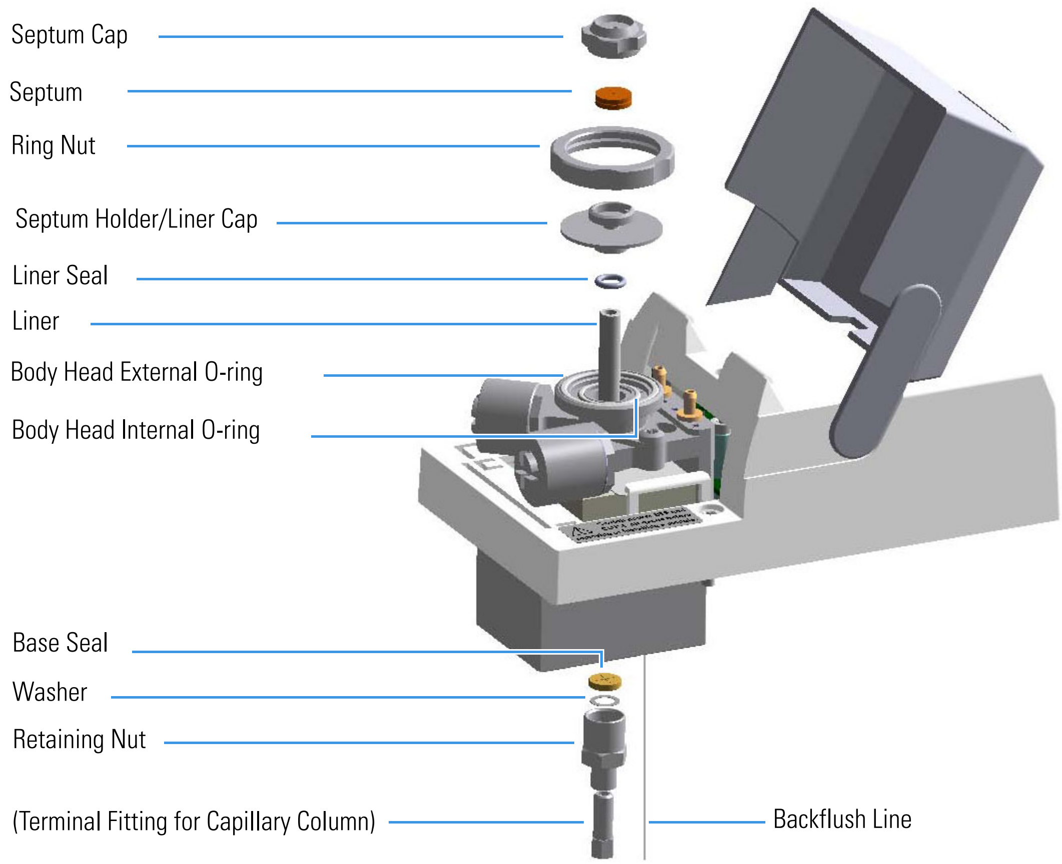


Figure 84. SSLBKF Injector Components



The SSLBKF injector periodic maintenance includes:

- **Replacing the SSLBKF septum**

  Replace the septum at least after every 200 injections, or every time a problem related to septum damage, or wear occurs.

  See "Replacing the SSLBKF Septum" on page 100.

- **Cleaning or replacing the SSLBKF liner**

  Check the liner for contaminants, debris, breakage, and proper installation. The liner must be replaced depending on the number of injections performed, and the characteristics of the samples injected. Typical symptoms will indicate that the liner must be replaced. The most common is the appearance of tailing peaks in the chromatogram, particularly for polar compounds.

  See "Cleaning or Replacing the SSLBKF Glass Liner" on page 102.

Tip It is good practice to replace the septum every time you replace the glass liner.

When replacing or removing a glass liner, it might break inside the injector. In this case the broken parts of the liner must be removed from the injector, including the glass splinters that might fall into the lower part of the vaporization chamber.

See “Replacing a SSLBKF Broken Liner” on page 104.

- **Replacing the active carbon filters on the carrier gas line and split line**

  The active carbon filters must be replaced depending on the volume of solvent injected in the time.

  See “Replacing the SSLBKF Carrier and Split Lines Filters” on page 106.

- **Replacing the body head O-rings**

  The internal (carrier line) and external (purge line) O-rings of the body head must be replaced when in presence of leaks.

  See “Replacing the SSLBKF Body Head O-Rings” on page 108.

Before maintaining the injector, read the following warning:

WARNING The injector fittings could be hot. Carry out all the operations at low temperature to avoid burns. Therefore, before beginning the sequence, the injector must be cooled to room temperature.

CAUTION When handling organic solvents you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a SSLBKF injector
Septum
Tweezers
Glass liner
Liner seal (O-ring)
Ultrasonic cleaner
Mixture 1:1 methanol/acetone
Base Seal (if necessary)
Carrier gas line and/or split gas line active carbon filters
Body head internal O-ring
Body head external O-ring
T20 screwdriver

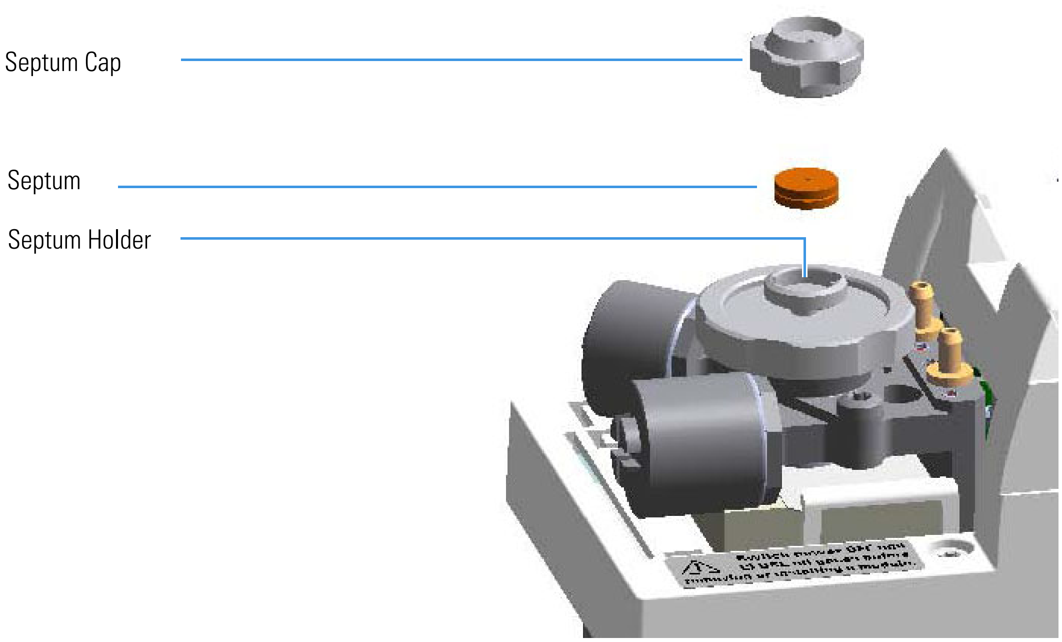
Note For maintaining or replacing any other component not listed in this section, see Chapter 6, "Injectors Advanced Maintenance."

- "Baking-out Contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF Injectors" on page 248
- "Removing/Replacing an Injector Module" on page 249
- "Cleaning the SSLBKF Injector Body" on page 256

Replacing the SSLBKF Septum

❖ To replace the septum

Figure 85. SSLBKF Injector: Septum Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the septum.
   a. Unscrew and remove the septum cap.

   b. Using tweezers, remove the septum from the septum holder.
   c. Avoid touching the septum with your fingers. Insert a new septum into the septum holder using tweezers.
   d. Screw and tighten the septum cap to finger-tight.

7. Close the module flap cover.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

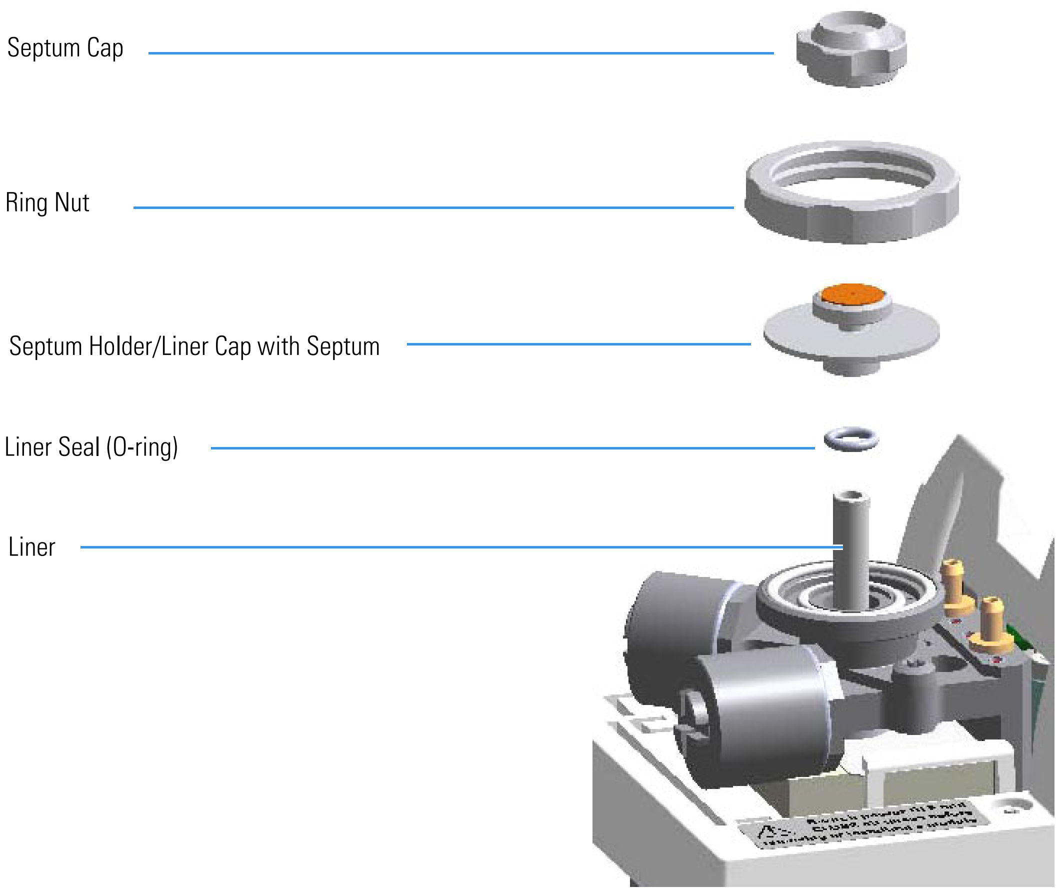
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Cleaning or Replacing the SSLBKF Glass Liner

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the glass liner

Figure 86. SSLBKF Injector: Glass Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.

6. Remove the top parts of the injector.

    a. Unscrew the septum cap of the injector.

    b. Unscrew the ring nut.

    c. Remove the septum holder/liner cap with septum from the injector body head.

7. Remove the liner.

    a. Use tweezers to remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, see “Replacing a SSL Broken Liner” on page 91.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez “Remplacement d’un liner SSL cassé”.

8. Replace or clean the liner.

    - If you are going to use a new liner, go directly to step 10.

    - If you are going to clean the dirty liner, go to step 9.

9. Clean the liner.

    a. Put the liner into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).

    b. Sonicate the liner for about half an hour.

    c. Using tweezers, remove the liner from the bath, and dry it with compressed clean air.

10. Install the liner.

    a. Holding the new (or cleaned) liner with tweezers place a new liner seal over the liner.

    b. Insert the liner into the injector and push it gently towards the bottom of the injector.

11. Reinstall the top parts of the injector.

    a. Place the septum holder/ liner cap with the septum on the body head of the injector and fix it by screwing the ring nut.

    b. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

12. Close the module flap cover.

13. If present, move the autosampler towards the module to restore the original alignment.

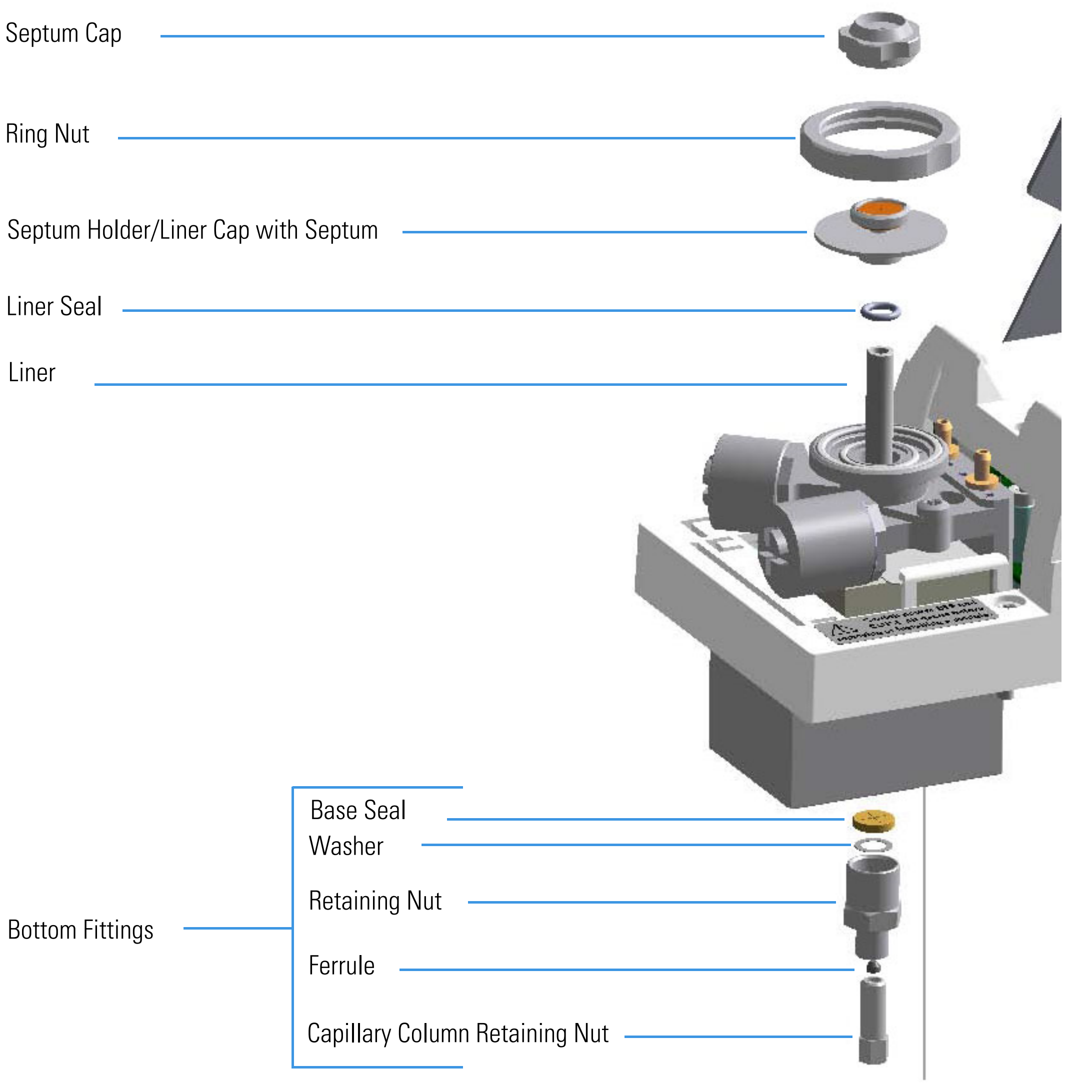
14. Turn the carrier gas on.

15. Set the normal injector, detector, and GC working conditions.

Replacing a SSLBKF Broken Liner

❖ **To replace a broken liner**

Figure 87. SSLBKF Injector: Broken Liner Replacement



1. Put the GC in standby condition.

2. Cool the oven and injector to room temperature.

3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Remove the broken liner.
   a. Use tweezers to remove the upper part of broken liner with the liner seal from the injector.
8. Remove the bottom parts of the injector.
   a. Inside the oven, unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.
   b. From the bottom of the injector, unscrew the retaining nut with the washer and the base seal. Glass splinters from the broken liner will fall from the injector.
   c. With the aid of a pipe cleaner, remove the possible glass fragments from the vaporization chamber.
9. Reinstall the bottom parts of the injector.
   a. Reinstall the analytical column.
   b. Reinstall the retaining nut with the new washer and the base seal (if necessary replace the base seal with a new one).
10. Install a new liner.
    a. Holding the new liner with tweezers, place a new liner seal over the liner.
    b. Insert the liner into the injector and push it gently towards the bottom of the injector.
11. Reinstall the top parts of the injector.
    a. Place the septum holder/liner cap with the septum on the body head of the injector and fix them by screwing the ring nut.
    b. Screw and tighten the injector cap to finger-tight

> **CAUTION** Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector, and GC working conditions.

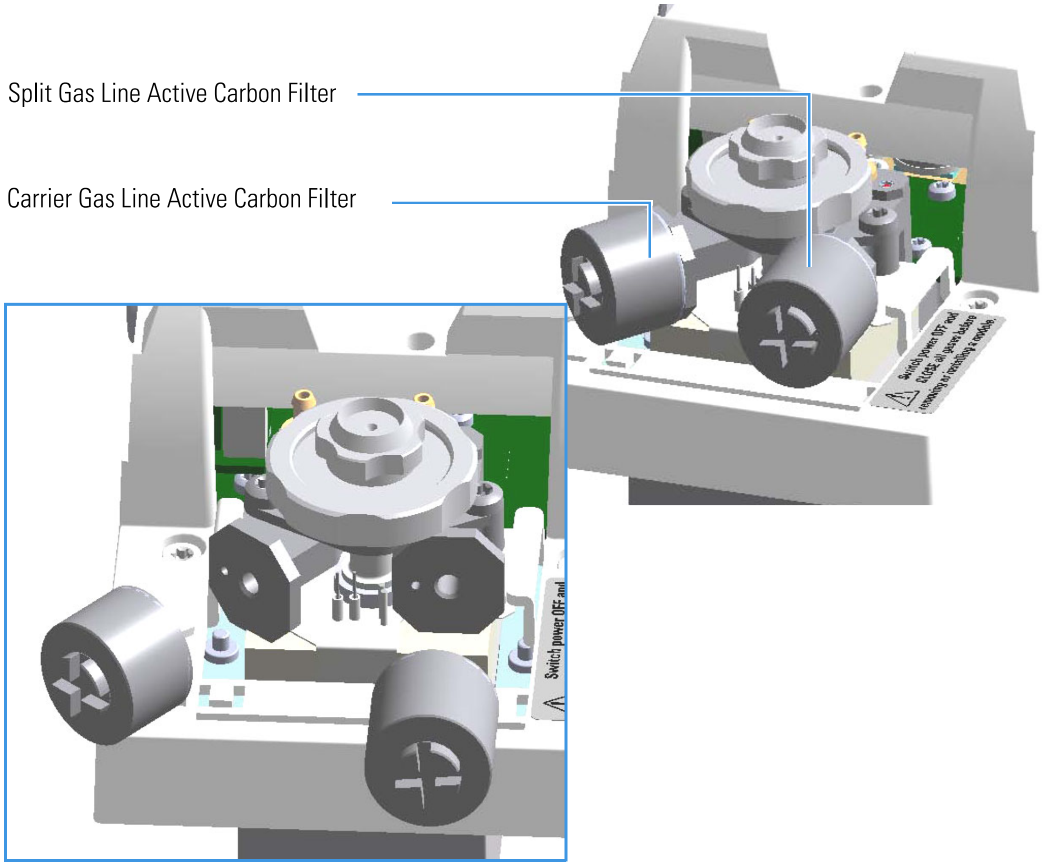
Replacing the SSLBKF Carrier and Split Lines Filters

CAUTION The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

ATTENTION Les dimensions des filtres sont différentes. Le filtre sur la conduite de gaz à débit divisé est plus grand que le filtre sur la conduite de gaz vecteur. N'inversez pas leur position pendant leur remplacement. Il n'est pas nécessaire de remplacer les filtres en même temps.

❖ **To replace the active carbon filters on carrier gas line and split line**

Figure 88. SSLBKF Injector: Active Filters Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

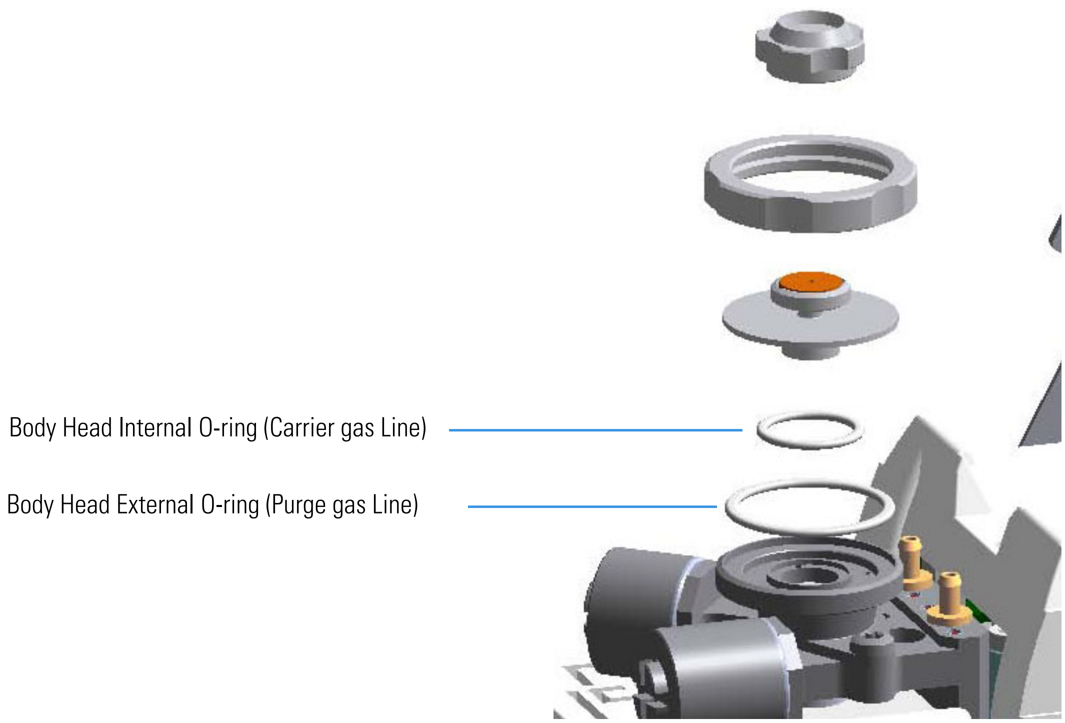
4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counter-clockwise.
   b. Install the new filter, with O-rings, in its seat by turning it clockwise.
7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.

10. Set the normal injector, detector, and GC working conditions.

Replacing the SSLBKF Body Head O-Rings

❖ To replace the body head O-rings

Figure 89. SSLBKF Injector: Body Head O-rings Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Replace the head body O-rings.

a. Use tweezers to remove the body head internal and external O-rings, and replace them with new O-rings.

8. Reinstall the top parts of the injector.

   a. Place the septum holder/liner cap with the septum on the body head of the injector and fix it by screwing the ring nut.

   b. Screw and tighten the injector cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

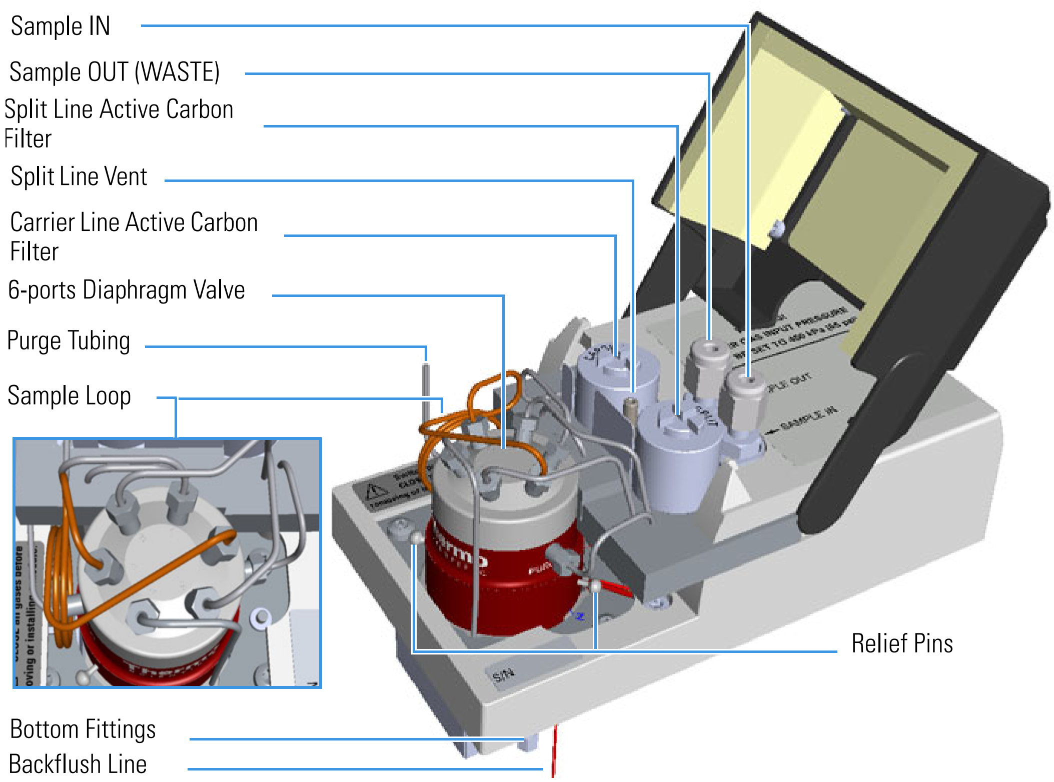
9. Close the module flap cover.
10. If present, move the autosampler towards the module to restore the original alignment.
11. Turn the carrier gas on.
12. Set the normal injector, detector, and GC working conditions.

Maintaining a Gas Sampling Valve Injector (GSV)

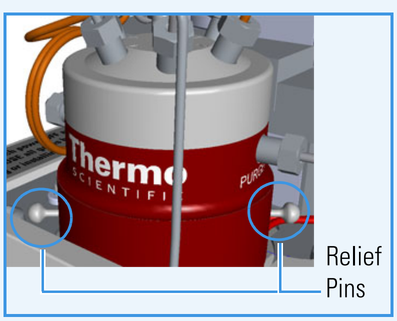
This section contains instructions for maintaining an Instant Connect Gas Sampling Valve injector (GSV) module.

The module and injector components are shown in Figure 90.

Figure 90. GSV Module Components



IMPORTANT The valve ships with relief pins. These pins MUST BE removed from the valve body before working with the valve.



Once the actuation tubing has been set up, set the carrier gas input pressure in a range from **450 kPa (65 psig; 4.5 bar)** to **690 kPa (100 psi, 6.9 bar)**, actuate the valve and remove the pins. You may need to increase pressure a little to ease hand removal of the pins.

Remember, make sure to properly readjust the actuating operating pressure after removing the pins, if you had to change it. Keeps these pins in a safe place. You may want to re-use them for valve maintenance. It is good practice to re-install the relief pins if the valve is not used for a long time. For details refer to the instructions provided by the valve manufacturer.

The Gas Sampling Valve periodic maintenance includes:

- **Connecting the sample In and Out lines**

  See Connecting the Sample In and Out Lines.

- **Replacing the active carbon filters on the carrier gas line and split line**

  The active carbon filters must be replaced depending on the volume of solvent injected in the time.
  See Replacing the Carrier and Split Lines Filters.

- **Replacing the sample loop**

  Replace the sample loop when an upper volume of sample than the volume of standard loop is required. Choose among the loops available.
  See Replacing the Sample Loop.

- **Replacing the gas sampling valve diaphragm**

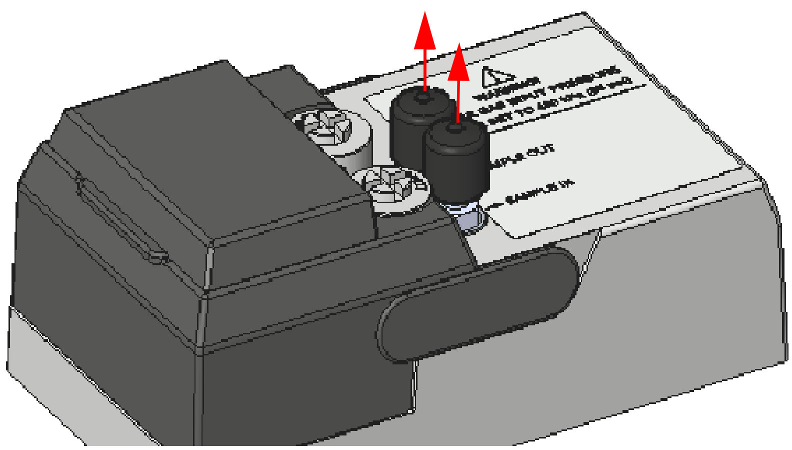
  Follow the instructions provided by the manufacturer of the valve.

Connecting the Sample In and Out Lines

❖ To connect the sample In and Out lines

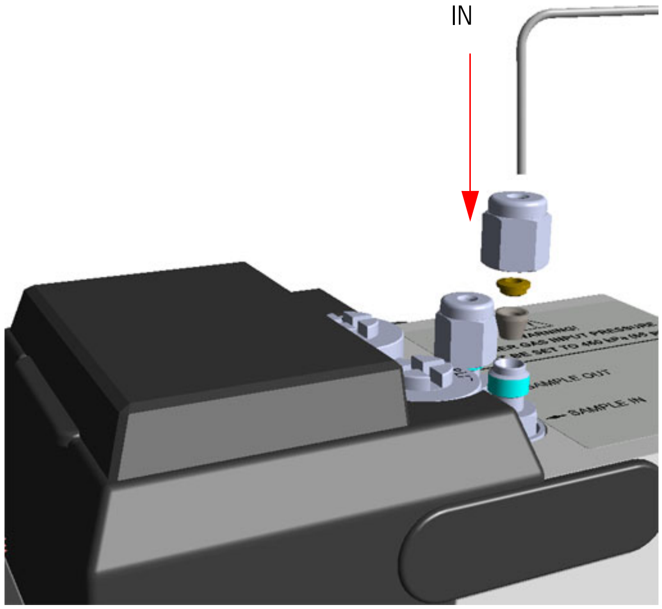
1. If not already done, remove the protective caps from the Sample In and Sample Out fittings. See Figure 91.

Figure 91. Protective Caps



1. By using the proper 1/8-in. tubing, nut and ferrule, connect the inlet sample line to the **Sample In** port on the GSV module. See Figure 92.

Figure 92. GSV Sample In Line Connection



2. By using the proper 1/8-in. tubing, nut and ferrule, connect the **Sample OUT** port on the GSV module to an exhaust system. See Figure 93.

Figure 93. GSV Sample Out Line Connection

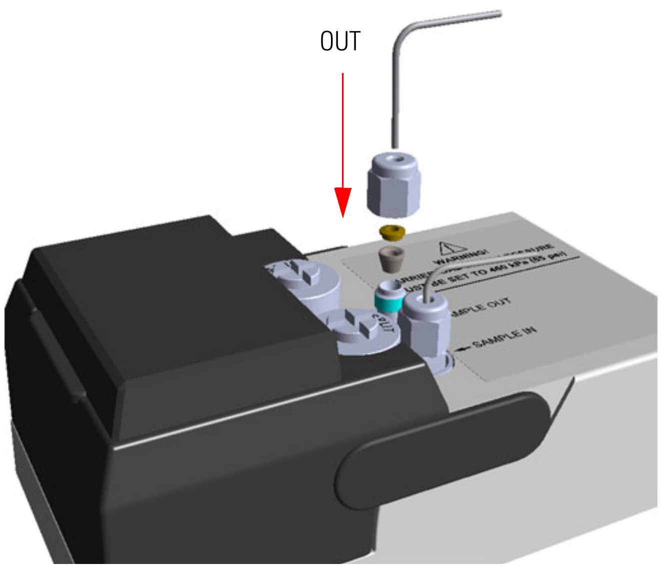
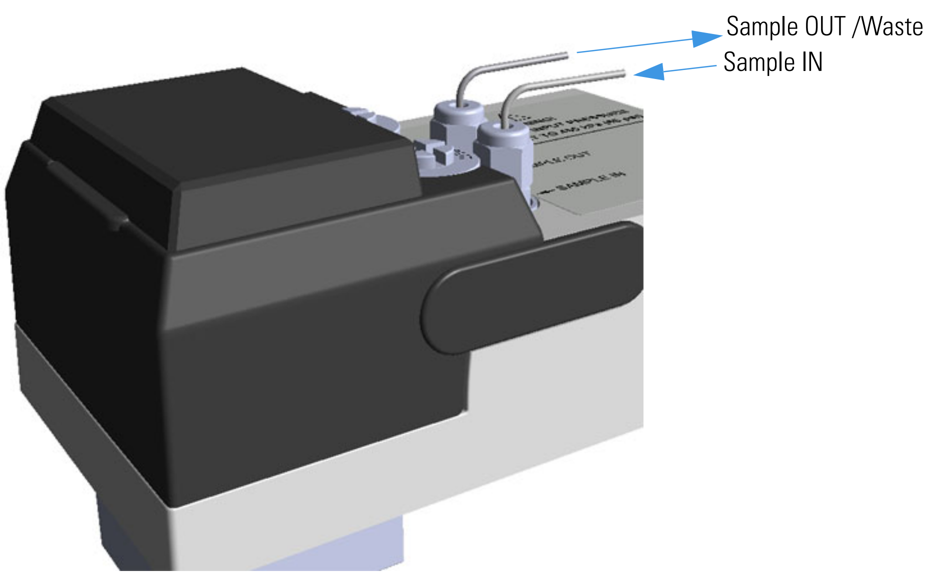


Figure 94. GSV Sample In and Out Lines Connection



Replacing the Carrier and Split Lines Filters

CAUTION The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

ATTENTION Les dimensions des filtres sont différentes. Le filtre sur la conduite de gaz à débit divisé est plus grand que le filtre sur la conduite de gaz vecteur. N'inversez pas leur position pendant leur remplacement. Il n'est pas nécessaire de remplacer les filtres en même temps.

❖ **To replace the active carbon filters on carrier gas line and split line**

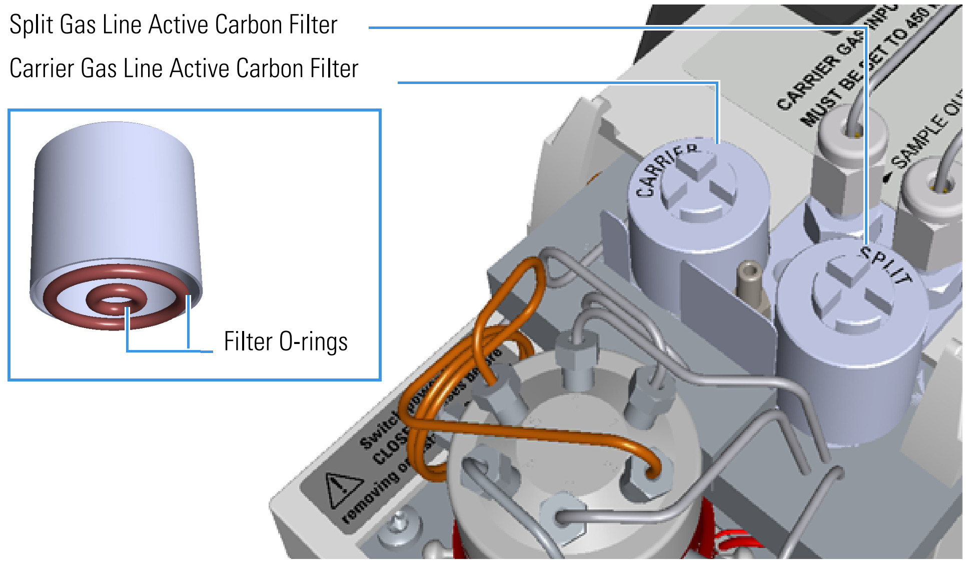
1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counter-clockwise.

b. Install the new filter, with O-rings, in its seat by turning it clockwise.

Figure 95. GSV Module Active Filters Replacement



7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Replacing the Sample Loop

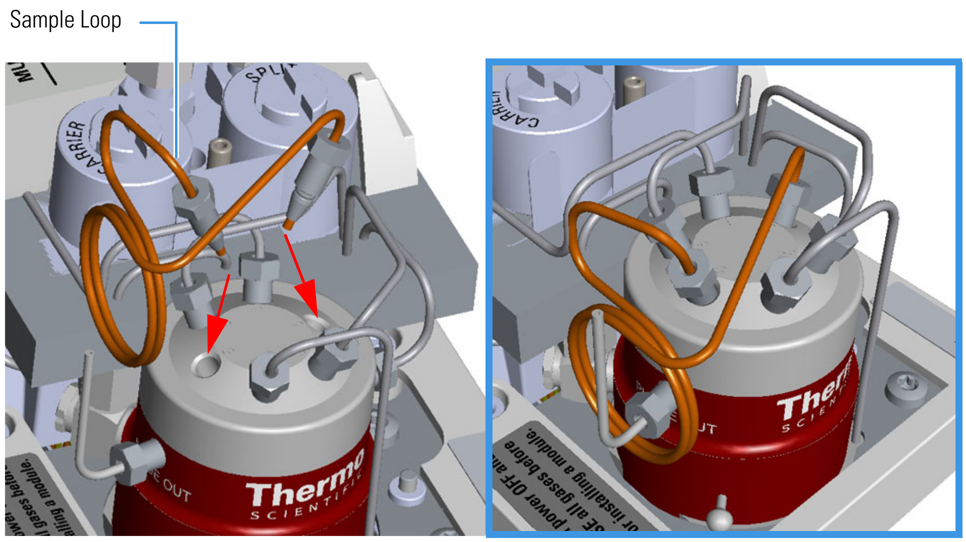
❖ **To replace the sampling loop**

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Open the module flap cover.
5. Replace the sampling loop.
   a. Use a 3/16-in. wrench to loosen the two nuts connecting the sample loop to the six–port valve.
   b. Remove the loop off the valve.
   c. Mount the new loop over the valve and tighten the nuts to the six-port valve.

Figure 96. Example of Sample Loop Replacement



6. Close the module flap cover.
7. Turn the carrier gas on.
8. Set the normal injector, detector, and GC working conditions.

Maintaining the Helium Saver-H2 Safer Option

This section provides instructions for maintaining the Helium Saver-H_2 Safer option.

The injector components are shown in Figure 97 and Figure 98.

Figure 97. Helium Saver-H_2 Safer Components

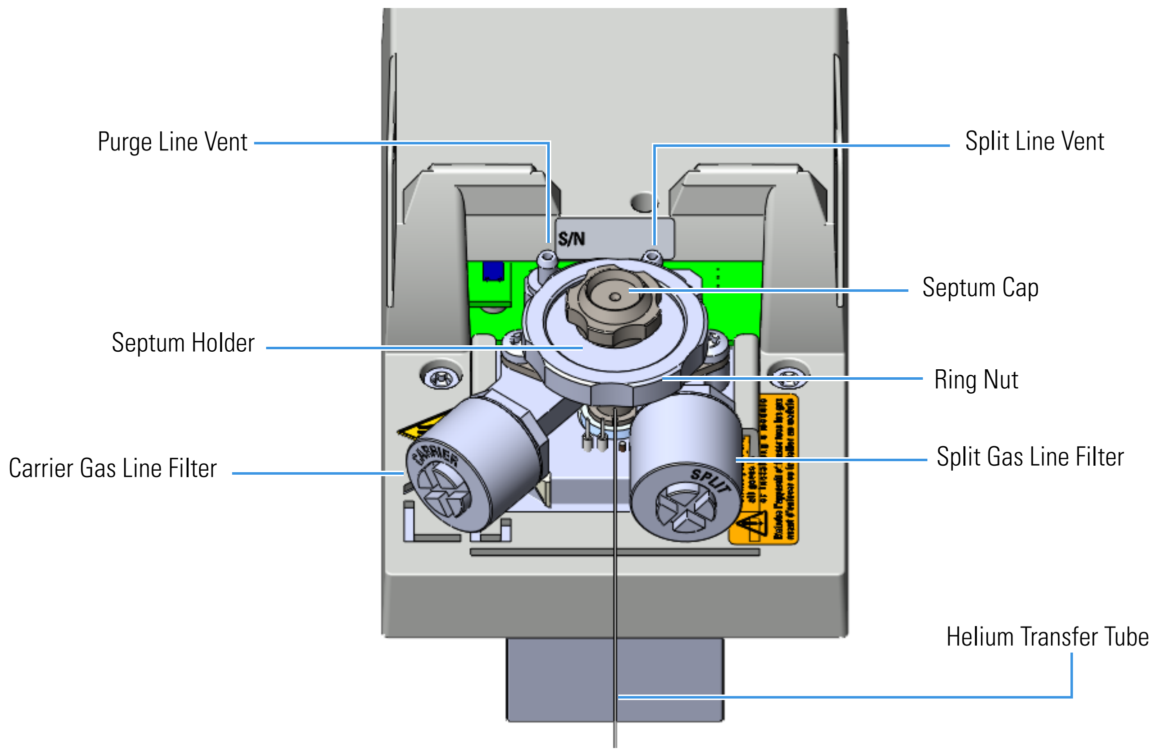
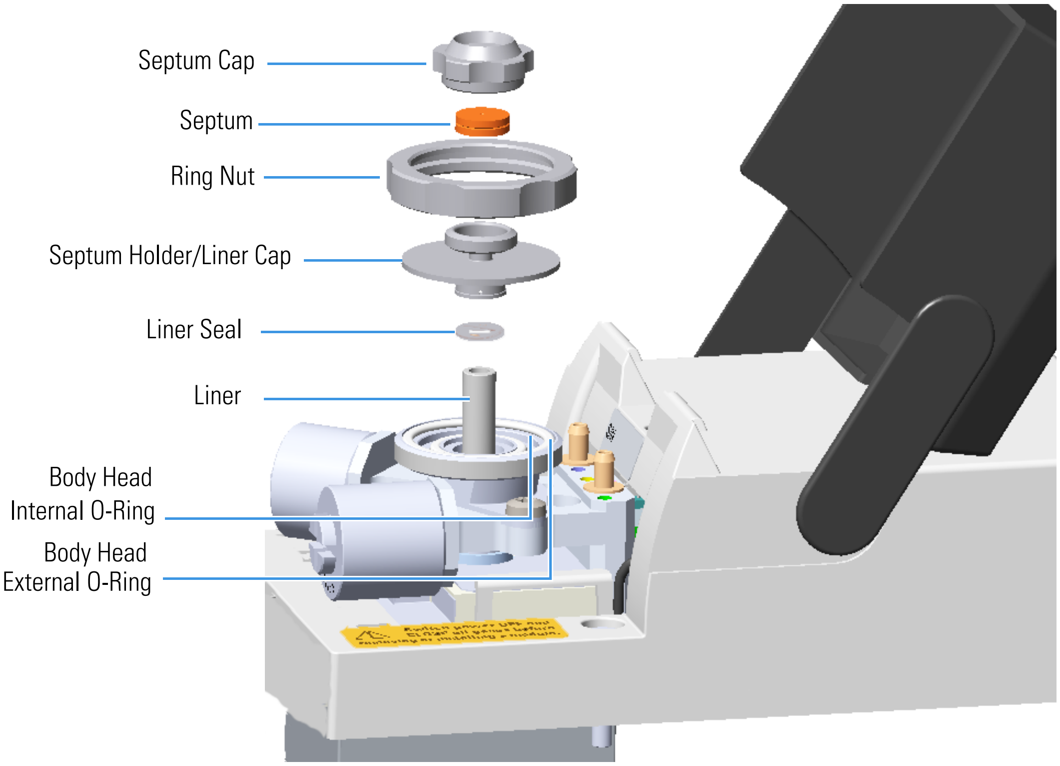


Figure 98. Helium Saver-H_2 Safer Injector Components



Maintaining the Helium Saver-H_2 Safer is largely the same as a conventional SSL inlet.

Note When using this option with a MS detector, routine septum and liner changes can be done without cooling the MS transfer line or ion source. This is desirable since cooling down and re-establishing stable MS temperatures takes much longer than cooling down and re-establishing the inlet temperature.

Routine maintenance includes:

- **Replacing the septum**

  You should change the septum periodically to prevent leakage. Replace the septum after every 200 injections, or when septum damage or wear occurs.

  See "Replacing the Septum" on page 119.

- **Cleaning or replacing the liner**

  The injection port liner needs to be replaced or cleaned as it becomes dirty.

  See "Cleaning or Replacing the Glass Liner" on page 120.

  Tip It is a best practice to replace the septum every time you replace the glass liner.

- **Replacing the active carbon filters on the carrier gas line and split line**

The active carbon filters must be replaced depending on the volume of solvent injected over time.

See "Replacing the Carrier and Split Lines Filters" on page 122.

- **Replacing the body head O-rings**

  The internal (carrier line) and external (purge line) O-rings of the body head must be replaced when there are leaks present.

  See "Replacing the Body Head O-rings" on page 124

- **Cleaning the Injector Body**

  Over time, contamination of the module will occur due to the deposition of cored septum particles or other material not captured by the glass wool of the injection port liner. In this case, the injector insert should be removed and cleaned according to the procedure.

  See "Cleaning the Injector Body" on page 125

Before maintaining the injector, read the following warning:

WARNING The injector fittings can be hot. Carry out all maintenance procedures at a low temperature to avoid burns. Therefore, before beginning the sequence, the injector must be cooled to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

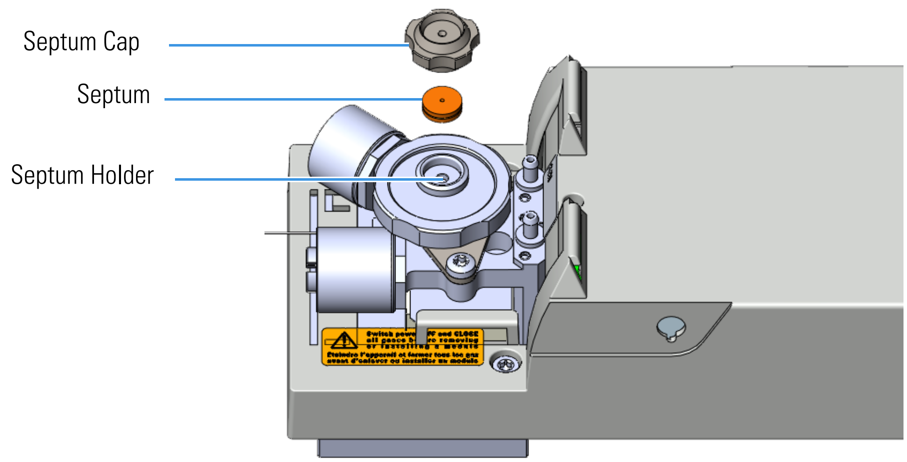
ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain an Instant Connect Helium Saver-H_2 Safer Injector
Septum
Tweezers
Glass liner
Liner seal (O-ring)
Ultrasonic cleaner
Mixture 1:1 methanol/acetone
Carrier gas line and/or split gas line active carbon filters
Body head internal O-ring
Body head external O-ring
1/8-inch wrench

Replacing the Septum

❖ To replace the septum

Figure 99. Helium Saver-H_2 Safer Septum Replacement



> **Note** Care should be taken when performing this procedure in order to keep from damaging analytical columns.

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.

   > **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Ensure the inlet configuration page is set to **Helium Saver** or **H_2 Safer**.
4. Check that there is at least 20 mL/min split flow exiting the split line, then turn the column flow to **Off** in the GC user interface and allow the inlet to depressurize.
5. Put the autosampler away if present.
6. Open the module flap cover.
7. Replace the septum.
   a. Unscrew and remove the septum cap.
   b. Using tweezers, remove the septum from the septum holder.
   c. Avoid touching the septum with your fingers. Insert a new septum into the septum holder using tweezers.
   d. Screw and tighten the septum cap to finger-tight.

> **CAUTION** Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

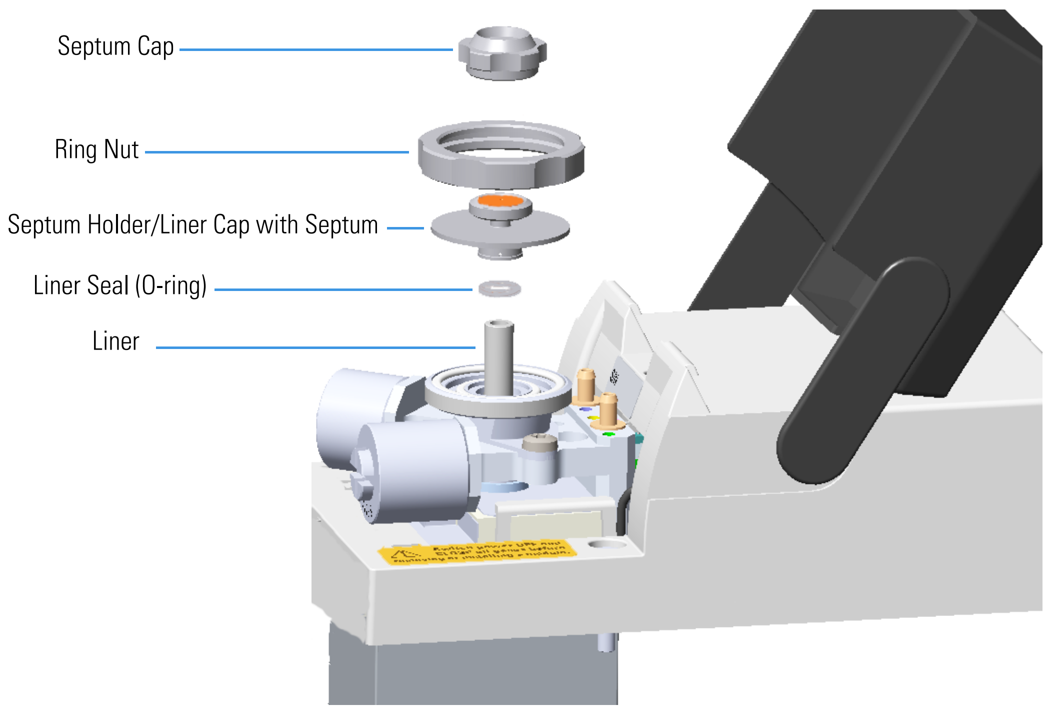
ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

8. Close the module flap cover.
9. If present, move the autosampler towards the module to restore the original alignment.
10. Wait two or three minutes for helium to purge the inlet.
11. Turn the inlet flow back on and enable the inlet heater.
12. Set the normal injector, detector, and GC working conditions.

Cleaning or Replacing the Glass Liner

❖ To clean or replace the glass liner

Figure 100. Helium Saver-H_2 Safer Glass Liner Replacement



Note Care should be taken when performing the procedure in order to keep from damaging analytical columns.

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.

   Note By pressing the **Maintenance** button, the GC will cool down automatically.

3. Ensure the inlet configuration page is set to **Helium Saver** or **H_2 Safer**.

4. Check that there is at least 20 mL/min split flow exiting the split line, then turn the column flow to **Off** in the GC user interface and allow the inlet to depressurize.
5. Remove the autosampler if present.
6. Open the module flap cover.
7. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
8. Remove the liner.
   a. Using tweezers, remove the liner with the liner seal (O-ring) from the injector.
9. Replace or clean the liner.
   - If you are going to clean the dirty liner, go to step 10.
   - If you are going to use a new liner, go directly to step 11.
10. Clean the liner.
   a. Put the liner into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).
   b. Sonicate the liner for about half an hour.
   c. Using tweezers, remove the liner from the bath and dry it with compressed clean air.
11. Install the liner
   a. Holding the new (or cleaned) liner with tweezers place a new liner seal over the liner.
   b. Insert the liner into the injector and push it gently towards the bottom of the injector.
12. Reinstall the top parts of the injector.
   a. Place the septum holder/liner cap with the septum on the body head of the injector and fix it by screwing the ring nut.
   b. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

13. Close the module flap cover.
14. If present, move the autosampler towards the module to restore the original alignment.
15. Wait two or three minutes for helium to purge the inlet.

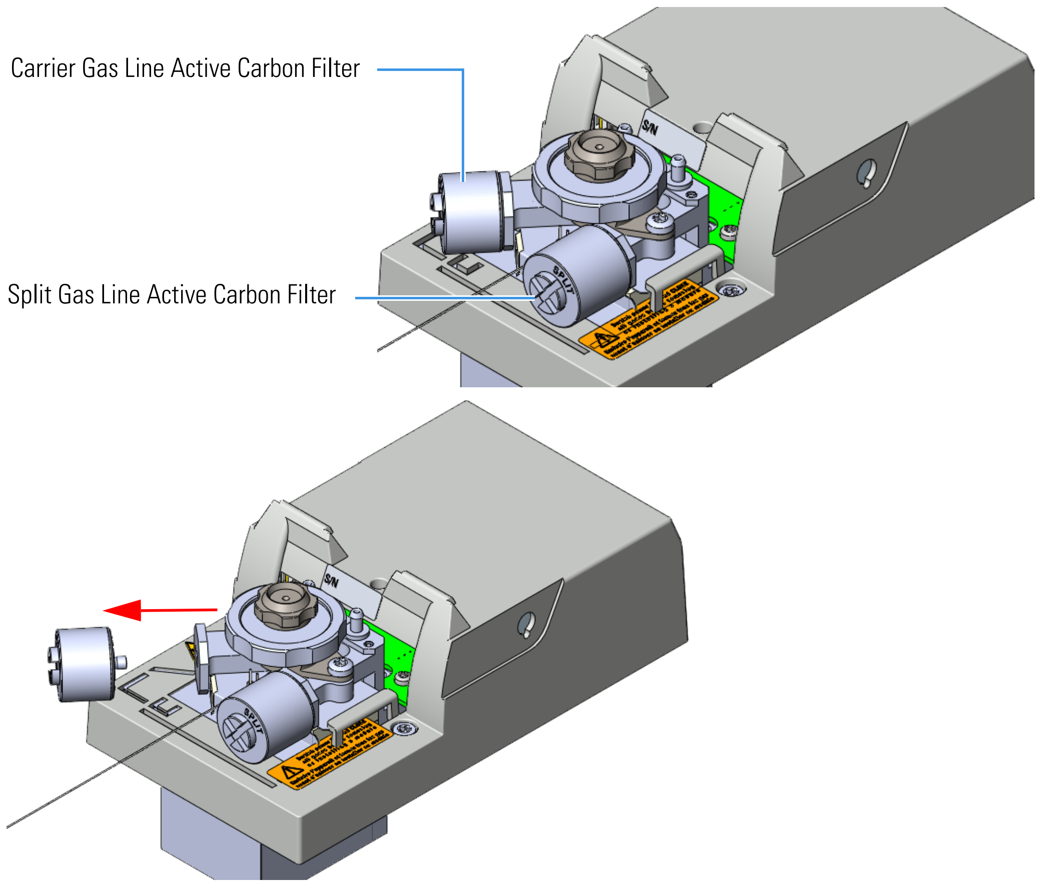
16. Turn the inlet flow back on and enable the inlet heater.
17. Set the normal injector, detector, and GC working conditions.

Replacing the Carrier and Split Lines Filters

IMPORTANT The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

❖ To replace the active carbon filters on carrier gas line and split line

Figure 101. Helium Saver-H_2 Safer Active Filter Replacement



1. Put the GC in standby condition, then cool the oven and injector to room temperature.

Note By pressing the **Maintenance** button, the GC will cool down automatically.

2. Ensure the inlet configuration page is set to **Helium Saver** or **H_2 Safer**.
3. Check that there is at least 20 mL/min split flow exiting the split line, then turn the column flow to **Off** in the GC user interface and allow the inlet to depressurize.

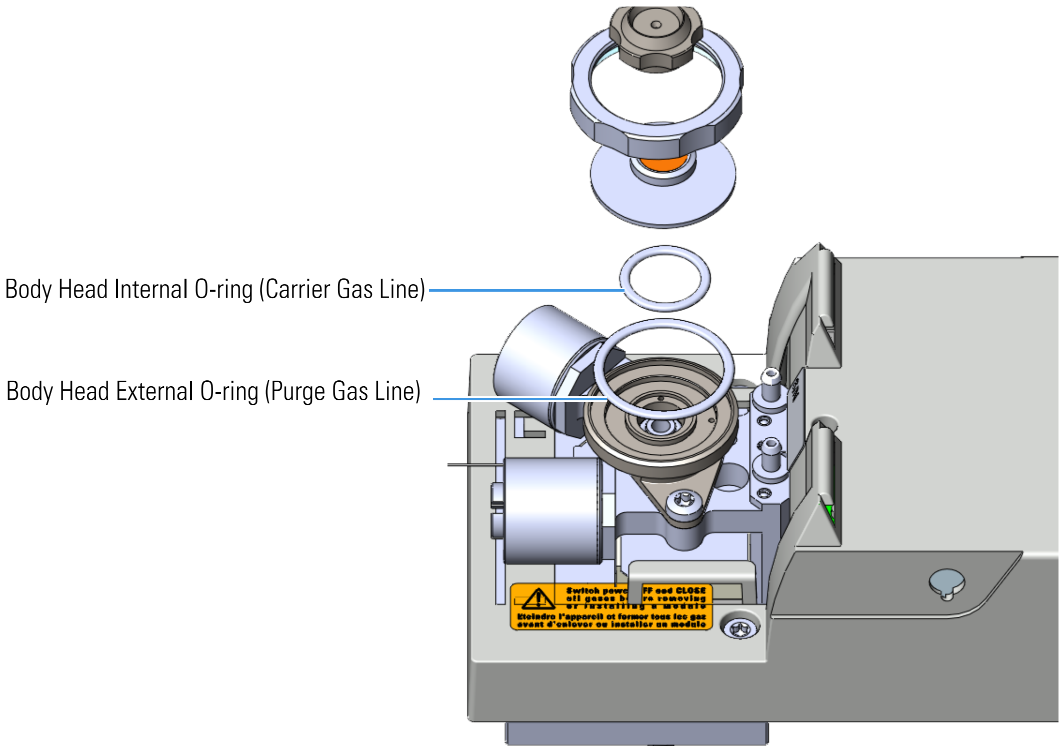
4. Remove the autosampler if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counterclockwise.
   b. Install the new filter, with O-rings, in its seat by turning it clockwise.
7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Wait two or three minutes for helium to purge the inlet.
10. Turn the inlet flow back on and enable the inlet heater.
11. Set the normal injector, detector, and GC working conditions.

.

Replacing the Body Head O-rings

❖ To replace the body head O-rings

Figure 102. Helium Saver-H_2 Safer Body Head O-Rings Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Ensure the inlet configuration page is set to **Helium Saver** or **H_2 Safer**.
4. Check that there is at least 20 mL/min split flow exiting the split line, then turn the column flow to **Off** in the GC user interface and allow the inlet to depressurize.
5. Remove the autosampler if present.
6. Open the module flap cover.
7. Remove the top parts of the injector.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.

8. Replace the head body O-rings.
   a. Use tweezers to remove the body head internal and external O-rings and replace them with new O-rings.
9. Reinstall the top parts of the injector.
   a. Place the septum holder/liner cap with the septum on the body head of the injector and fix it by screwing the ring nut.
   b. Screw and tighten the injector cap to finger tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

10. Close the module flap cover.
11. If present, move the autosampler towards the module to restore the original alignment.
12. Wait two or three minutes for helium to purge the inlet.
13. Turn the inlet flow back on and enable the inlet heater.
14. Set the normal injector, detector, and GC working conditions.

Cleaning the Injector Body

Over time, contamination of the Helium Saver-H_2 Safer will occur due to deposits of cored septum particles or other material not captured by the glass wool of the injection port liner. In this case, the injector insert should be removed and cleaned according to the following steps.

❖ To clean the Instant Connect Helium Saver-H_2 Safer injector body

Materials needed
Ultrasonic cleaning bath
Methanol/acetone mixture 1:1
GC-grade methanol
Methylene chloride
Hexane
T20 Torxhead screwdriver
Forceps or tweezers

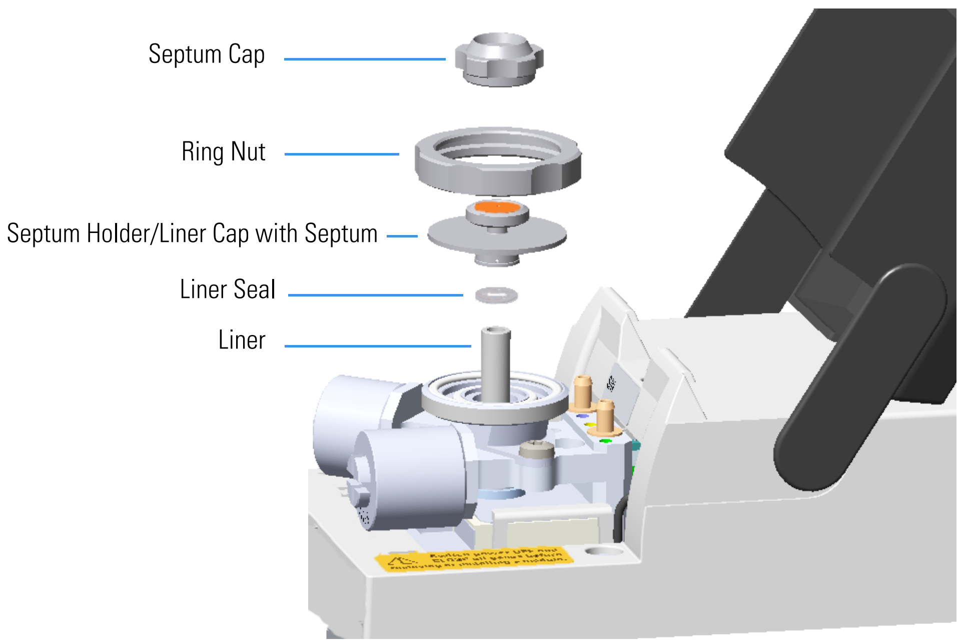
1. Put the GC in standby condition.
2. Cool the GC oven, injectors, and detectors.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

Note If you are using a mass spectrometer, vent it and set the inlet flow rate (nitrogen) to **Off**. Keep the helium enabled and pressurized as usual.

3. Remove the autosampler if present.
4. Open the module flap cover.
5. Remove the top parts of the injector. See Figure 103.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
6. Remove the liner. See Figure 103.
   a. Use tweezers to remove the liner with the liner seal from the injector.
7. Remove the analytical column.
   a. Unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.

Figure 103. Helium Saver-H_2 Safer: Cleaning the Injector Body



8. Disconnect the transfer tube to the mating block of the gas net on the top deck.
   a. Loosen the fitting of the helium transfer tube and remove the tube from the gas net.
9. Remove the body head O-rings. See Figure 104.
   a. Using tweezers, remove both the internal and external body head O-rings.

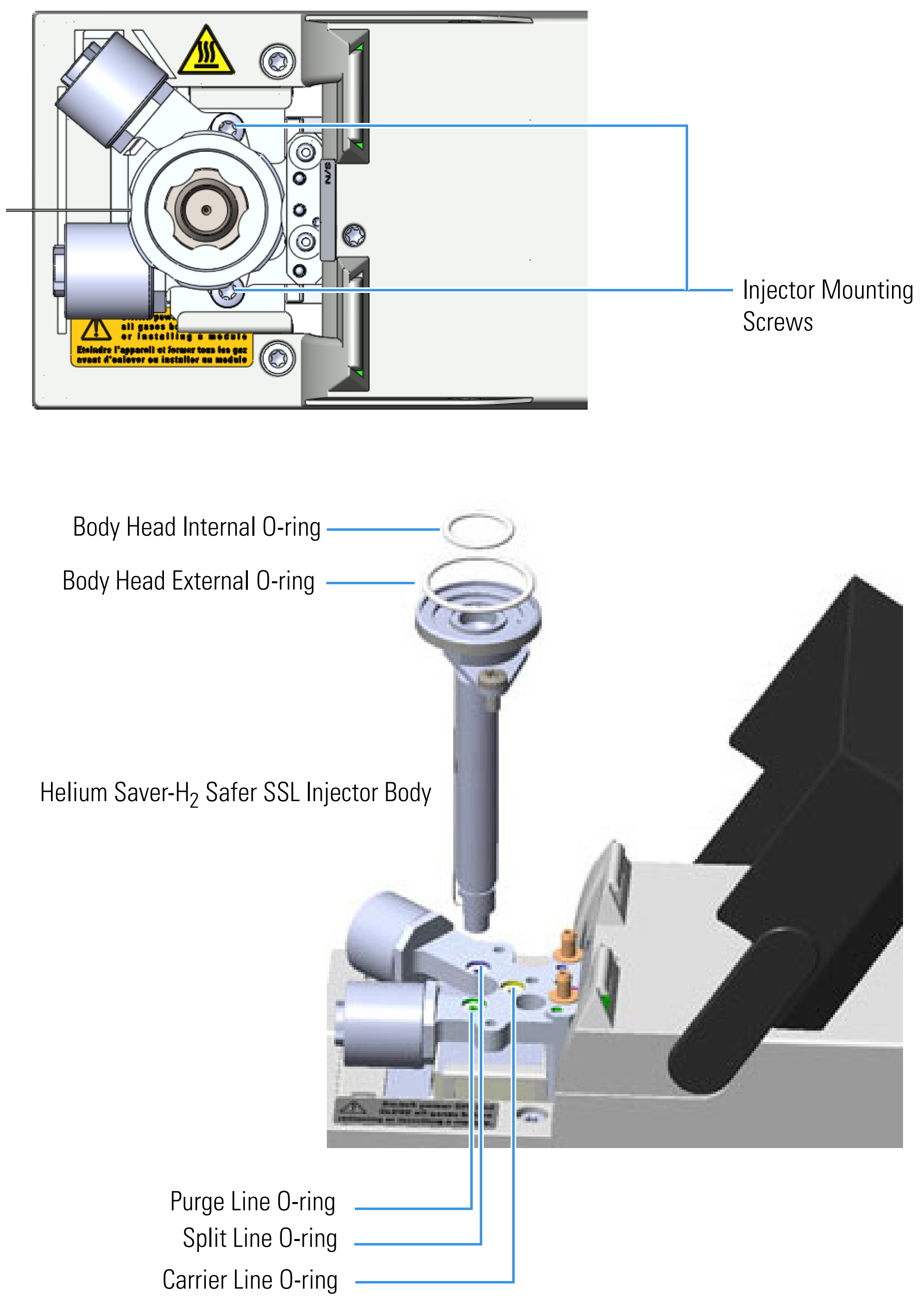
b. Place and keep all the removed components on a clean surface.

10. Remove the injector body. See Figure 104.

a. Using a T20 Torx screwdriver, undo the two-injector body fixing screws, and extract the injector body from its housing.

Note Do not remove the carrier, split and purge lines O-rings.

Figure 104. Cleaning the Helium Saver-H_2 Safer Injector Body



11. Clean the injector body.

    a. Thoroughly rinse the insert then ultrasonically clean in chromatographic grade methanol or acetone followed by solvents of lower polarity such as methylene chloride and hexane. Limit ultrasonication to 5 min in each solvent.

    b. Blow dry the insert using high purity gas (do not use compressed house air as it contains residual oils from the compressor) then assemble in the reverse order of removal.

    Note Do not use abrasives, cleaning wires, or brushes on the inlet insert as these will damage the passivation treatment layers. Be especially careful not to bend the short segment of tubing at the base of the insert interior. Nothing should be inserted into the bore of the insert other than glass liners.

12. Reinstall the injector body.

    a. Reinstall and fix the injector body into its housing by screwing the two fixing screws.

    b. Using tweezers, replace both the internal and external body head O-rings.

13. Reconnect to the gas net.

    Replace the gas net O-ring with a new one whenever it is damaged or clearly deteriorated.

14. Reinstall the liner.

    a. Using tweezers, place the liner seal over the liner, insert the liner into the injector, and push it gently towards the bottom of the injector.

15. Reinstall the analytical column. See "Installing the Column" on page 53.

16. Reinstall the top parts of the injector.

    a. Place the septum holder/liner cap with the septum on the body head of the injector. Fix them by screwing the ring nut.

    b. Screw and tighten the injector cap to finger tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

17. Close the module flap cover.

18. If present, move the autosampler towards the module to restore the original alignment.

19. Wait two or three minutes for helium to purge the inlet.

20. Turn the inlet flow back on and enable the inlet heater.

21. Set the normal injector, detector, and GC working conditions.

Maintaining a Programmable Temperature Vaporizing Injector (PTV)

This section provides instructions for maintaining an Instant Connect Programmable Temperature Vaporizing injector (PTV).

The module and injector components are shown in Figure 105 and Figure 106.

Figure 105. PTV Module Components

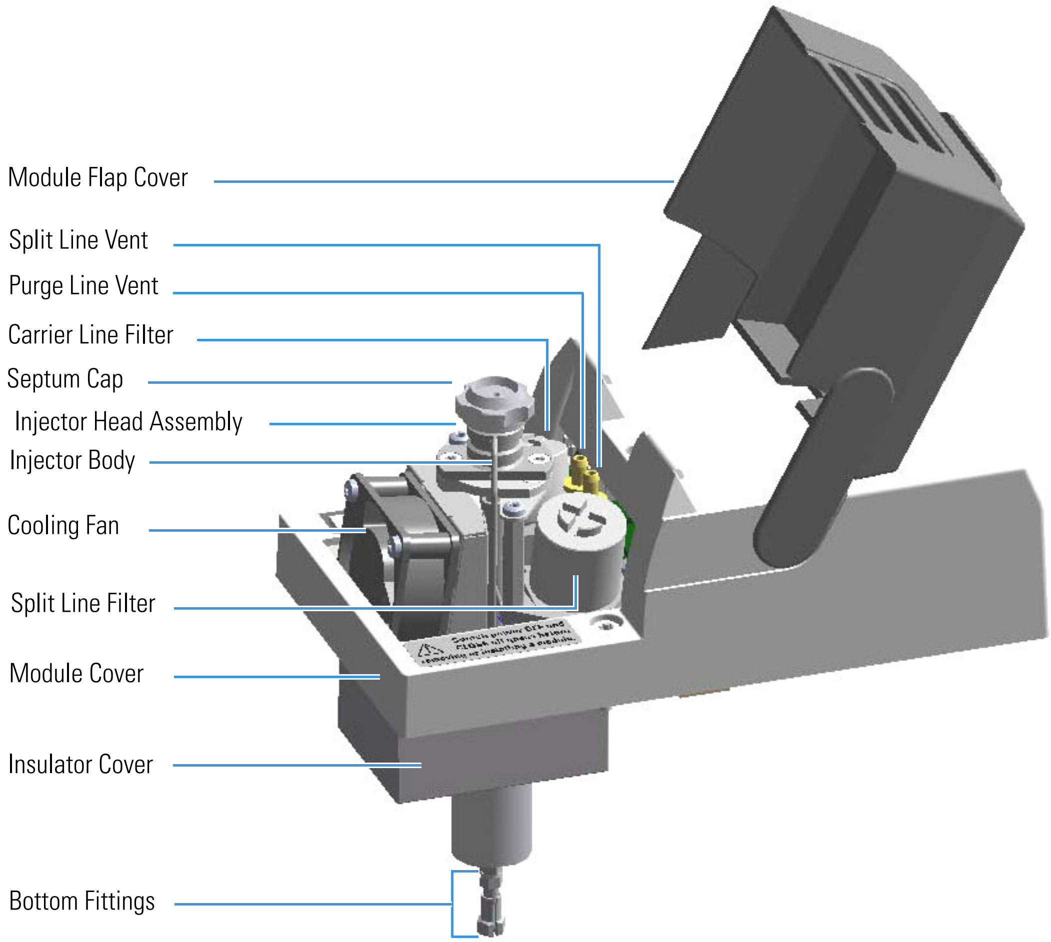
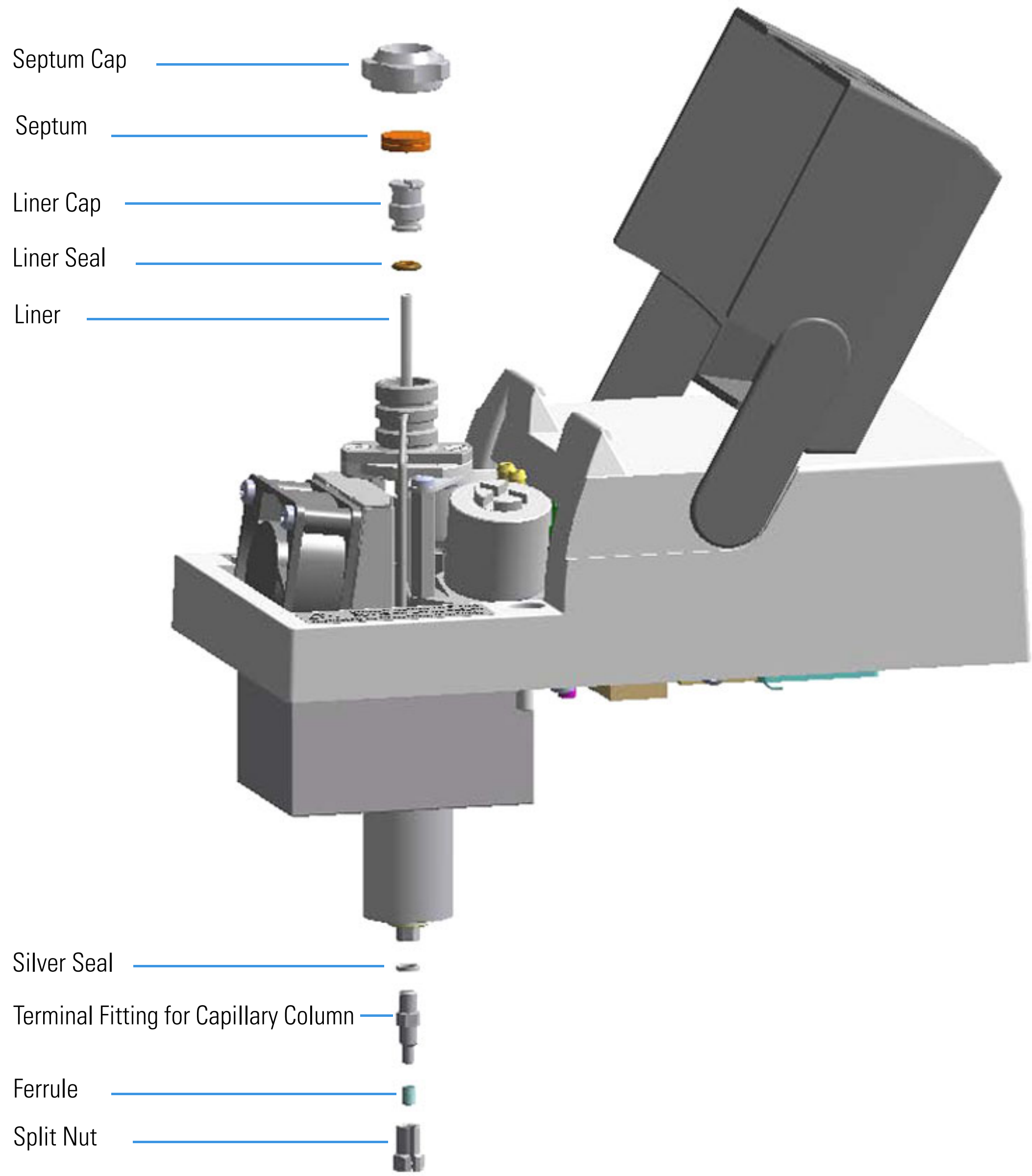


Figure 106. PTV Injector Components



The PTV injector periodic maintenance includes:

- **Replacing the PTV septum**

  Replace the septum at least after every 200 injections, or every time a problem related to septum damage, or wear occurs.

  See "Replacing the PTV Septum" on page 132.

- **Cleaning or replacing the PTV liner**

  Check the liner for contaminants, debris, breakage and proper installation.

The liner must be replaced depending on the number of injections performed, and the characteristics of the samples injected. Typical symptoms will indicate that the liner must be replaced. The most common is the appearance of tailing peaks in the chromatogram, particularly for polar compounds.

Tip It is good practice to replace the septum every time you replace the gas liner.

See "Cleaning or Replacing the PTV Glass Liner" on page 133.

When replacing or removing a glass liner, it might break inside the injector. In this case the broken parts of the liner must be removed from the injector, including the glass splinters that might fall into the lower part of the vaporization chamber.

See "Replacing the PTV Broken Liner" on page 136.

- **Replacing the active carbon filters on the carrier gas line and split line**

  The active carbon filters must be replaced depending on the volume of solvent injected in the time.

  See "Replacing the PTV Carrier and Split Lines Filters" on page 138.

Before maintaining the injector, read the following warning:

WARNING The injector fittings could be hot. Carry out all the operation at low temperature to avoid burns. Therefore, before beginning the sequence, the injector must be cooled to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a PTV injector
Septum
Tweezers
Glass liner
Liner seal (O-ring)
Ultrasonic cleaner
Mixture 1:1 methanol/acetone
Carrier gas line and/or split gas line active carbon filters
5.5 x 25 mm slotted stubby driver
Silver seal

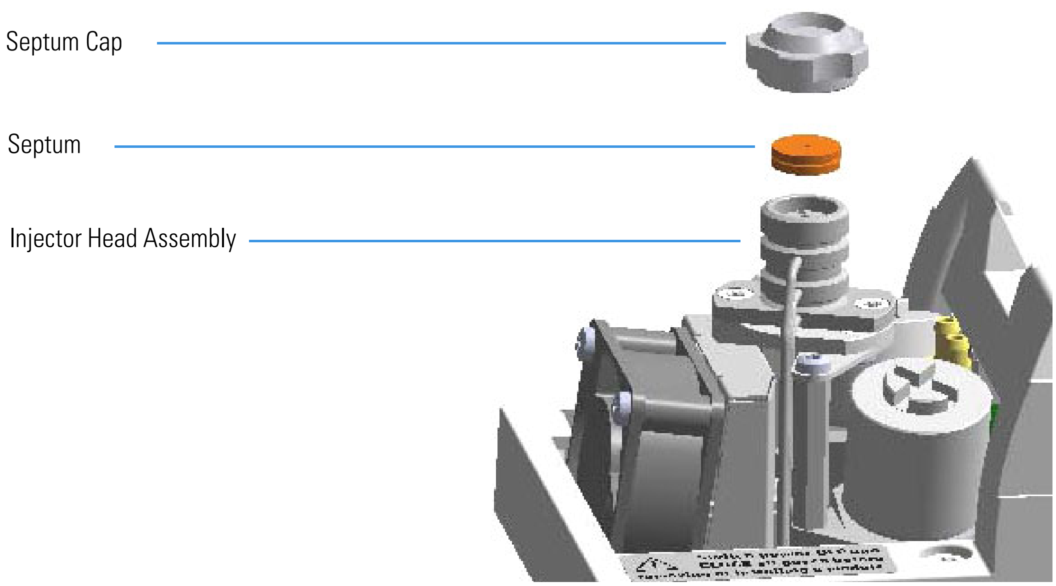
Note For maintaining or replacing any other component not listed in this section, see Chapter 6, "Injectors Advanced Maintenance."

- "Baking-out Contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF Injectors" on page 248
- "Removing/Replacing an Injector Module" on page 249
- "Cleaning the PTV Injector Head Assembly" on page 264

Replacing the PTV Septum

❖ To replace the septum

Figure 107. PTV Injector: Septum Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the septum.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the injector head assembly.

c. Avoid touching the septum with your fingers. Insert a new septum into the injector head assembly using tweezers. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

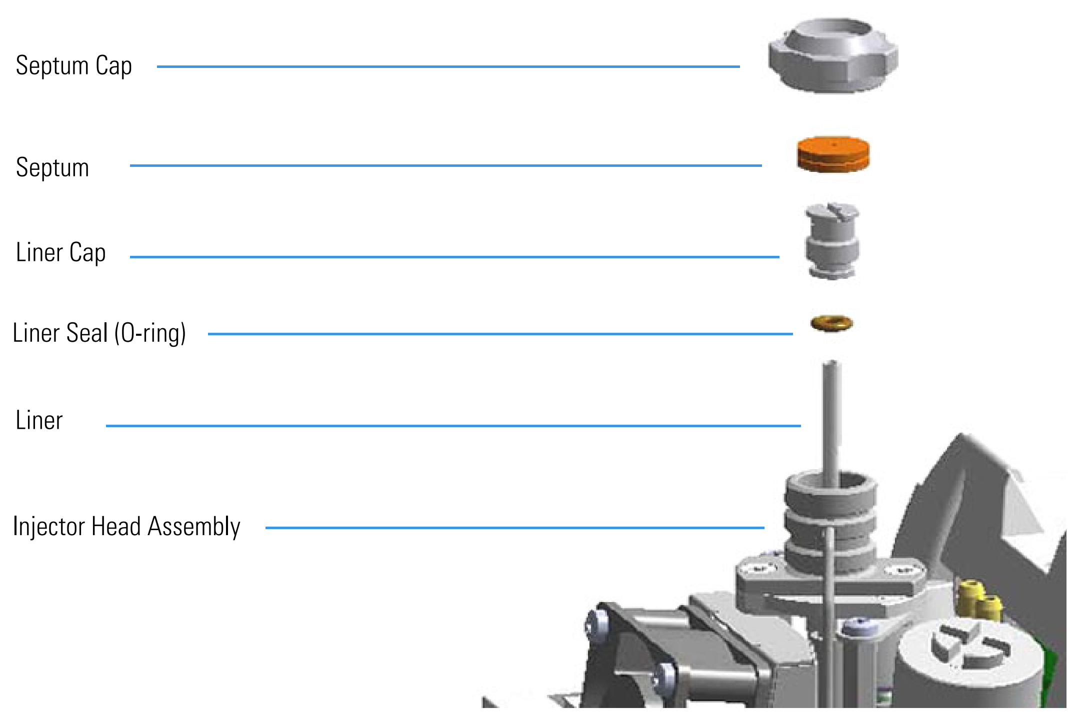
7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Cleaning or Replacing the PTV Glass Liner

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ **To clean or replace the glass liner**

Figure 108. PTV Injector: Glass Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top part of the injector.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the top of the injector head assembly.
7. Remove the liner.
   a. Using the slotted stubby driver provided, unscrew and remove the liner cap.
   b. Use tweezers to remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, see “Replacing a SSL Broken Liner” on page 91.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez “Remplacement d’un liner SSL cassé”.

8. Replace or clean the liner.
   - If you are going to use a new liner, go directly to step 10.
   - If you are going to clean the dirty liner, go to step 9.
9. Clean the liner.
   a. Put the liner into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).
   b. Sonicate the liner for about half an hour.
   c. Using tweezers, remove the liner from the bath, and dry it with compressed clean air.
10. Install the liner
    a. Holding the new (or cleaned) liner with tweezers place a new liner seal over the liner.
    b. Insert the liner into the injector, and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.

11. Reinstall the top parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

    b. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

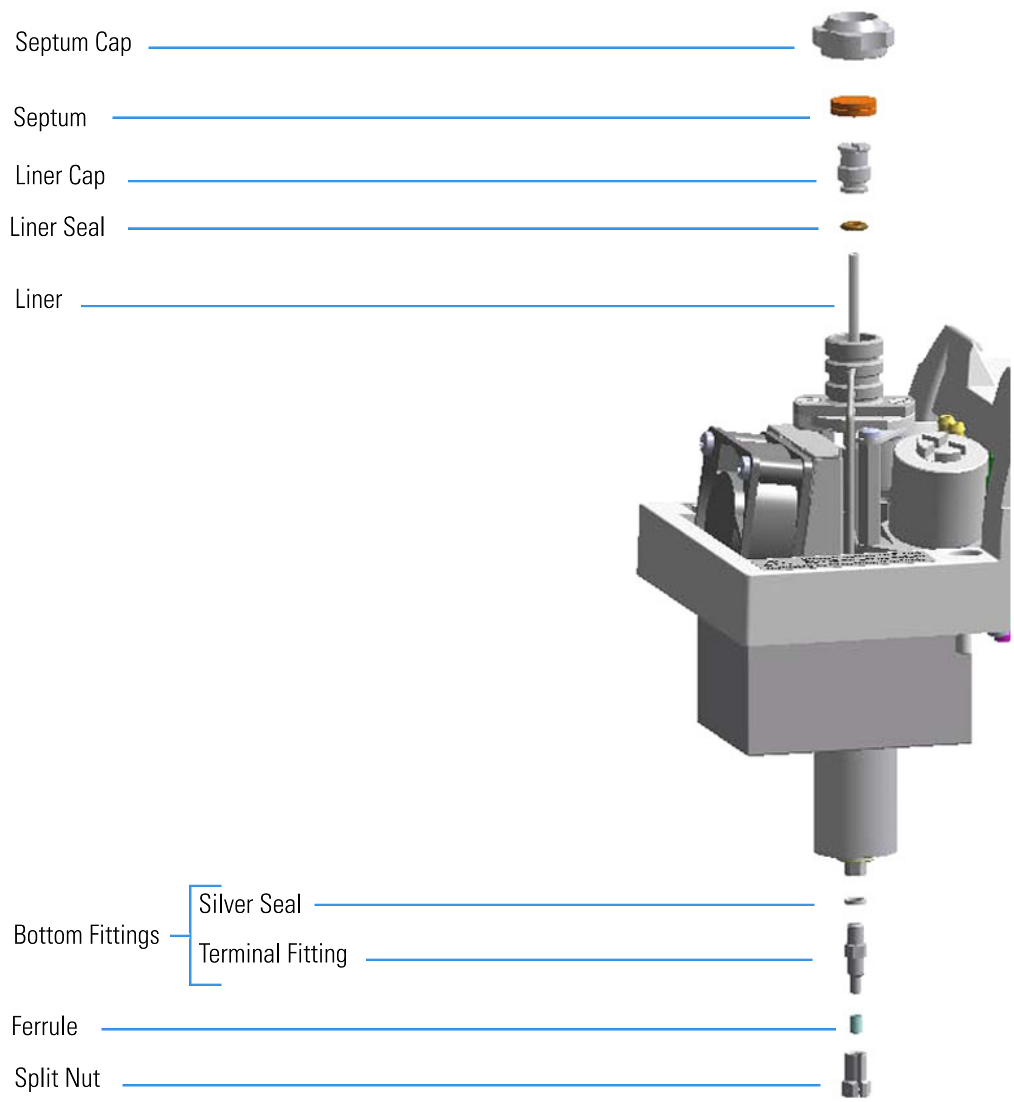
ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector, and GC working conditions.

Replacing the PTV Broken Liner

❖ To replace a broken liner

Figure 109. PTV Injector: Broken Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.

5. Open the module flap cover.
6. Remove the top part of the injector.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the top of the injector head assembly.
7. Remove the broken liner.
   a. Using the slotted stubby driver provided, unscrew and remove the liner cap.
   b. Use tweezers to remove the upper part of broken liner with the liner seal from the injector.
8. Remove the bottom parts of the injector.
   a. Inside the oven, unscrew the split nut, and remove the analytical column with its ferrule from the terminal fitting at the bottom of the injector.
   b. Unscrew the terminal fitting with the silver seal. Glass splinters from the broken liner will fall from the injector.
   c. With the aid of a pipe cleaner, remove the possible glass fragments from the vaporization chamber.
9. Reinstall the bottom part of the injector.
   a. Reinstall the terminal fitting with the silver seal.
   b. Reinstall the analytical column.
10. Install a new liner.
    a. Holding the new liner with tweezers, place a new liner seal over the liner.
    b. Insert the liner into the injector, and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.
11. Reinstall the top parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

    b. Screw and tighten the injector cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector, and GC working conditions.

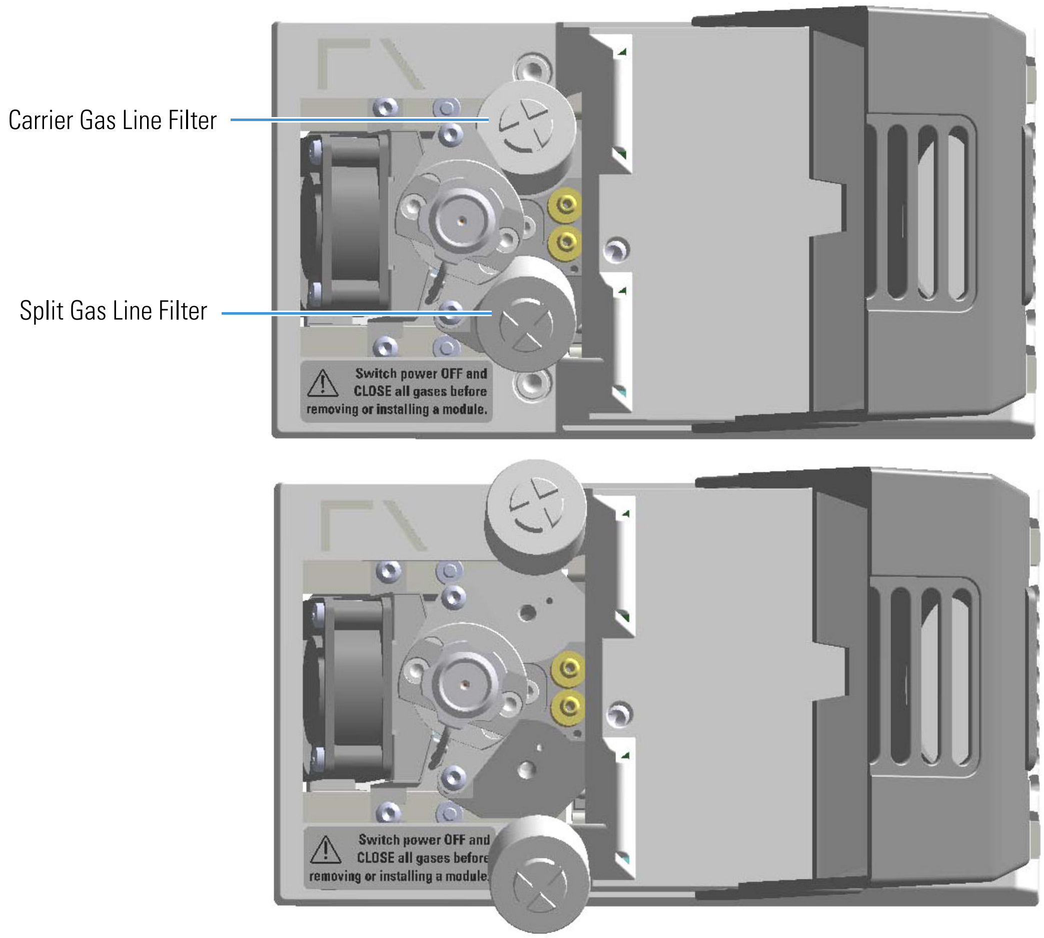
Replacing the PTV Carrier and Split Lines Filters

CAUTION The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

ATTENTION Les dimensions des filtres sont différentes. Le filtre sur la conduite de gaz à débit divisé est plus grand que le filtre sur la conduite de gaz vecteur. N’inversez pas leur position pendant leur remplacement. Il n’est pas nécessaire de remplacer les filtres en même temps.

❖ To replace the active carbon filters on carrier gas line and split line

Figure 110. PTV Injector: Active Filters Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counter-clockwise.
   b. Install the new filter, with the O-rings, in its seat by turning it clockwise.
7. Close the module flap cover.

8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Maintaining a Programmable Temperature Vaporizing Injector with Backflush (PTVBKF)

This section provides instructions for maintaining an Instant Connect Programmable Temperature Vaporizing injector for backflush (PTVBKF) applications.

The module and injector components are shown in Figure 111 and Figure 112.

Figure 111. PTVBKF Module Components

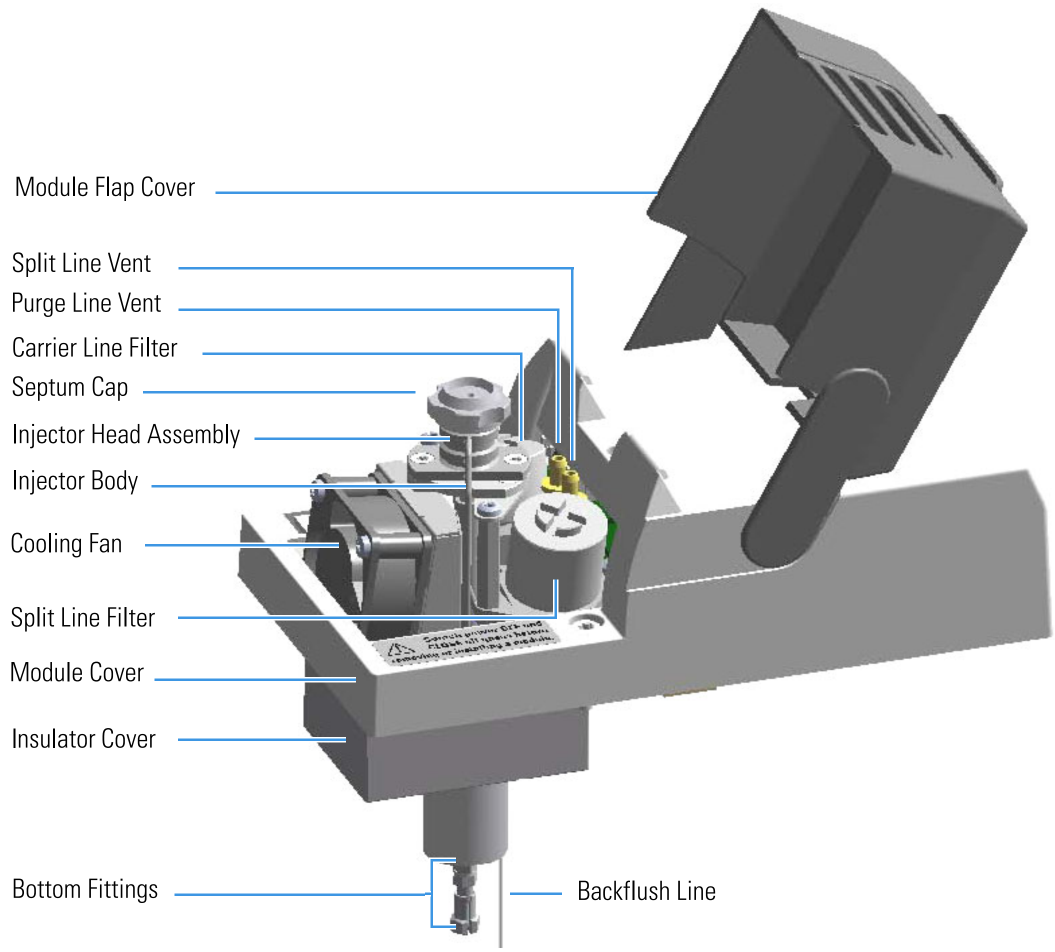
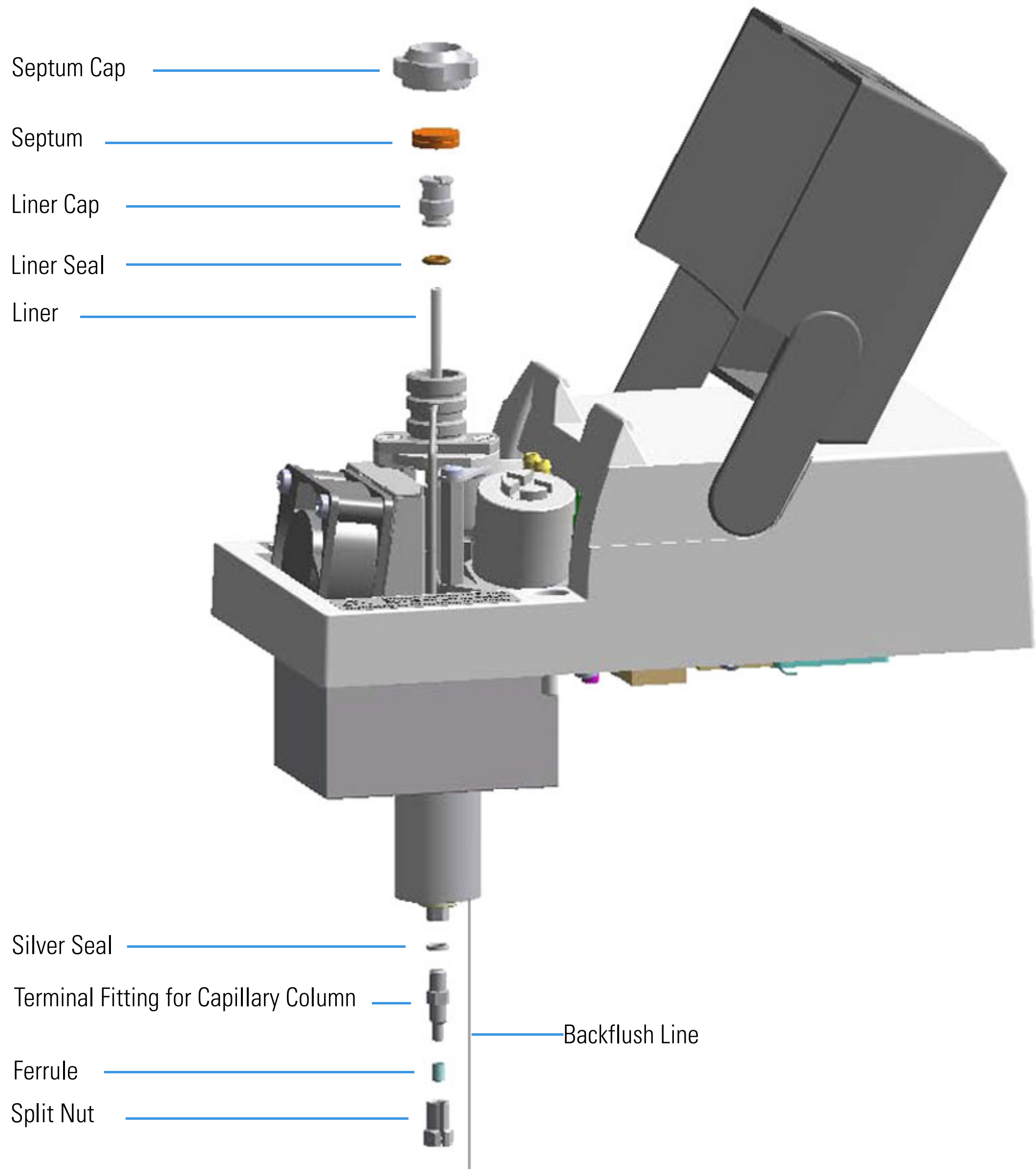


Figure 112. PTVBKF Injector Components



The PTVBKF injector periodic maintenance includes:

- **Replacing the PTVBKF septum**

  Replace the septum at least after every 200 injections, or every time a problem related to septum damage, or wear occurs.

  See "Replacing the PTVBKF Septum" on page 143.

- **Cleaning or replacing the PTVBKF liner**

Check the liner for contaminants, debris, breakage and proper installation. The liner must be replaced depending on the number of injections performed, and the characteristics of the samples injected. Typical symptoms will indicate that the liner must be replaced. The most common is the appearance of tailing peaks in the chromatogram, particularly for polar compounds.

See “Cleaning or Replacing the PTVBKF Glass Liner” on page 144

Tip It is good practice to replace the septum every time the liner is replaced.

When replacing or removing a glass liner, it might break inside the injector. In this case the broken parts of the liner must be removed from the injector, including the glass splinters that might fall into the lower part of the vaporization chamber.

See “Replacing the PTVBKF Broken Liner” on page 147.

- **Replacing the PTVBKF active carbon filters on the carrier gas line and split line**

  The active carbon filters must be replaced depending on the volume of solvent injected in the time.

  See Replacing the PTVBKF Carrier and Split Lines Filters on page 149.

Before maintaining the injector, read the following warning:

WARNING The injector fittings could be hot. Carry out all operations at low temperature to avoid burns. Therefore, before beginning the sequence, the injector must be cooled to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a PTVBKF injector
Septum
Tweezers
Glass liner
Liner seal (O-ring)
Ultrasonic cleaner
Mixture 1:1 methanol/acetone
Carrier gas line and/or split gas line active carbon filters
5.5 x 25 mm slotted stubby driver
Silver seal

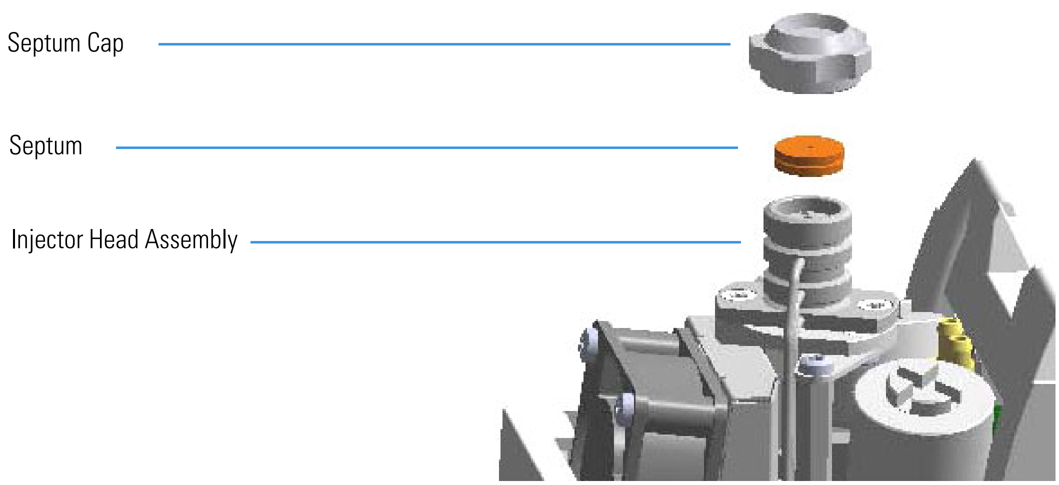
Note For maintaining or replacing any other component not listed in this section, see Chapter 6, “Injectors Advanced Maintenance.”

- “Baking-out Contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF Injectors” on page 248
- “Removing/Replacing an Injector Module” on page 249
- “Cleaning the PTVBKF Injector Head Assembly” on page 272

Replacing the PTVBKF Septum

❖ To replace the septum

Figure 113. PTVBKF Injector: Septum Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the septum.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the injector head assembly.
   c. Avoid touching the septum with your fingers. Insert a new septum into the injector head assembly using tweezers. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

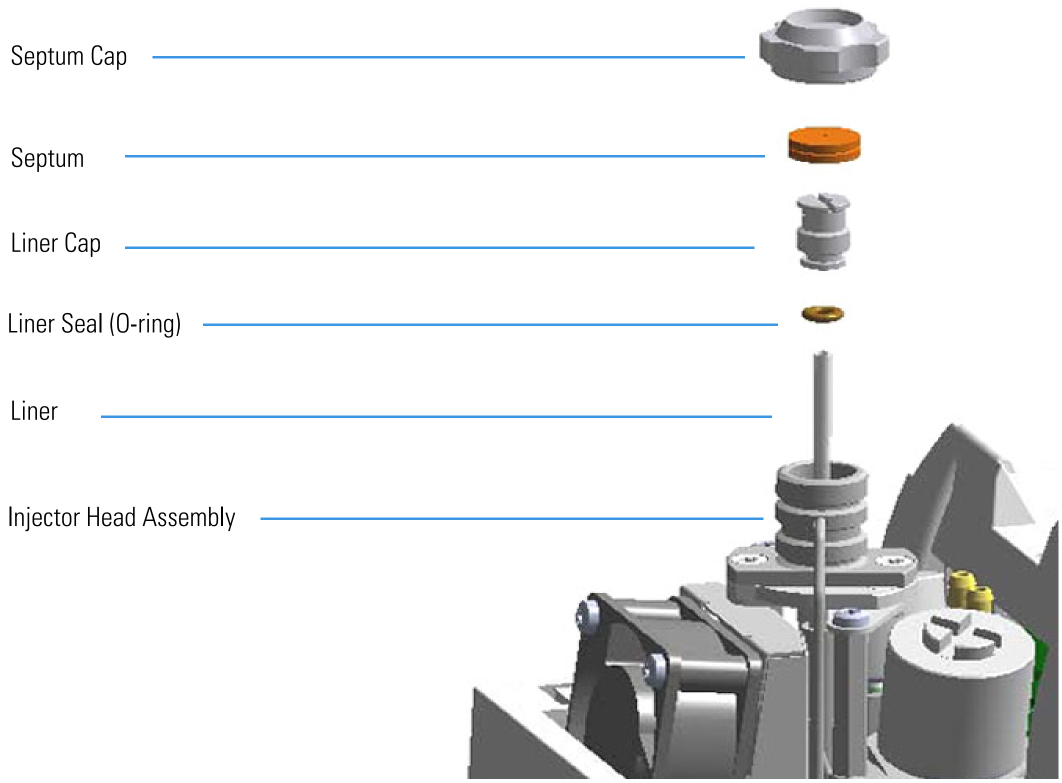
ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

7. Close the module flap cover.
8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

Cleaning or Replacing the PTVBKF Glass Liner

❖ **To clean or replace the glass liner**

Figure 114. PTVBKF Injector: Glass Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.

3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top part of the injector.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the top of the injector head assembly.
7. Remove the liner.
   a. Using the slotted stubby driver provided, unscrew and remove the liner cap.
   b. Use tweezers to remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, see "Replacing a SSL Broken Liner" on page 91.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez "Remplacement d'un liner SSL cassé".

8. Replace or clean the liner.
   - If you are going to use a new liner, go directly to step 9.
   - If you are going to clean the dirty liner, go to step 10.
9. Clean the liner.
   a. Put the liner into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).
   b. Sonicate the liner for about half an hour.
   c. Using tweezers, remove the liner from the bath, and dry it with compressed clean air.
10. Install the liner.
    a. Holding the new (or cleaned) liner with tweezers, place a new liner seal over the liner.
    b. Insert the liner into the injector, and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.
11. Reinstall the top parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

b. Screw and tighten the septum cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

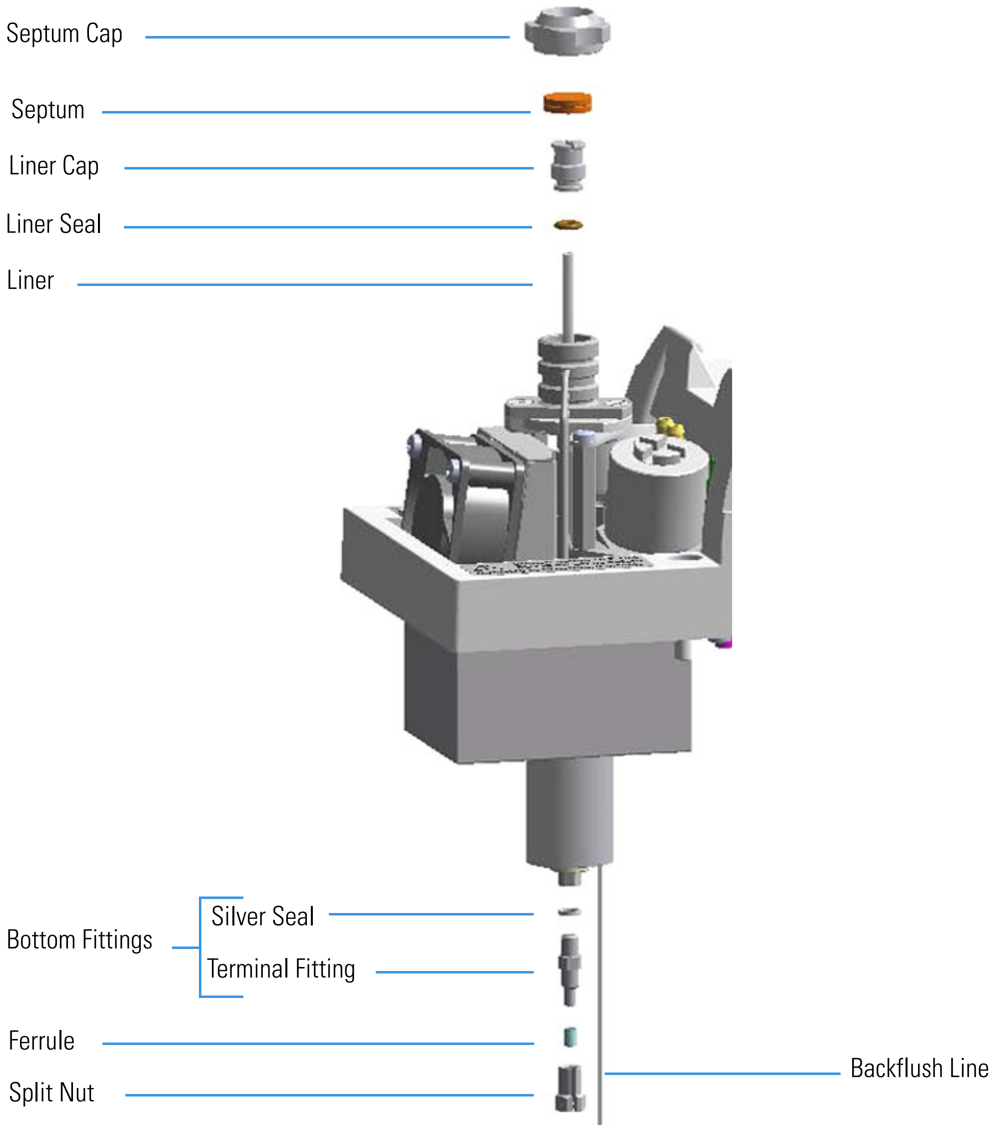
ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector, and GC working conditions.

Replacing the PTVBKF Broken Liner

❖ **To replace a broken liner**

Figure 115. PTVBKF Injector: Broken Liner Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.

5. Open the module flap cover.
6. Remove the top part of the injector.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the top of the injector head assembly.
7. Remove the broken liner.
   a. Using the slotted stubby driver provided, unscrew and remove the liner cap.
   b. Use tweezers to remove the upper part of broken liner with the liner seal from the injector.
8. Remove the bottom parts of the injector.
   a. Inside the oven, unscrew the split nut, and remove the analytical column with its ferrule from the terminal fitting at the bottom of the injector.
   b. Unscrew the terminal fitting with the silver seal. Glass splinters from the broken liner will fall from the injector.
   c. With the aid of a pipe cleaner, remove the possible glass fragments from the vaporization chamber.
9. Reinstall the bottom part of the injector.
   a. Reinstall the terminal fitting with the silver seal (if necessary replace it with a new one).
   b. Reinstall the analytical column.
10. Install a new liner.
    a. Holding the new liner with tweezers, place a new liner seal over the liner.
    b. Insert the liner into the injector, and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.
11. Reinstall the top parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

    b. Screw and tighten the injector cap to finger-tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

12. Close the module flap cover.
13. If present, move the autosampler towards the module to restore the original alignment.
14. Turn the carrier gas on.
15. Set the normal injector, detector, and GC working conditions.

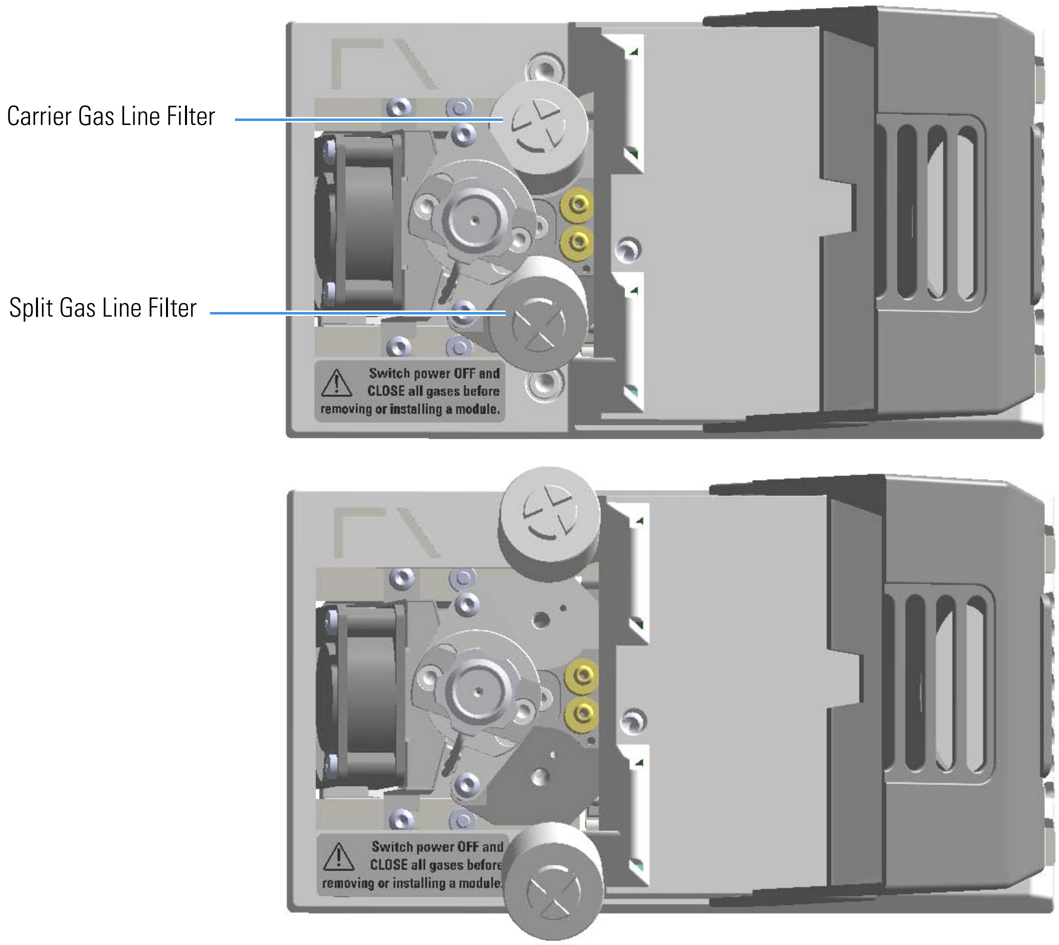
Replacing the PTVBKF Carrier and Split Lines Filters

CAUTION The dimensions of the filters are different. The filter on the split gas line is bigger than the filter on the carrier gas line. Do not invert their position when you replace them. It is not necessary to replace the filters together.

ATTENTION Les dimensions des filtres sont différentes. Le filtre sur la conduite de gaz à débit divisé est plus grand que le filtre sur la conduite de gaz vecteur. N'inversez pas leur position pendant leur remplacement. Il n'est pas nécessaire de remplacer les filtres en même temps.

❖ To replace the active carbon filters on carrier gas line and split line

Figure 116. PTVBKF Injector: Active Filters Replacement



1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   > **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Replace the filter.
   a. Remove the filter to replace from its seat by turning it counter-clockwise.
   b. Install the new filter, with the O-rings, in its seat by turning it clockwise.
7. Close the module flap cover.

8. If present, move the autosampler towards the module to restore the original alignment.
9. Turn the carrier gas on.
10. Set the normal injector, detector, and GC working conditions.

4

Performing Detectors Routine Maintenance

This chapter provides instructions for performing routine maintenance on the TRACE 1600/1610 detectors modules.

Contents

Maintaining a Flame Ionization Detector (FID)

This section provides instructions for maintaining an Instant Connect Flame Ionization Detector (FID). The module and detector components are shown in Figure 117 and Figure 118.

Figure 117. FID: Module Components

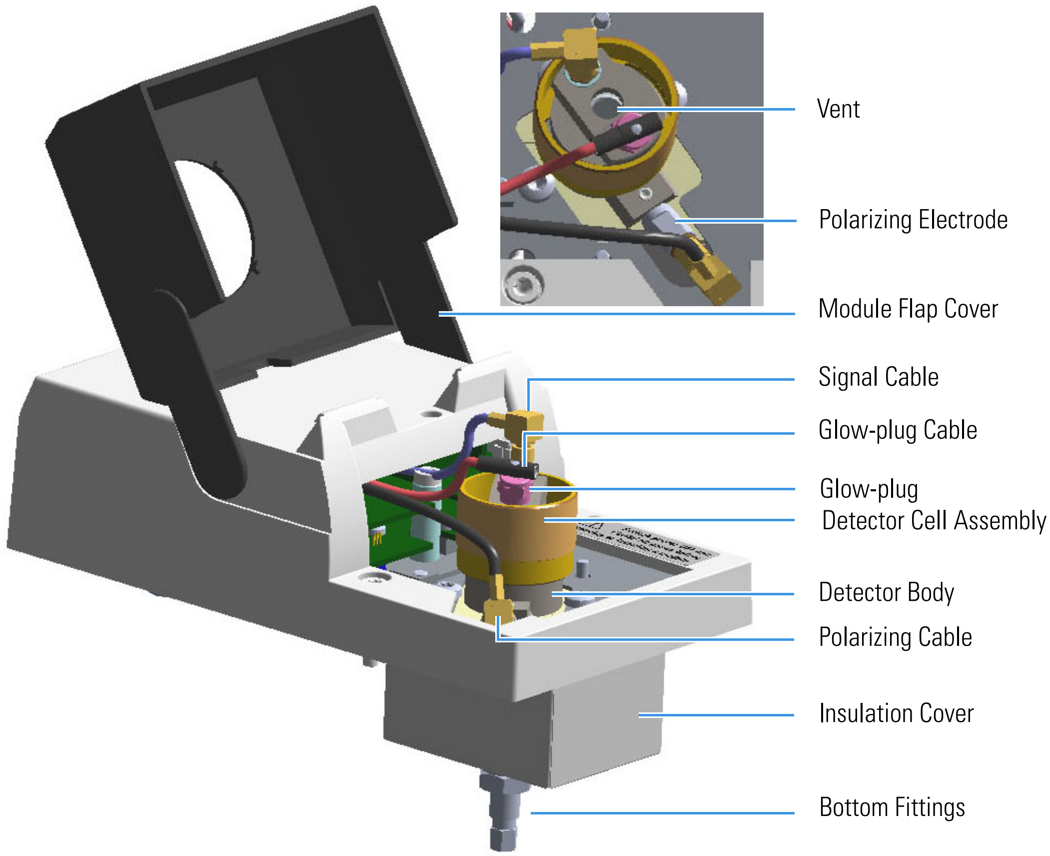


Figure 118. FID: Cell Assembly Components

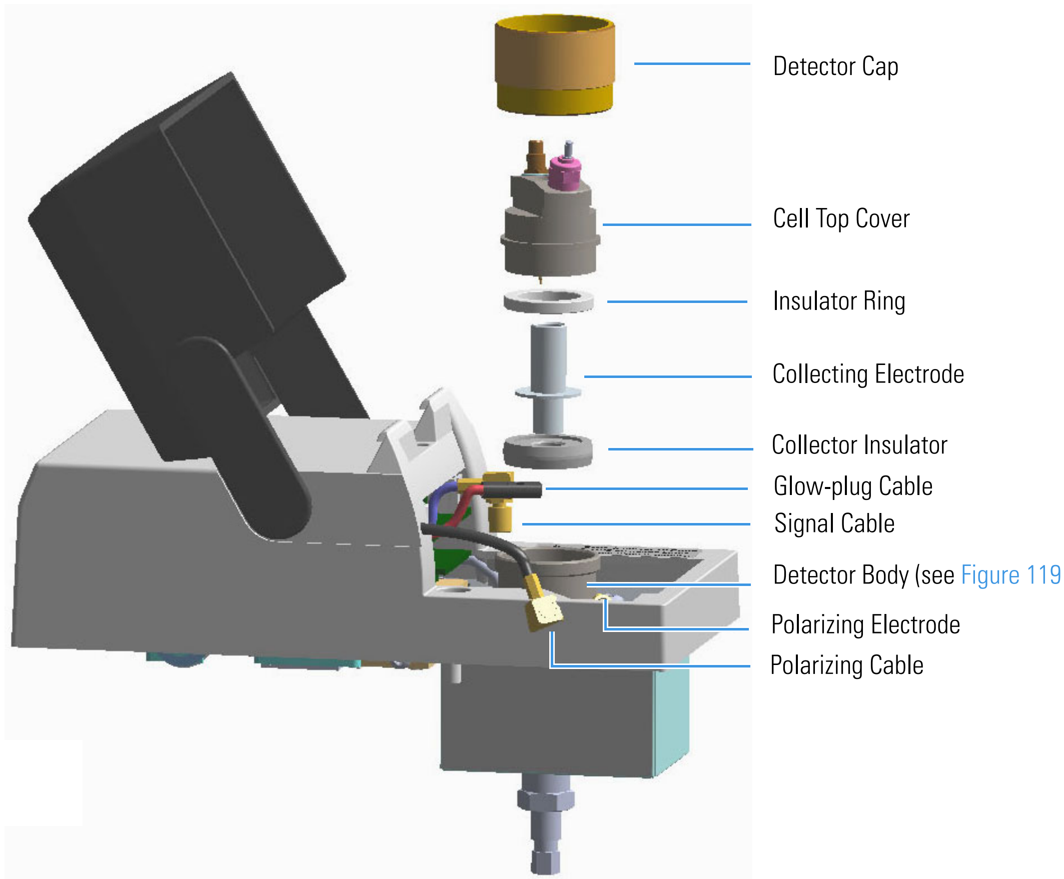
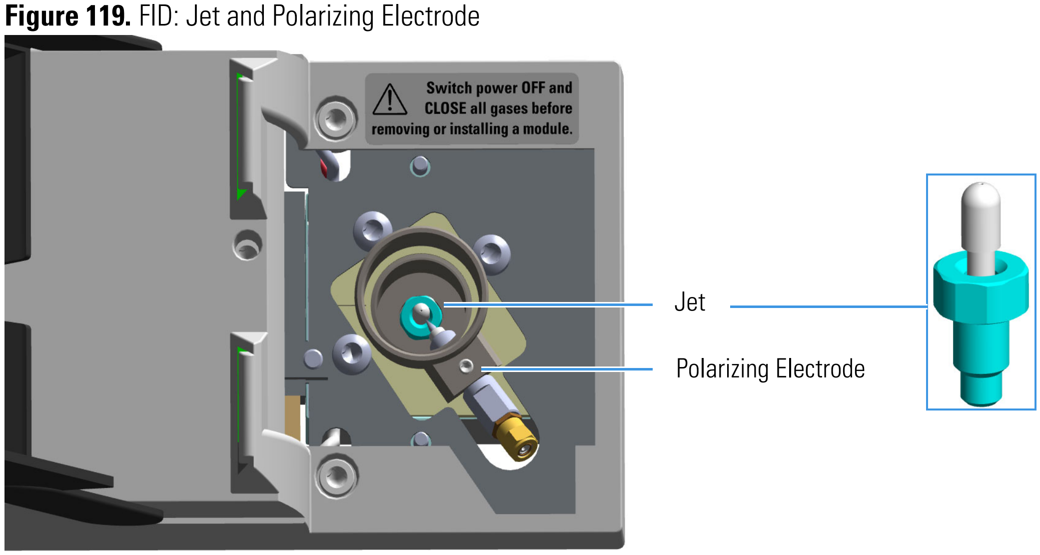


Figure 119. FID: Jet and Polarizing Electrode



To keep optimum performance of the FID, you must keep it clean and free of dust and deposits. Symptoms, such as reduced sensitivity and increased noise, indicate that the detector needs cleaning.

The FID detector periodic maintenance includes:

- **Cleaning the collecting electrode**

  It is suggested to clean the collecting electrode annually, or when a high noise baseline is found, due to some compounds that produce detector contamination. If necessary, replace the collecting electrode.

  See "Cleaning or Replacing the FID Collecting Electrode" on page 157.

- **Replacing the FID ignition glow-plug**

  This operation is NOT part on the ordinary maintenance. The flame ignition element must be replaced only when defective.

  See "Replacing the FID Ignition Glow-plug" on page 160.

Before maintaining the detector, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a FID detector
Ultrasonic cleaner
Liquid detergent
GC-grade methanol
Distilled water
FID Ignition Glow-plug
Collecting electrode (if necessary)
8-mm elbowed box wrench
T6 Torxhead screwdriver
Forceps or tweezers

Note For maintaining or replacing any other component not listed in this section, see Chapter 7, "Detectors Advanced Maintenance."

- "Removing/Replacing a Detector Module" on page 281
- "Cleaning or Replacing the FID Jet" on page 291

Cleaning or Replacing the FID Collecting Electrode

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the collecting electrode

1. Put the GC in standby condition.
2. Turn the flame off. The fuel gases, hydrogen and air, are automatically closed.
3. Cool the detector to room temperature.
4. Turn the make-up gas off.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
6. If external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
7. Open the module flap cover.
8. Disconnect the signal, glow-plug, and polarizing cables from their contacts on the cell.

Figure 120. FID Cables

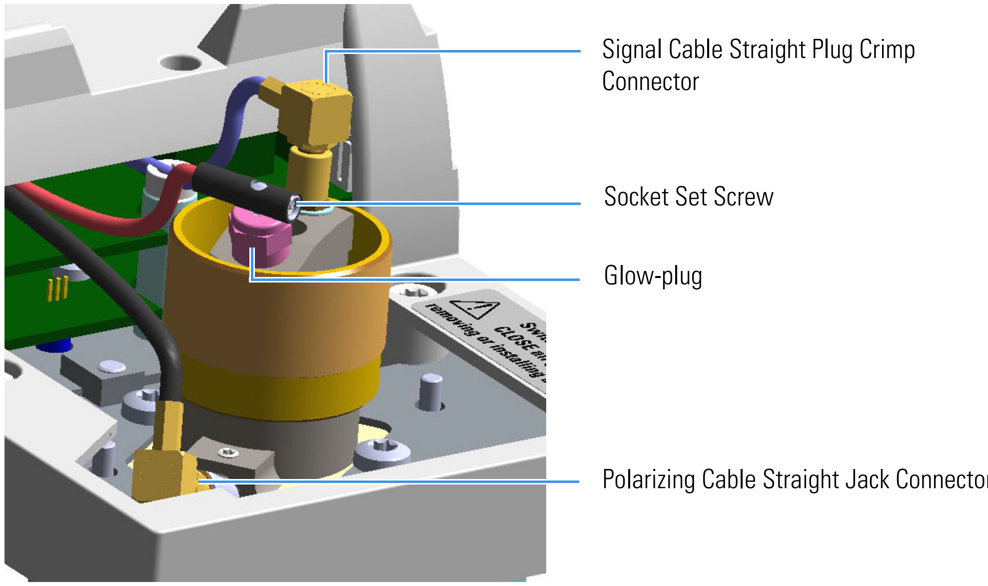
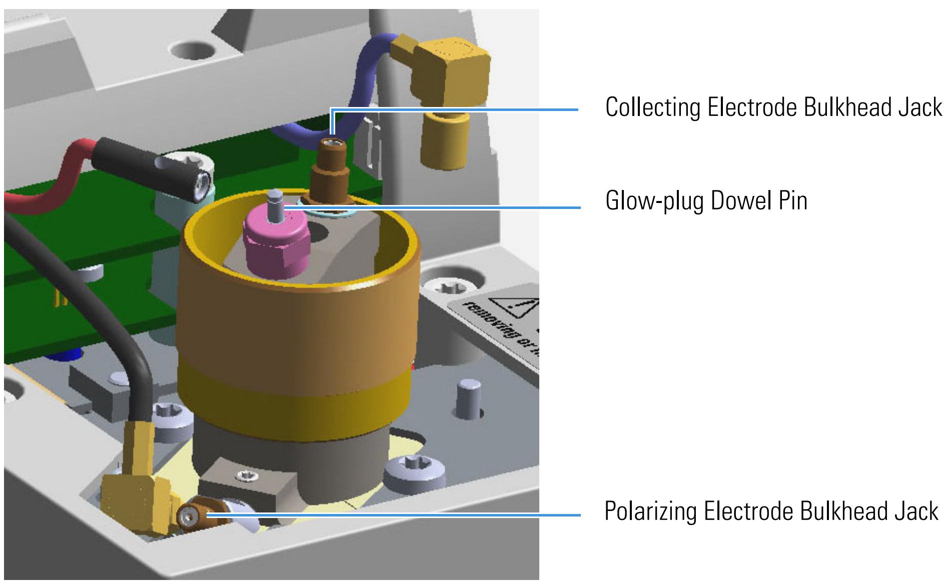


Figure 121. FID Cables Disconnection



a. Loosen the glow-plug cable socket set screw using a T6 Torxhead screwdriver. Carefully pull out the terminal body of the glow-plug cable from the dowel pin on the glow-plug element.

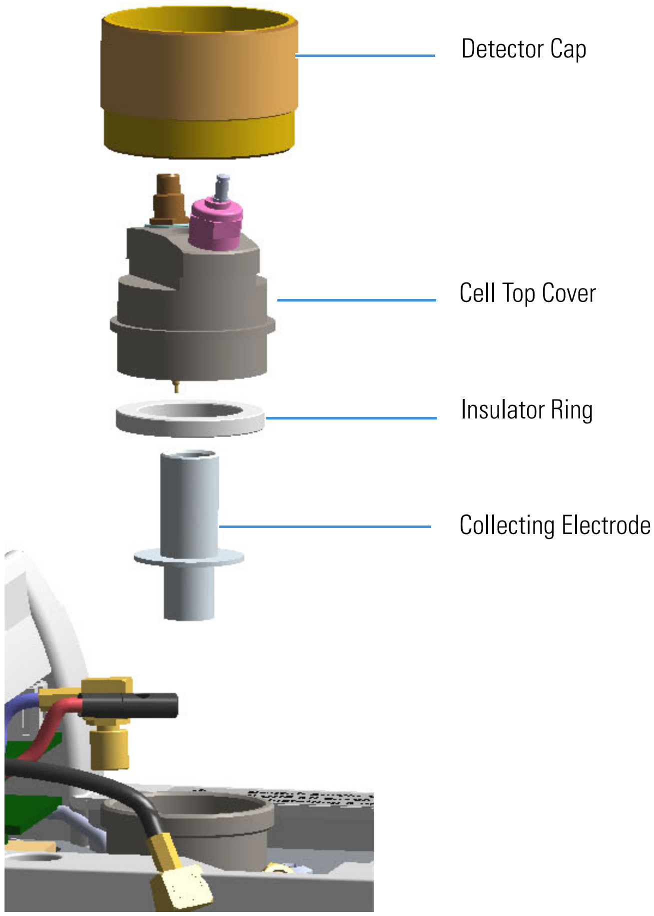
b. Unscrew and pull out the straight plug crimp connector of the signal cable from the collecting electrode bulkhead jack.

c. Pull out the quick coupling straight jack connector of the polarizing cable from the polarizing electrode bulkhead jack.

d. Carefully move the cables in order to have free space for handling the detector.

9. Remove the top parts of the detector.

Figure 122. FID Collecting Electrode



a. Unscrew and remove the detector cap, paying attention to not rotate the cell top cover.

b. Remove the cell top cover and put it on a safe place. Pay attention to not damaging the FID collecting electrode pin.

10. Remove, clean and reinstall the collecting electrode.

a. Using forceps or tweezers, carefully extract the collecting electrode and the insulator ring through the top of the detector cell.

b. Slip off the insulator ring from the collecting electrode.

WARNING The insulator ring must be placed carefully away in a place where it stays clean.

c. Place the collecting electrode in the ultrasonic cleaner filled with liquid detergent.

d. Sonicate the collecting electrode for about five minutes.

e. Handling the collecting electrode with forceps or tweezers, rinse it using distilled water, then methanol.

f. Place the collecting electrode on a paper towel and let it air dry.

> **Note** If after the cleaning the physical condition of the collecting electrode does not permit its reuse, replace the electrode with a new one.

g. Place the cleaned (or a new) collecting electrode and the insulator ring in its housing.

11. Reinstall the top parts of the detector.

    a. Remount the cell top cover, then screw the detector cap, paying attention to not rotate the cell top cover.

    b. Reconnect the signal, glow-plug, and polarizing cables.

12. Close the module flap cover.

13. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

14. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

15. Set the make-up gas on.

16. Set the normal detector working conditions.

17. Ignite the flame.

Replacing the FID Ignition Glow-plug

❖ To replace the ignition glow-plug

1. Put the GC in standby condition.

2. Turn the flame off. The fuel gases, hydrogen and air, are automatically closed.

3. Cool the detector to room temperature.

4. Turn the make-up gas off.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.

    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

6. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
7. Open the module flap cover.
8. Disconnect the signal cable, glow-plug and polarizing cables from their contacts on the cell top cover.

Figure 123. FID Cables

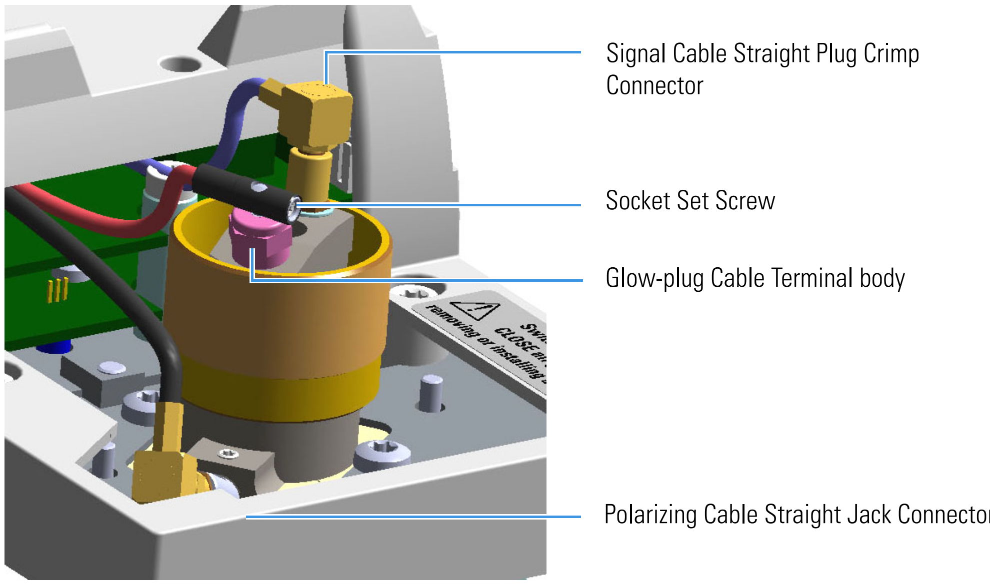
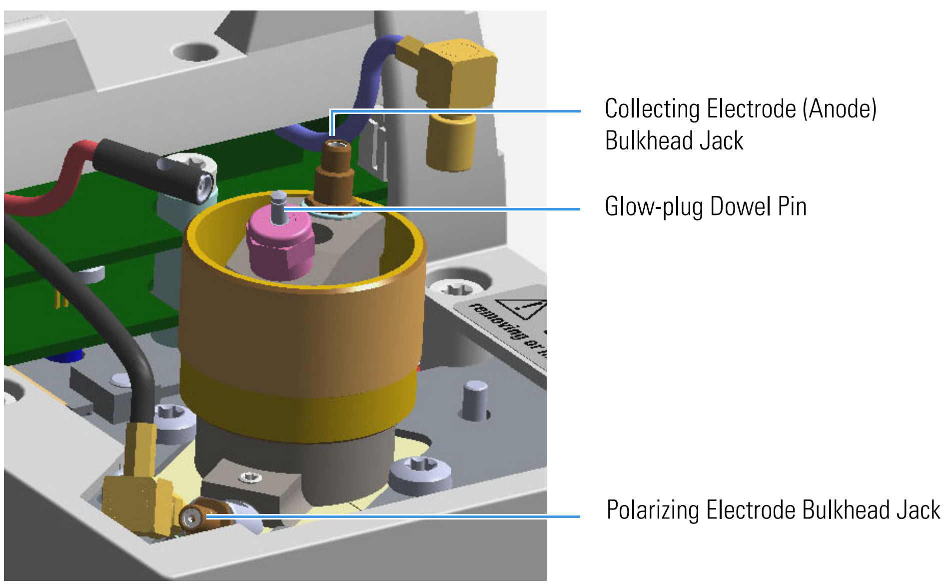


Figure 124. FID Cables Disconnection



a. Loosen the glow-plug cable socket set screw using a T6 Torxhead screwdriver. Carefully pull out the terminal body of the glow-plug cable from the dowel pin on the glow-plug element.

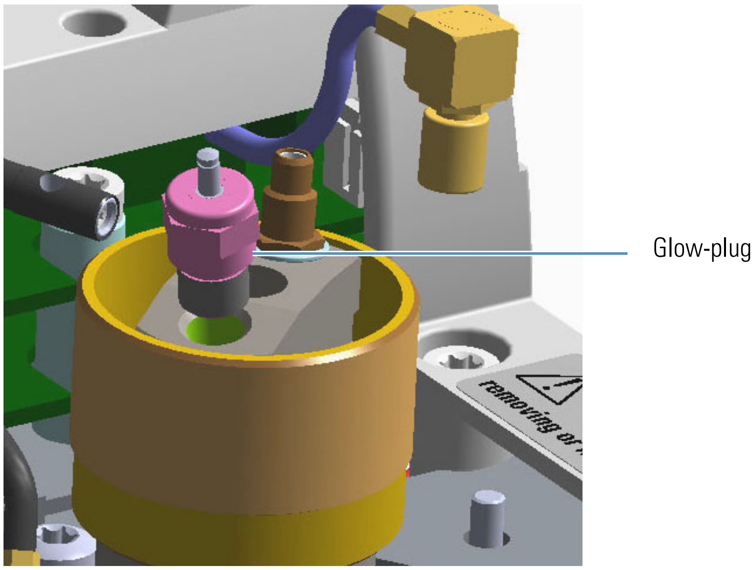
b. Unscrew and pull out the straight plug crimp connector of the signal cable from the collecting electrode (anode) bulkhead jack.

c. Pull out the quick coupling straight jack connector of the polarizing cable from the polarizing electrode bulkhead jack.

d. Carefully move the cables in order to have free space for handling the detector.

9. Replace the defective glow-plug.

Figure 125. FID Glow-plug Replacement



a. Using an 8-mm wrench, unscrew and remove the defective glow-plug with its washer.

b. Replace the glow-plug with a new one interposing the new washer.

c. Reconnect the glow-plug, signal, and polarizing cables.

10. Close the module flap cover.

11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

12. Power on the GC.

a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

b. Flip up the power switch (breaker) to the position I.

13. Turn the make-up gas on.

14. Set the normal detector working conditions.

15. Ignite the flame.

Maintaining a Nitrogen Phosphorous Detector (NPD)

This section provides instructions for maintaining an Instant Connect Nitrogen Phosphorous Detector (NPD). The components of the module and detector are shown in Figure 126, Figure 127, and Figure 128.

Figure 126. NPD Module Components

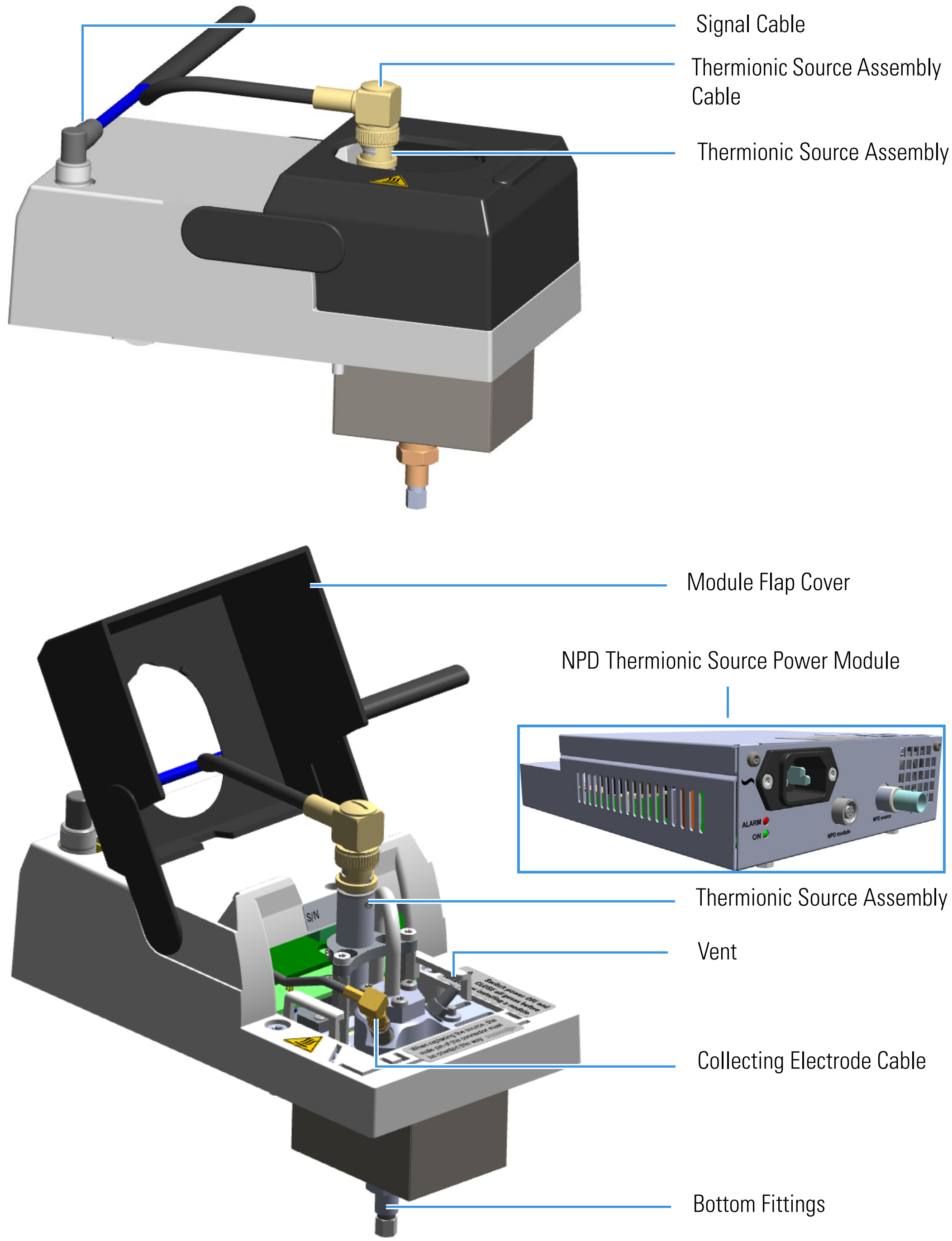


Figure 127. NPD Cell Assembly Components

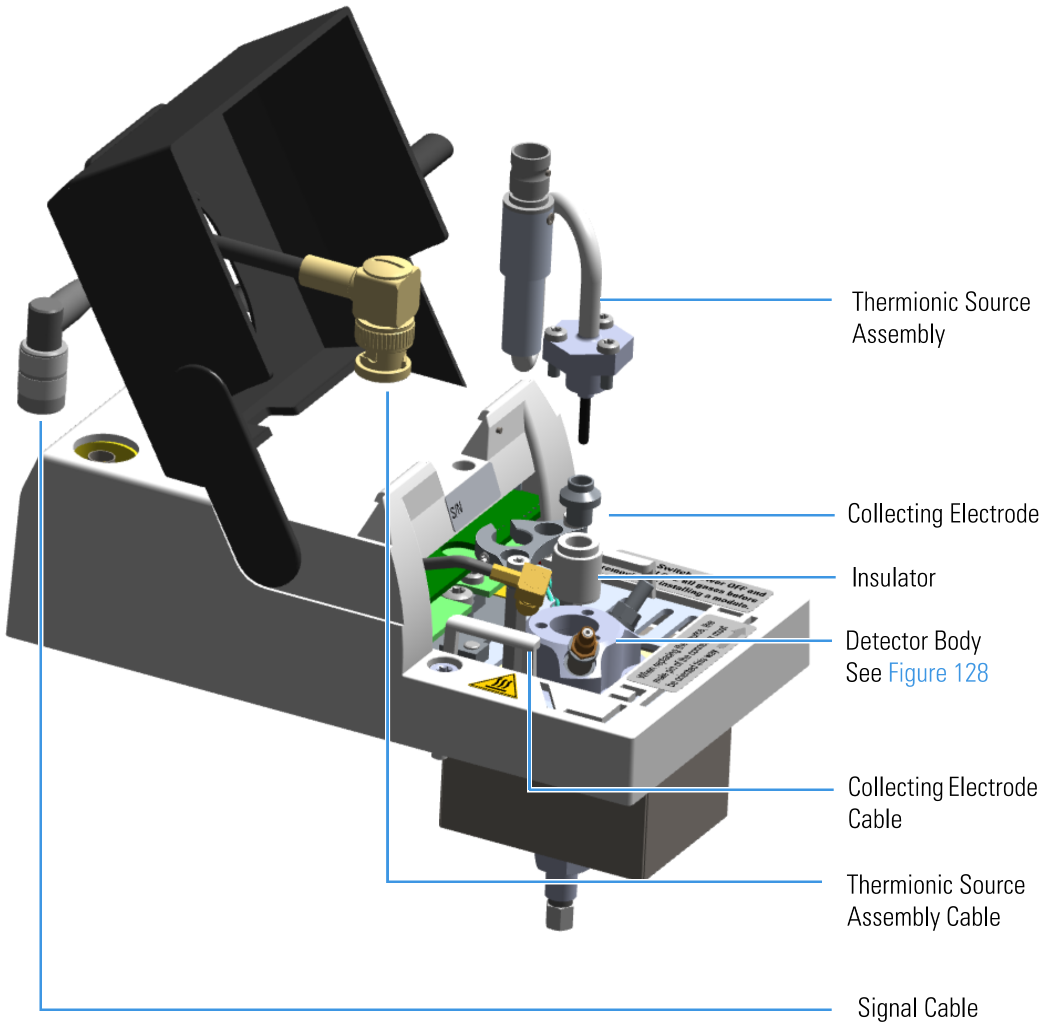
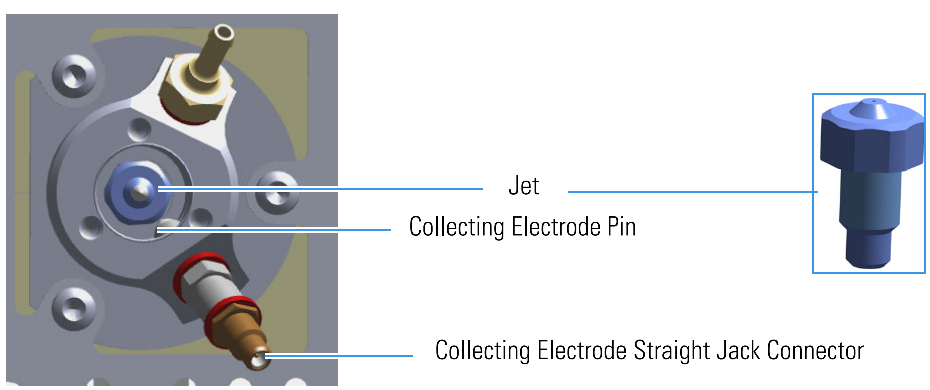


Figure 128. NPD Detector: Jet and Collecting Electrode (Anode) Pin



To ensure optimum performance of the NPD, you must keep it clean and free of dust and deposits. Symptoms such as reduced sensitivity and increased noise indicate that detector cleaning, or thermionic source replacement could be necessary.

Note The thermionic source is supplied by a separated NPD Thermionic Source Power Module placed into an external module housing on the back of the GC.

The NPD detector periodic maintenance includes:

- **Replacing the thermionic source**

  New thermionic sources may require slightly different values of source heating current to produce the same signal observed with a previous thermionic source.

  See "Replacing the NPD Thermionic Source" on page 166.

- **Cleaning the collecting electrode**

  We suggest cleaning the collecting electrode semiannually, or when a high noise baseline is found, due to some compounds that produce detector contamination. If necessary, replace the collecting electrode.

  See "Cleaning or Replacing the NPD Collecting Electrode" on page 173.

Before maintaining the detector, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a NPD detector
Thermionic Source
Gloves
Ultrasonic cleaner
Liquid detergent
GC-grade methanol
Distilled water
Collecting electrode (if necessary)
Forceps or tweezers
T6 Torxhead key

Materials needed to maintain a NPD detector
T10 Torxhead screwdriver
6 mm wrench

Note For maintaining or replacing any other component not listed in this section, see Chapter 7, "Detectors Advanced Maintenance."

- "Measuring the NPD Gas Flows" on page 295
- "Cleaning or Replacing the NPD Jet" on page 305

Replacing the NPD Thermionic Source

CAUTION The thermionic source is delicate. Be careful not to break or crack the source. When performing maintenance on the NPD, avoid touching the source with your fingers, and prevent it from coming in contact with other surfaces. Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

ATTENTION La source thermo-ionique est fragile. Veillez à ne pas briser ou fissurer la source. Pendant la maintenance du NPD, évitez de toucher la source avec les doigts et empêchez-la d'entrer en contact avec d'autres surfaces. Portez des gants propres et non pelucheux pour éviter de contaminer les pièces avec de la poussière ou de sébum.

❖ To replace the thermionic source

1. Put the GC in standby condition.
2. Switch off the thermionic source. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.
4. Turn the make-up gas off.

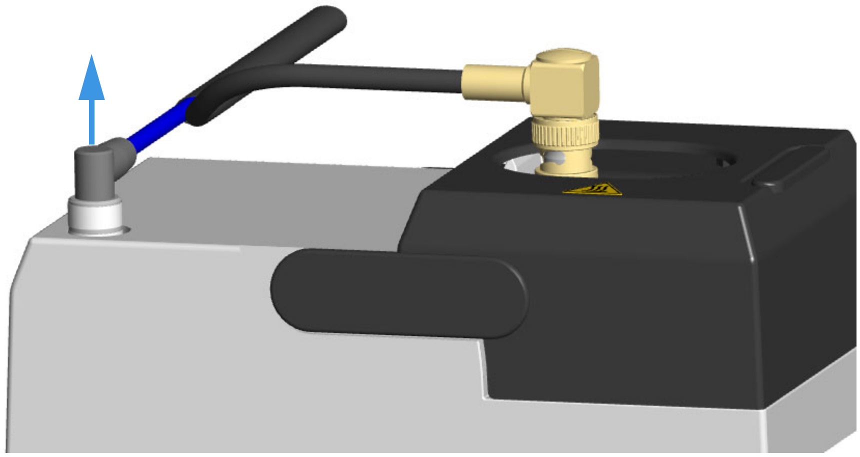
   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
6. Unplug the power cable from the AC input connector of the **NPD Thermionic Source Power Module** and from the wall outlet.

   If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

7. Unplug the signal cable from the detector module. See Figure 129.

Figure 129. Unplug NPD Signal Cable



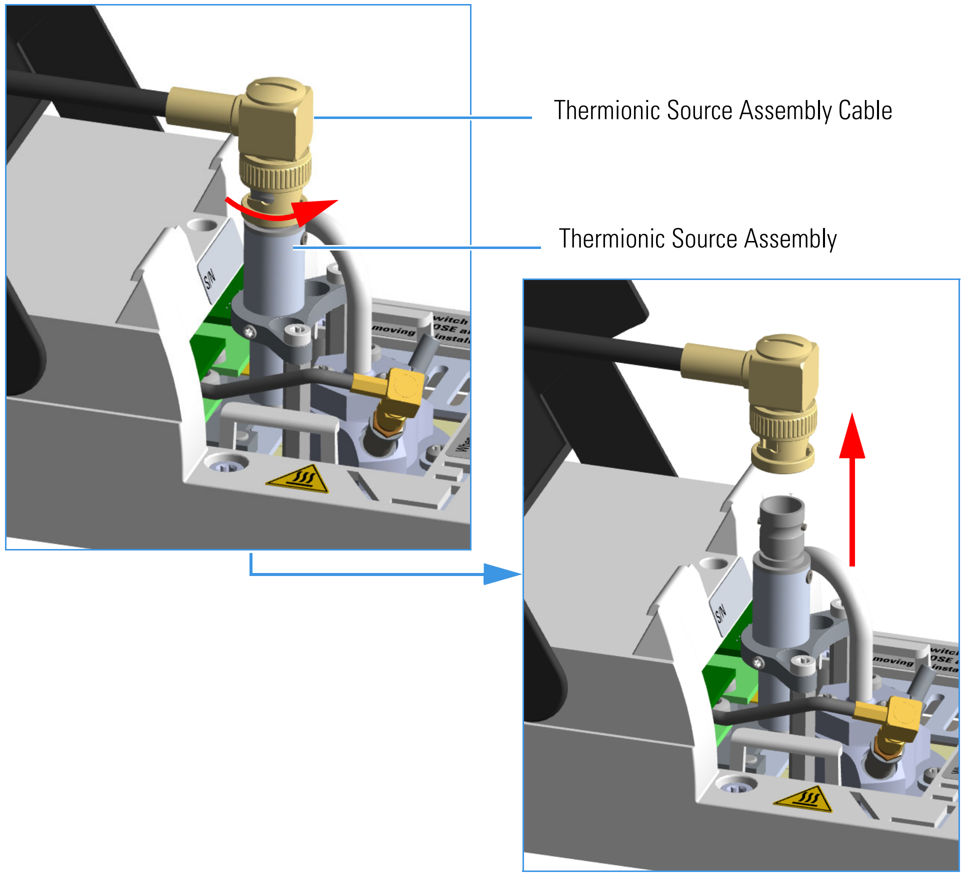
8. Open the module flap cover.

9. Remove the thermionic source assembly cable.

   a. Twist the ring to disconnect the thermionic source assembly cable.

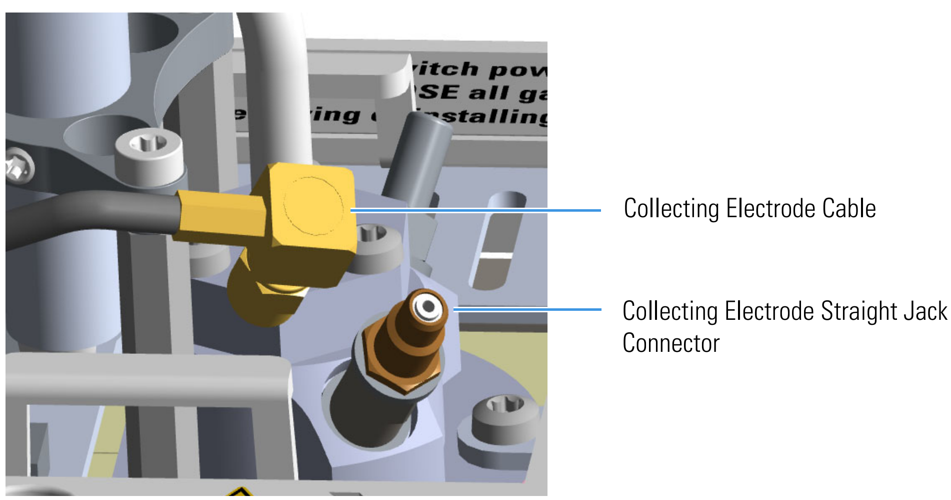
   b. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart. See Figure 130.

Figure 130. NPD Thermionic Source Cable Removal



10. Unscrew and pull out the straight jack connector of the collecting electrode cable from the collecting electrode bulkhead jack. See Figure 131.

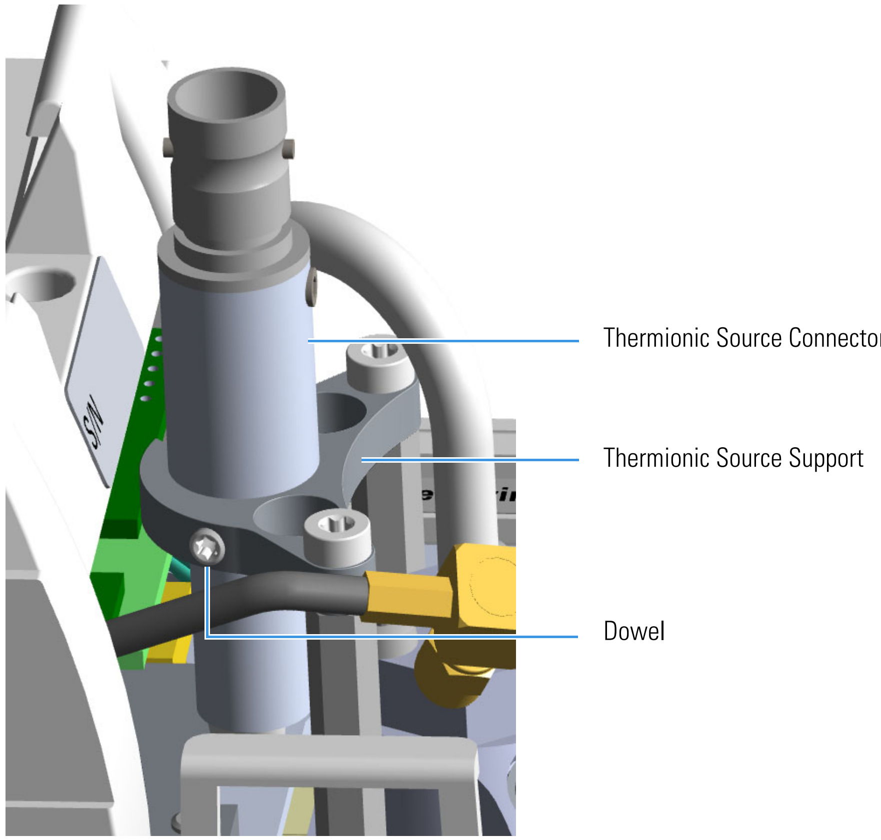
Figure 131. Collecting Electrode Cable Removal



11. Remove the thermionic source.

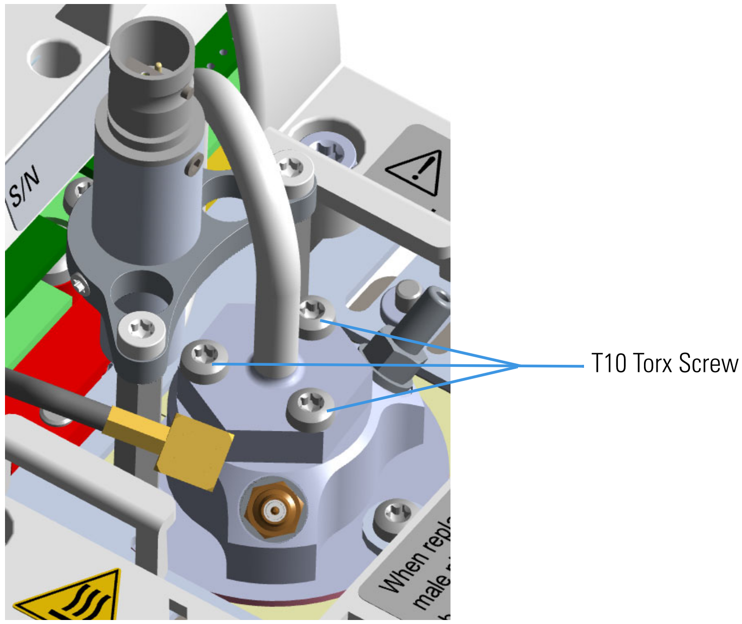
a. Using a T6 Torxhead key, loosen the dowel which fix the thermionic source connector to the thermionic source support. See Figure 132.

Figure 132. NPD Thermionic Source Removal (1)



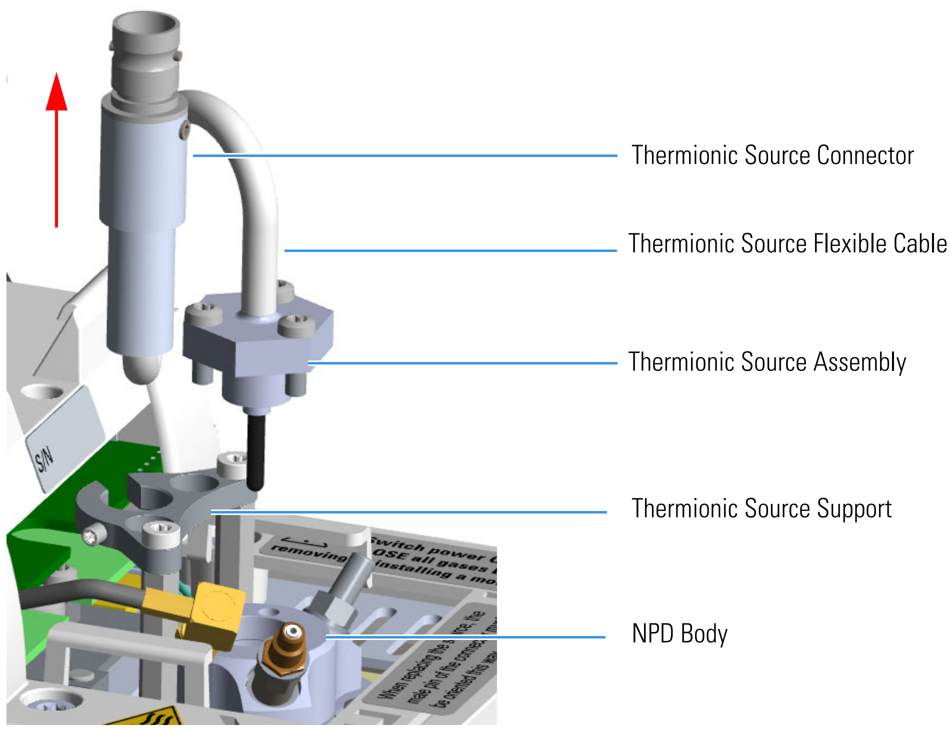
b. Using the T10 Torxhead screwdriver, remove the three T10 Torx screws from the thermionic source assembly. See Figure 133.

Figure 133. NPD Thermionic Source Removal (2)



c. Gently lift up the thermionic source connector guiding the flexible cable from the thermionic source support, then remove the thermionic source assembly from the NPD body. Avoid bumping the bead on the sides of the collector. See Figure 134.

Figure 134. NPD Thermionic Source Removal (3)



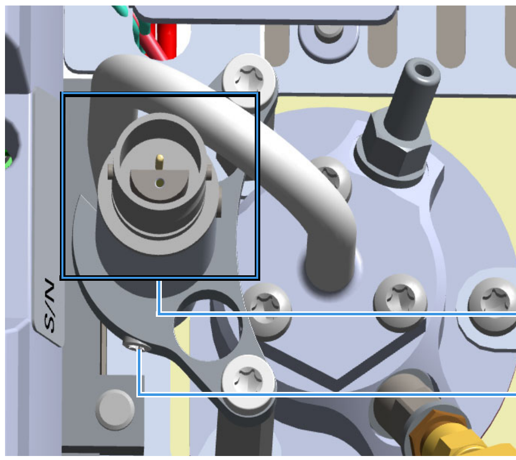
12. Replace the thermionic source.

a. Remove the protective cap covering the new thermionic source.

b. Mount and guide the source assembly on the NPD body proceeding in the reverse order in which it was removed. Be careful not to bump the bead on the sides of the body and collecting electrode.

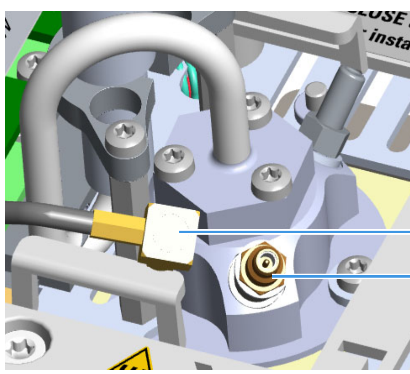
c. Rotate and align the thermionic source connector, then tighten the dowel to fix the connector to the support using the T6 Torxhead key. See Figure 135.

Figure 135. Replace NPD Thermionic Source (1)



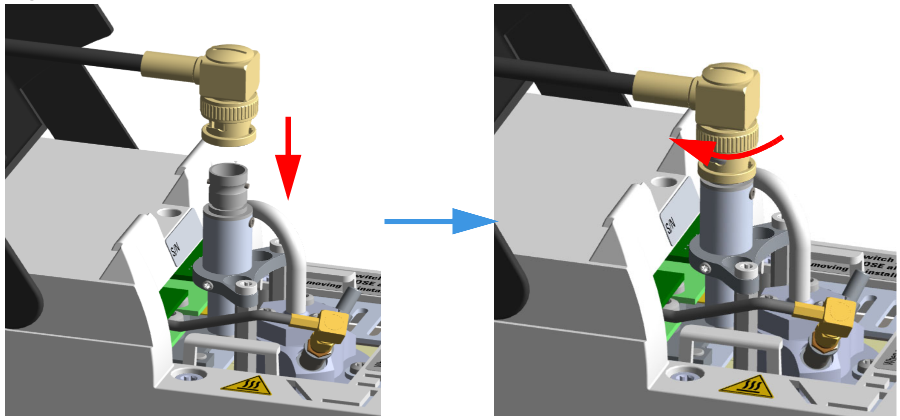
13. Reconnect and screw the straight jack connector of the collecting electrode cable to the collecting electrode bulkhead jack. See Figure 136.

Figure 136. Replace NPD Thermionic Source (2)



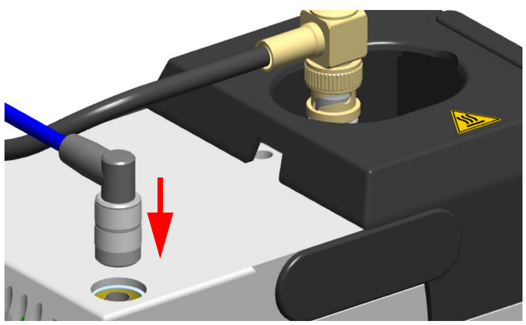
14. Reconnect the source assembly cable to the NPD thermionic source, and twist the ring to lock the connection. See Figure 137.

Figure 137. Reconnect Source Assemble Cable



15. Close the module flap cover.
16. Plug in the signal cable into its contact on the detector module. See Figure 138.

Figure 138. Reconnect Signal Cable



17. Plug the power cable to the AC input connector of the **NPD Thermionic Source Power Module** and to the wall outlet. The LED marked **On** blinks green.

    If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

18. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
19. Set the make-up gas on.
20. Switch on the thermionic source. Hydrogen and air are automatically opened.
    The LED marked **On** of the NPD Thermionic Source Power Module becomes solid green.
21. With all gases on, heat the detector to 150 °C and hold for about 15 minutes. Increase the temperature to 250 °C and hold for 15 minutes.

22. Increase the temperature to the operating value: 300 to 320 °C is recommended. Allow 15 minutes for equilibration.

23. Check the NPD leakage current. If > 2.0 pA, verify the installation.

Cleaning or Replacing the NPD Collecting Electrode

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the NPD collecting electrode

1. Put the GC in standby condition.
2. Switch off the thermionic source. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.
4. Set the make-up gas off.

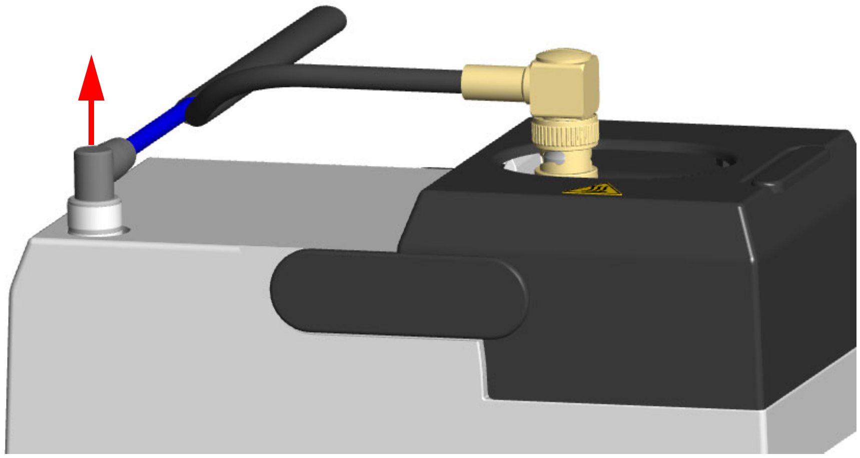
   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
6. Unplug the power cable from the AC input connector of the **NPD Thermionic Source Power Module** and from the wall outlet.

   If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

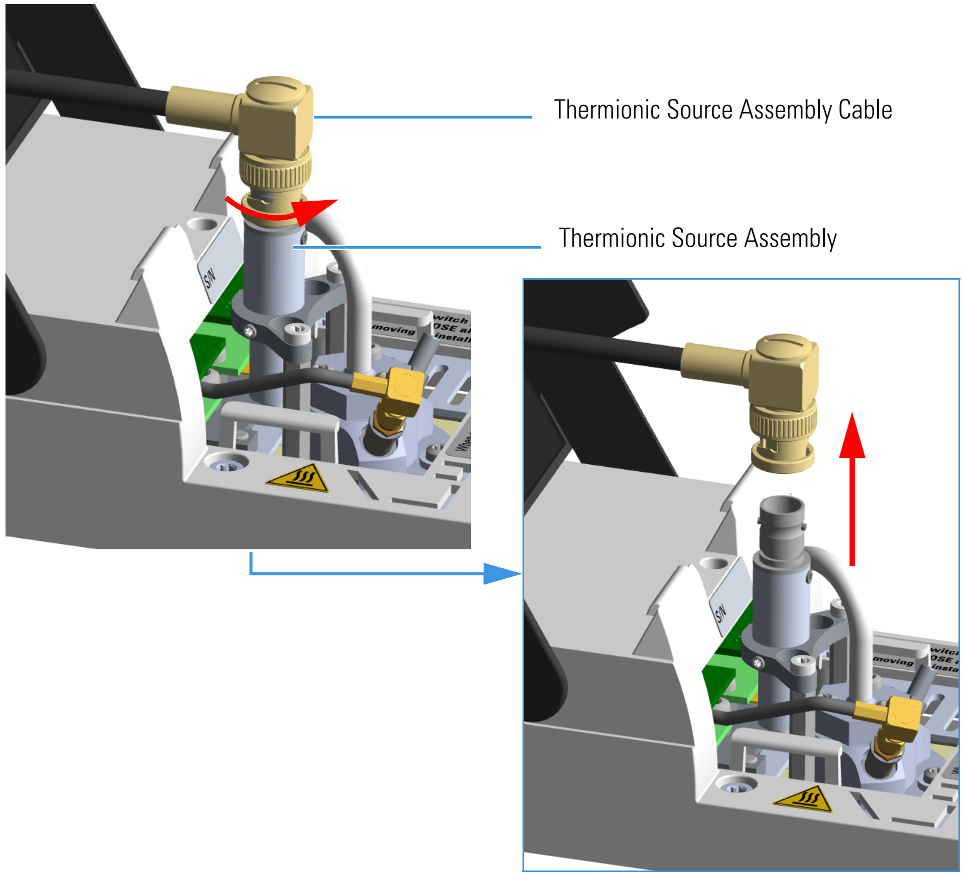
7. Unplug the signal cable from the detector module. See Figure 139.

Figure 139. Unplug NPD Signal Cable



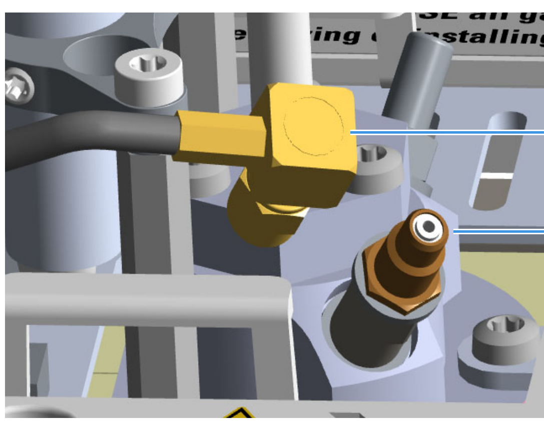
8. Open the module flap cover.
9. Remove the thermionic source assembly cable.
   a. Twist the ring to disconnect the thermionic source assembly cable.
   b. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart. See Figure 140.

Figure 140. NPD Thermionic Source Cable Removal



10. Unscrew and pull out the straight jack connector of the collecting electrode cable from the collecting electrode bulkhead jack. See Figure 141.

Figure 141. Collecting Electrode Cable Removal



11. Remove the thermionic source.

CAUTION The thermionic source is delicate. Be careful not to break or crack the source. When performing maintenance on the NPD, avoid touching the source with your fingers, and prevent it from coming in contact with other surfaces.

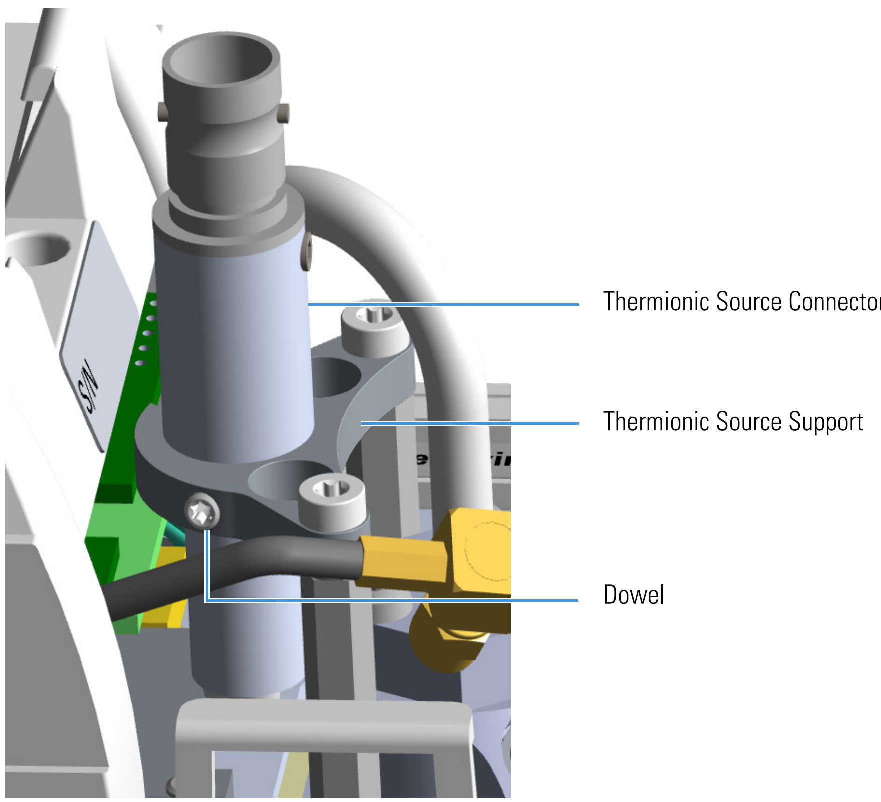
Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

ATTENTION La source thermo-ionique est fragile. Veillez à ne pas briser ou fissurer la source. Pendant la maintenance du NPD, évitez de toucher la source avec les doigts et empêchez-la d'entrer en contact avec d'autres surfaces.

Portez des gants propres et non pelucheux pour éviter de contaminer les pièces avec de la poussière ou de sébum.

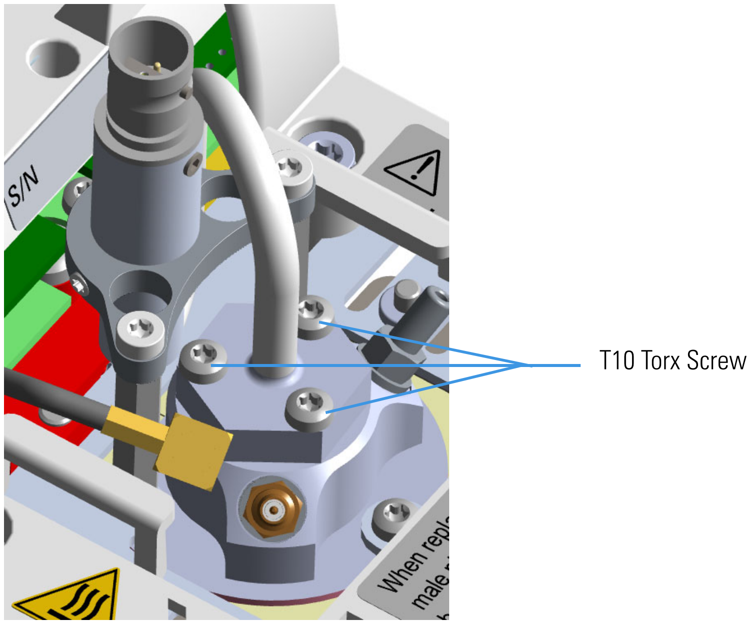
a. Using a T6 Torxhead key, loosen the dowel which fix the thermionic source connector to the thermionic source support. See Figure 142.

Figure 142. NPD Thermionic Source Removal (1)



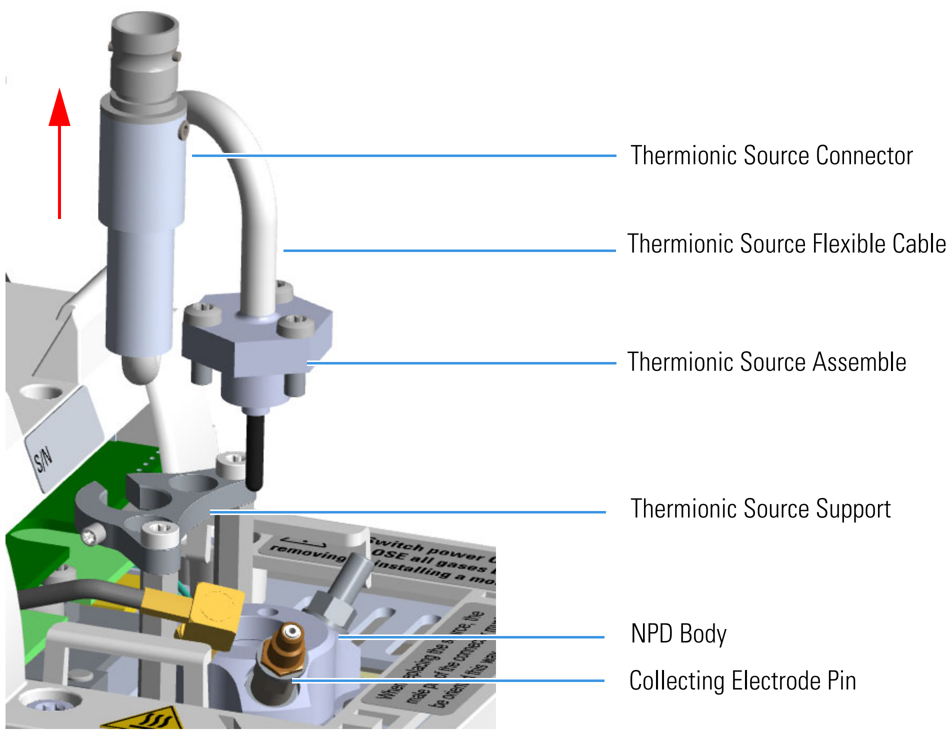
b. Using the T10 Torxhead screwdriver, remove the three T10 Torx screws from the thermionic source assembly. See Figure 143.

Figure 143. NPD Thermionic Source Removal (2)



c. Gently lift up the thermionic source connector guiding the flexible cable from the thermionic source support, then remove the thermionic source assemble from the NPD body. Avoid bumping the bead on the sides of the collector. See Figure 144.

Figure 144. NPD Thermionic Source Removal (3)

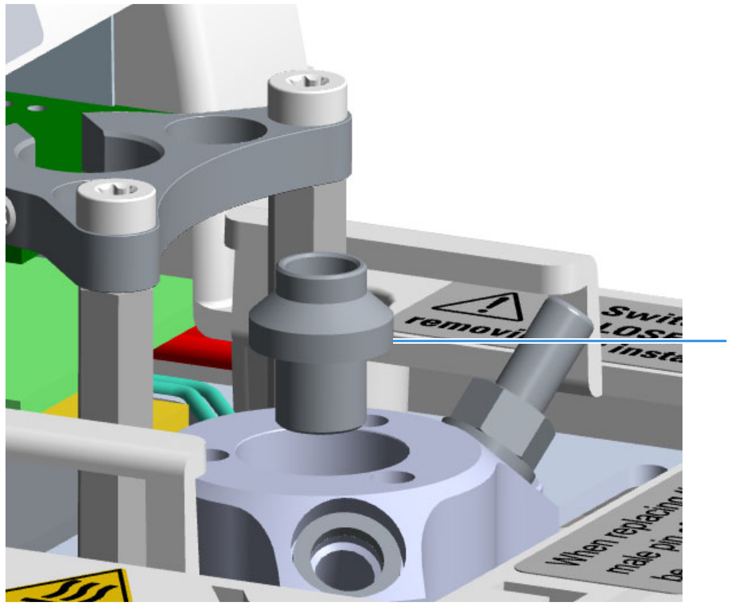


12. Remove and clean the collecting electrode.

a. Using a 6-mm wrench, unscrew and remove the collecting electrode pin from its seat on the detector body.

b. Using forceps or tweezers, extract the collecting electrode through the top of the detector body. See Figure 145.

Figure 145. NPD Collecting Electrode Removal



c. Place the collecting electrode in the ultrasonic cleaner filled with liquid detergent.

d. Sonicate the collecting electrode for about five minutes.

e. Handling the collecting electrode with forceps or tweezers, rinse it using distilled water, then methanol.

f. Place the collecting electrode on a paper towel and let it air dry.

> **Note** If after cleaning the physical condition of the collecting electrode does not permit its reuse, replace the electrode with a new one.

13. Reinstall the collecting electrode.

    a. Place the cleaned (or a new) collecting electrode in its housing.

    b. Using a 6-mm wrench, screw the collecting electrode pin into its seat on the detector body.

    c. Screw the straight plug crimp connector of the collecting electrode cable to the collecting electrode bulkhead jack.

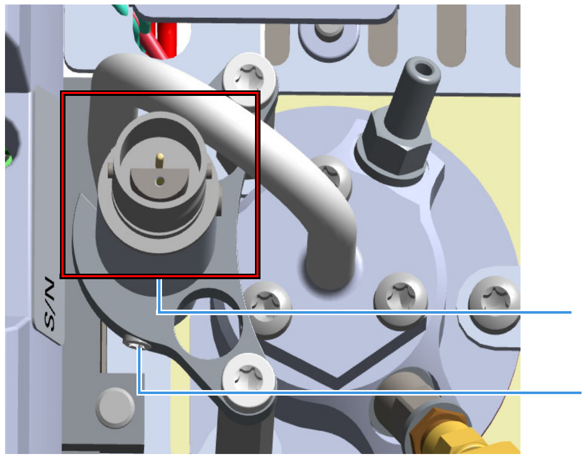
14. Reinstall the thermionic source.

    a. Remove the protective cap covering the new thermionic source.

b. Mount and guide the new source assembly on the NPD body proceeding in the reverse order in which it was removed. Be careful not to bump the bead on the sides of the body and collecting electrode.

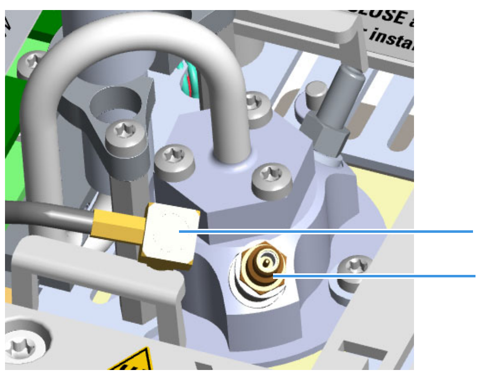
c. Rotate and align the thermionic source connector, then tighten the dowel to fix the connector to the support using the T6 Torxhead key. See Figure 146.

Figure 146. Replace NPD Thermionic Source (1)



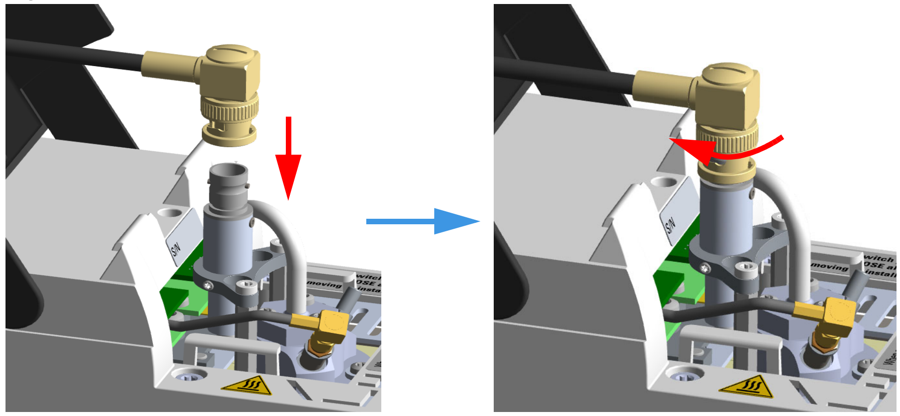
15. Reconnect and screw the straight jack connector of the collecting electrode cable to the collecting electrode bulkhead jack. See Figure 147.

Figure 147. Replace NPD Thermionic Source (2)



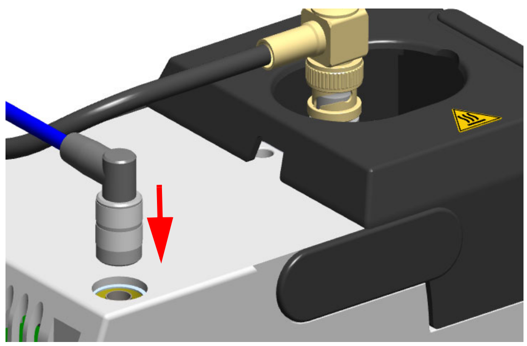
16. Reconnect the source assemble cable to the NPD cable and twist the ring to lock the connection. See Figure 148.

Figure 148. Reconnect Source Assemble Cable



17. Close the module flap cover.
18. Plug in the signal cable into its contact on the detector module. See Figure 149.

Figure 149. Reconnect Signal Cable



19. Plug the power cable to the AC input connector of the **NPD Thermionic Source Power Module** and to the wall outlet. The LED marked **On** blinks green.

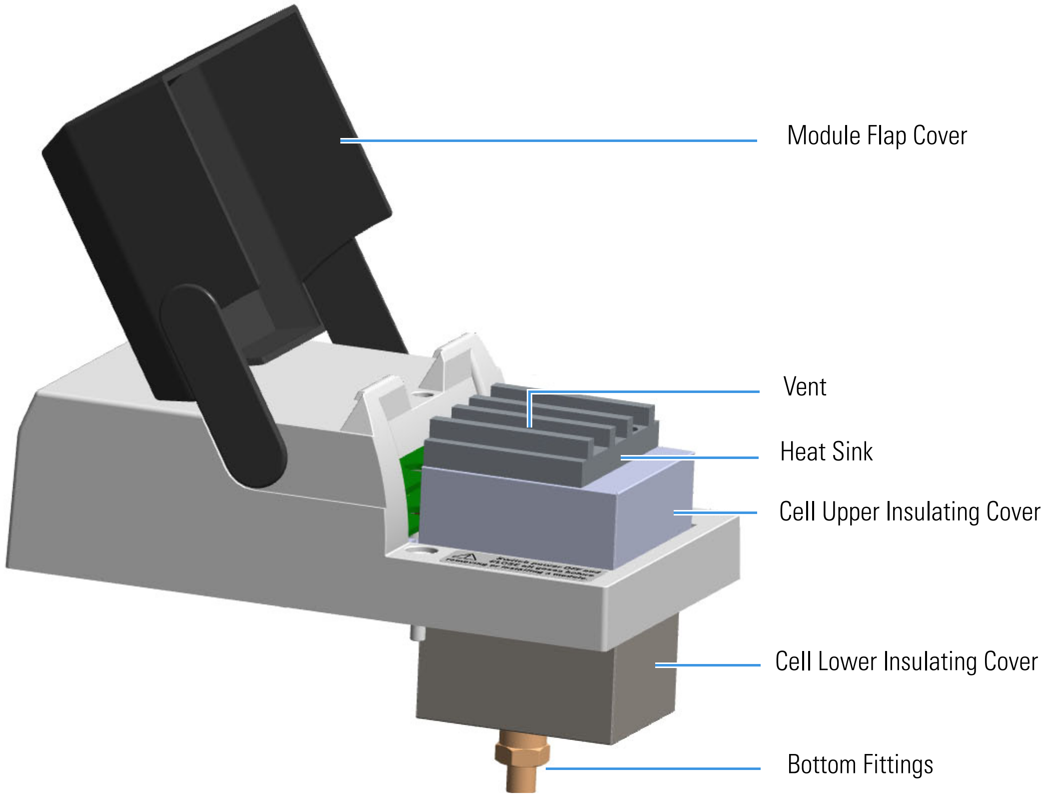
    If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

20. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
21. Turn the make-up gas on.
22. Heat the detector at the working temperature.
23. Switch on the thermionic source. Hydrogen and air are automatically opened.
    The LED marked **On** of the NPD Thermionic Source Power Module becomes solid green.

Maintaining a Thermal Conductivity Detector (TCD)

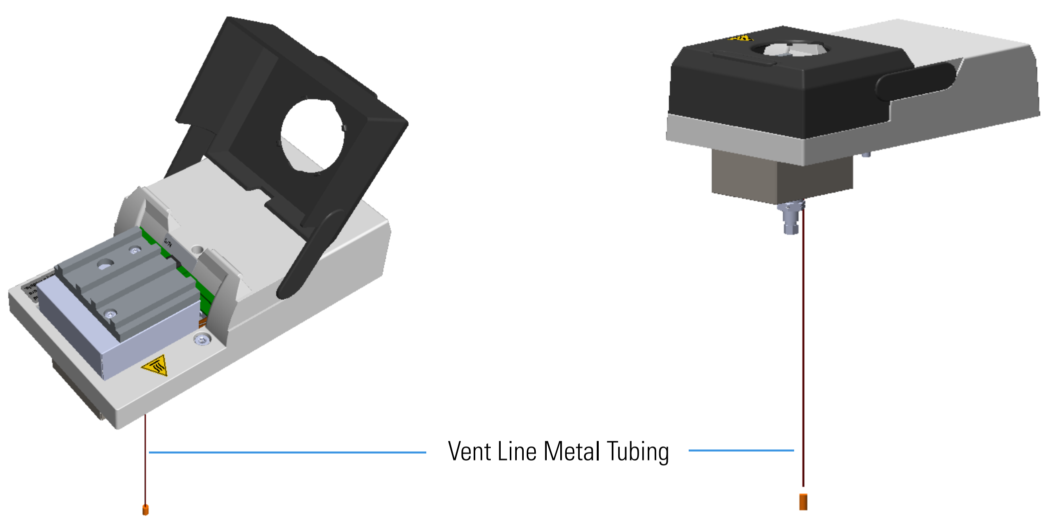
This section provides instructions for maintaining an Instant Connect Thermal Conductivity Detector (TCD). The component of module and detector are shown in Figure 150.

Figure 150. TCD Module Components



The same routine maintenance is applied to the **In-Series Connection TCD Module**. See Figure 151.

Figure 151. In-Series Connection TCD Module



The TCD detector does not usually need maintenance. Nevertheless, if you follow a few simple precautions, you will avoid problems and prolong the detector's lifetime. Pay a special attention to avoid contamination or damage to the filaments.

CAUTION Do not turn the filament on until the carrier gas is flowing through the detector.

Do not shut off or disconnect the carrier gas when the detector is hot, even if the unit is turned off.

ATTENTION N'activez pas le filament tant que le gaz vecteur ne transite pas par le détecteur.

Veillez à ne pas couper ou débrancher le gaz vecteur quand le détecteur est chaud, même si l'unité est hors tension.

Follow these simple rules:

- Avoid switching on the filaments when unnecessary. Doing so considerably reduces the filament's lifetime.
- Avoid injecting samples that contain halogenated or acid compounds at high concentrations.
- Ensure that oxygen (air) cannot enter into the filament's cells. Oxidation will irreversibly damage the filaments. Install traps for moisture and oxygen on the gas lines to reduce the risk of contamination.
- Turn off the filament before disconnecting the column from the detector. When the column is disconnected, air will enter into the cell and the filament, if powered on, will be damaged.
- Turn on the filament only if the column is connected. It is a good practice to let the gas flow through the cells for 5-10 minutes before powering the filaments.

See Bake-out Procedure, Measuring the Carrier Gas Flow Rate, and Shutting Down the TCD for additional information.

Bake-out Procedure

Under normal conditions, the TCD requires no routine maintenance. However, if the detector is exposed to chemicals which may condense or polymerize within the detector and adversely affect performance, an attempt of filament cleaning could be baked out at high temperatures (up to 300 °C). Inert carrier gas flow should be maintained during the reconditioning procedure.
Filament temperature should also be increased to approximate the setpoint of the bake-out temperature.
If a 24-hour bake-out is not sufficient to remove the contamination, the unit must be returned to the factory for disassembly and cleaning.

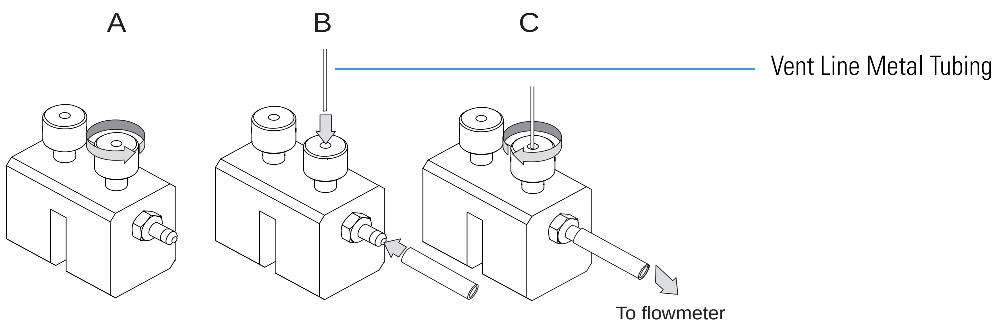
Measuring the Carrier Gas Flow Rate

While the measuring of the carrier gas flow rate through the **standard TCD detector** is performed simply connecting the flow-meter to the vent outlet, the **TCD In-series detector** requires the use of the **column- flowmeter connector**.

❖ To measure the TCD In-Series carrier gas flow rate

Carefully push the vent line metal tubing end into the flow meter section of the column-flowmeter connector. See Figure 152.

Figure 152. Column Flowmeter Connector



Connect the flowmeter to the dedicated fitting on the column-flowmeter connector, then measure the carrier gas flow rate.

Shutting Down the TCD

To shut down the detector at the end of the analytical cycle:

1. Turn off the filaments.
2. Reduce the carrier gas flow to 50% of the normal operating flow to conserve gas supplies.

Maintaining an Electron Capture Detector (ECD)

This section provides instructions for maintaining an Instant Connect Electron Capture Detector (ECD). The component of module and detector are shown in Figure 153 and Figure 154.

Figure 153. ECD Module Components

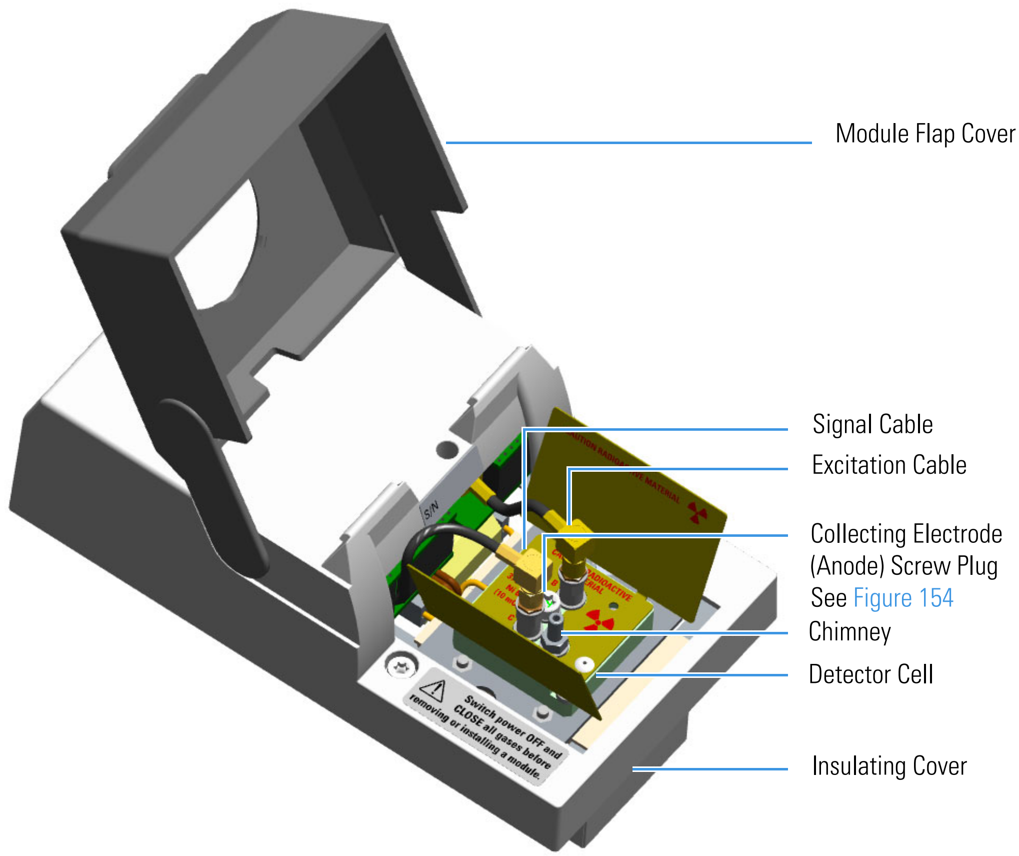
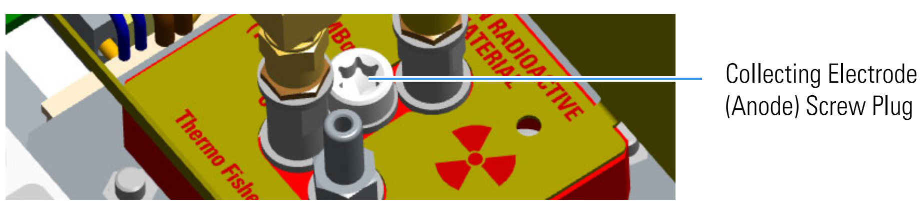


Figure 154. Collecting Electrode (Anode) Screw Plug



The ECD detector periodic maintenance includes:

- **Cleaning the collecting electrode (Anode)**

  We suggest cleaning the collecting electrode annually or when a high noise baseline is found producing detector contamination. Replace the collecting electrode if necessary. See "Cleaning or Replacing the Collecting Electrode (Anode)" on page 187.

Before maintaining the detector, read the following precautions and notes:

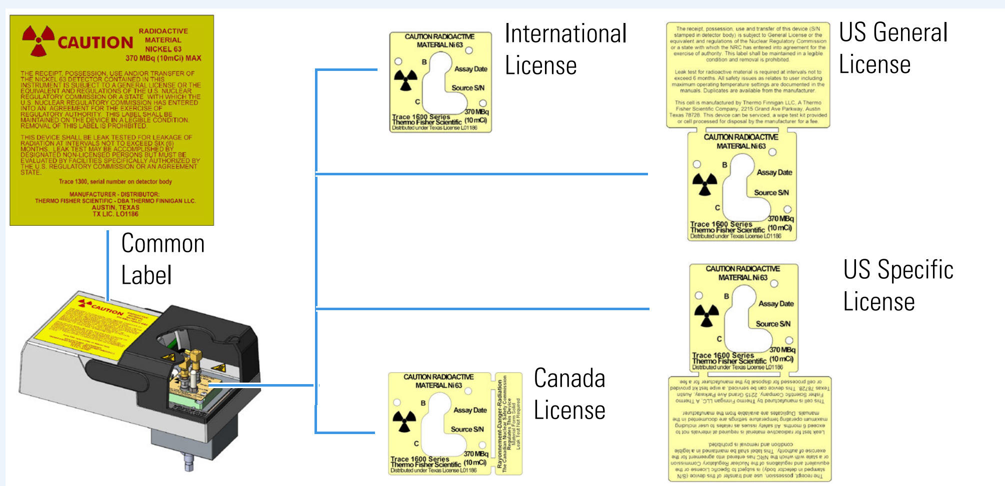
CAUTION The Electron Capture Detector contains a ^{63}Ni beta-emitting radioactive source at 370 MBq (10 mCi). The detector should never be opened or handled by the user. Any maintenance or service operations involving even partial disassembling of the detector must be performed ONLY by qualified personnel at a laboratory expressly authorized by Thermo Fisher Scientific and specifically licensed to handle radioactive material.

IMPORTANT For customers within the jurisdiction of the United States Nuclear Regulatory Commission (US NRC), you may find a listing of the agreement states and the current contact information for the regulators covering both Generally and Specifically licensed devices like an ECD at http://nrc-stp.ornl.gov/rulemaking.html. This information is maintained by the US NRC.

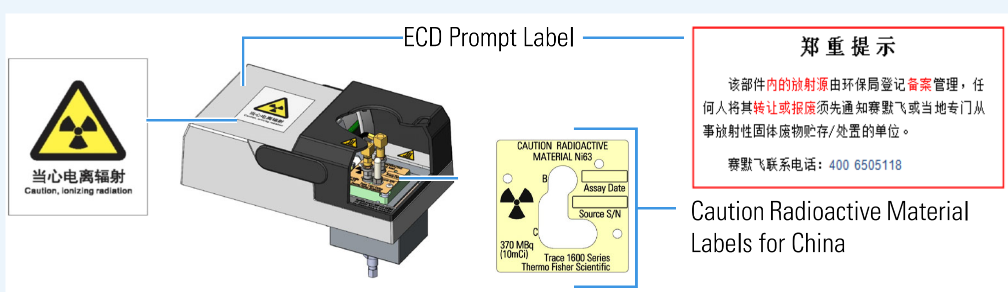
IMPORTANT For customers within the jurisdiction of the Canadian Nuclear Safety Commission, you may find current contact information for the regulators at http://www.nuclearsafety.gc.ca

IMPORTANT The recommended working life of the detector is 15 years, after which the user should arrange for the radioactive source to be inspected and assessed by a qualified authority to extend its working life, or dispose of the product through a suitable disposal route.

IMPORTANT According to International, USA, and Canada licenses, the appropriate Radioactivity Data labels are applied on the ECD detector module.



Exclusively for ECD detector module used in **China**, the **Caution Radioactive Material Ni63** labels are replaced by the followings:



WARNING All the operations must be carrier out at low temperature to avoid burns. Therefore, before conducting maintenance, cool the detector to room temperature.

Materials needed to maintain an ECD detector
Ultrasonic cleaner
GC-grade hexane
GC-grade toluene
Fine emery paper
Little flathead screwdriver
T20 Torxhead screwdriver
Forceps or tweezers
Collecting electrode (Anode) if necessary

Detector Chemical Contamination

The ECD, if properly used, has a good resistance against chemical contamination. However, some critical operating conditions may cause, over time, contamination of the collecting electrode (anode). This contamination is highlighted by an excessive increase of the base frequency, and a baseline drift when the reference current or the pulse amplitude is changed. The collecting electrode can be easily removed and cleaned without disturbing the radioactive source.

Detector contamination could be indicated by the following effects in the chromatogram:

- Reduced signal to noise ratio
- High-noise baseline (high frequency)
- Baseline drift with changing pulse voltage
- Negative dips after peaks

If chemical contamination of the whole cell is suspected proceed as follows:

1. Heat the ECD at the maximum operating temperature with carrier and make-up gases flowing through the detector (thermal cleaning).
2. Follows the decontamination process by monitoring the base frequency. Initially the frequency value tends to increase to very high values, and then it decreases to acceptable ones.

If irreversible contamination of the cell is suspected, please contact your local Thermo Fisher Scientific Technical Service office.

Wipe Test

Before leaving the factory, each ECD is leak tested for surface radio contamination by means of the **Wipe Test** method. Each detector is provided with a **Wipe Test Certificate** reporting the results of the values found and the procedure followed.

IMPORTANT The users of the ECD detector in the United States are required to perform a **Wipe Test** on their ECD at intervals not exceeding 6 months, following the reported procedure. For other countries, please refer to the appropriate agency for equivalent requirements.

Cleaning or Replacing the Collecting Electrode (Anode)

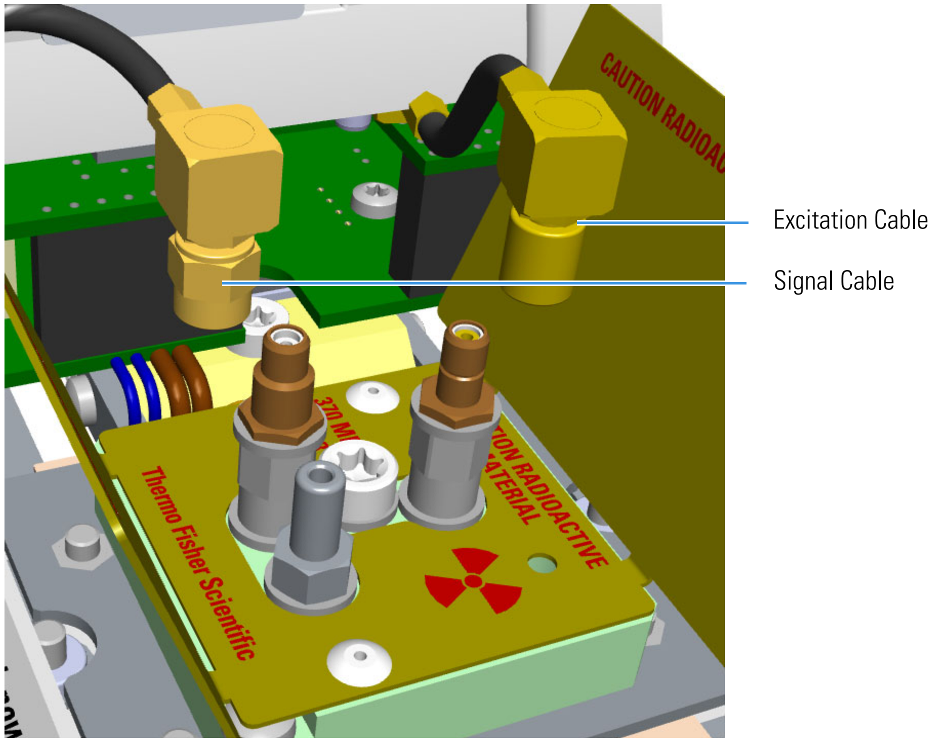
❖ **To clean or replace the collecting electrode**

1. Put the GC in standby condition.
2. Cool the detector to room temperature.
3. Turn the make-up gas off.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Open the module flap cover.
7. Disconnects the signal and excitation cables from their contacts on the cell top cover. See Figure 155.

Figure 155. ECD Cables Disconnection



a. Unscrew and pull out the straight plug crimp connector of the signal cable from the collecting electrode (anode) bulkhead jack.

b. Pull out the quick coupling straight jack connector of the excitation cable from the polarizing electrode bulkhead jack.

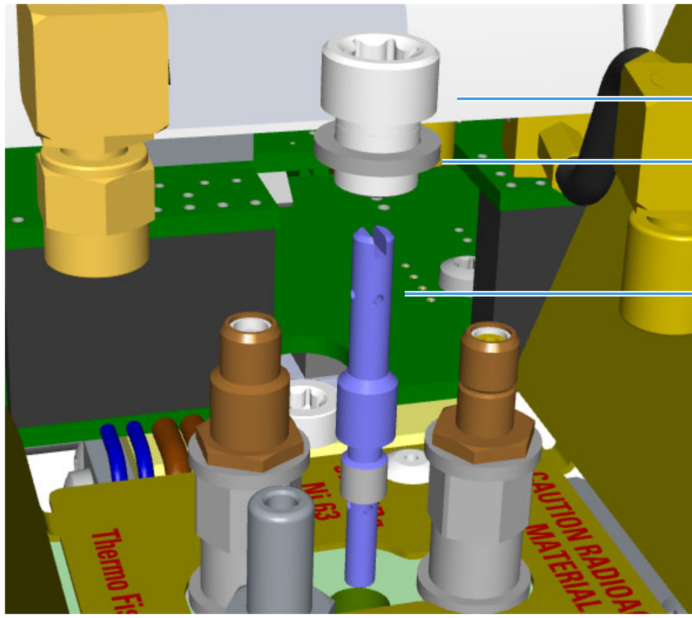
c. Carefully move the cables in order to have free space for handling the detector.

8. Remove and clean the collecting electrode (anode).

   a. Unscrew the screw plug with its seal hiding the collecting electrode (anode) using the T20 Torxhead screwdriver.

   b. Using a little flathead screwdriver, unscrew and remove the collecting electrode (anode). See Figure 156.

Figure 156. Collecting Electrode (Anode) Removal



c. Place the collecting electrode in the ultrasonic cleaner filled with liquid detergent, and clean it for about five minutes.

d. Handling the collecting electrode (anode) with forceps or tweezers, rinse it using distilled water, then methanol.

e. Place the collecting electrode (anode) on a paper towel and let it air dry.

> **Note** If after cleaning the physical condition of the collecting electrode (anode) does not permit its reuse, replace the electrode with a new one.

9. Reinstall the collecting electrode (anode).

   a. Screw the cleaned, or a new collecting electrode (anode) into its housing. Screw the hiding screw plug and its seal.

10. Reconnect signal and excitation cables.

11. Close the module flap cover.

12. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

13. Power on the GC.

    a. Plug the power cable to the AC Input connector on the back of the GC, and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

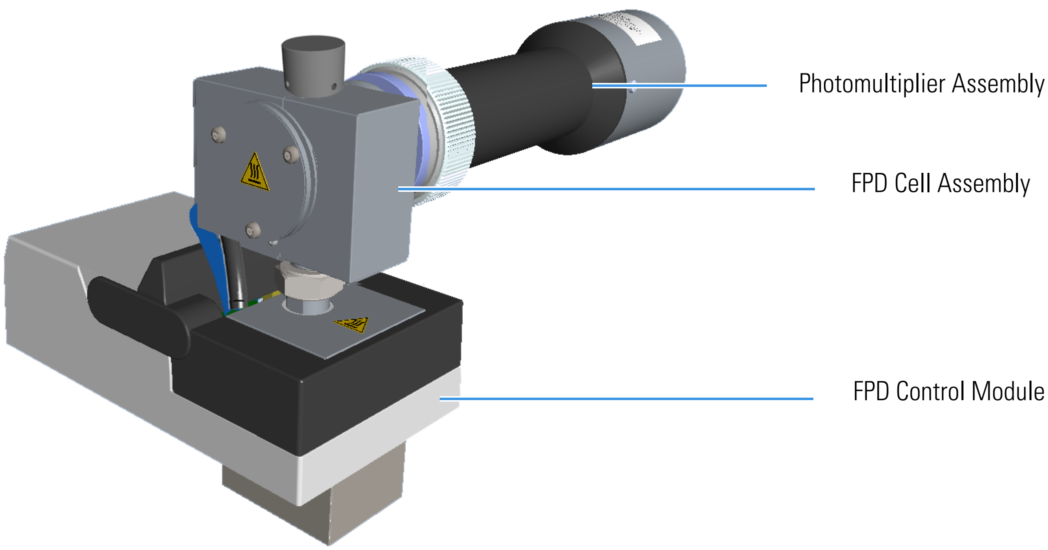
14. Set the make-up gas on.

15. Set the normal detector working conditions.

Maintaining a Flame Photometric Detector (FPD)

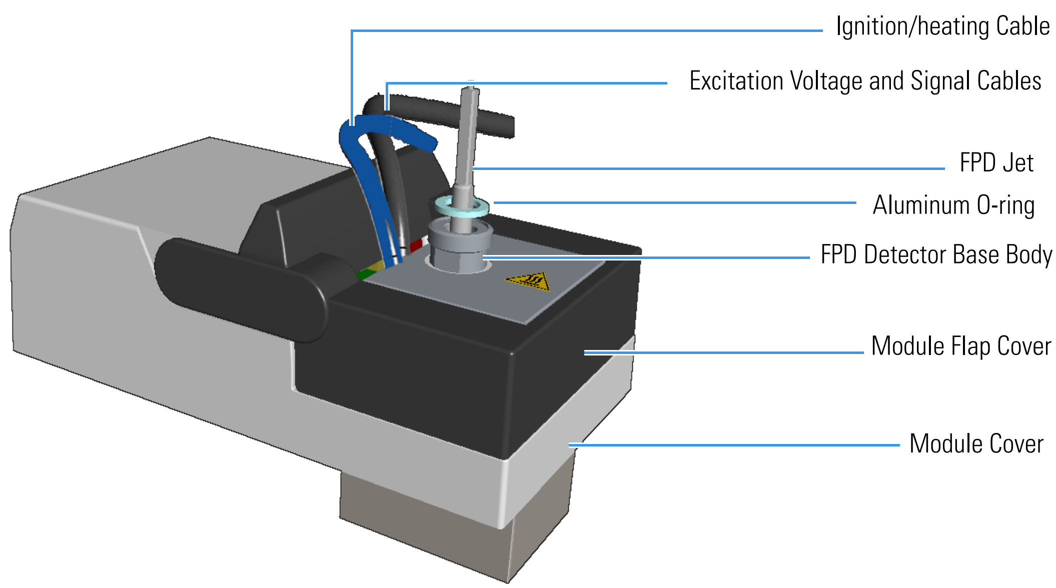
This section provides instructions for maintaining an Instant Connect Flame Photometric Detector (FPD). See Figure 157.

Figure 157. FPD Control Module



The control module and detector cell assembly components are shown in Figure 158, Figure 159, and Figure 160.

Figure 158. FPD Control Module Components



Note The signal, excitation voltage, and ignition/heating cables will be not shown in the next illustrations for graphic convenience.

Figure 159. FPD Detector Assembly Components

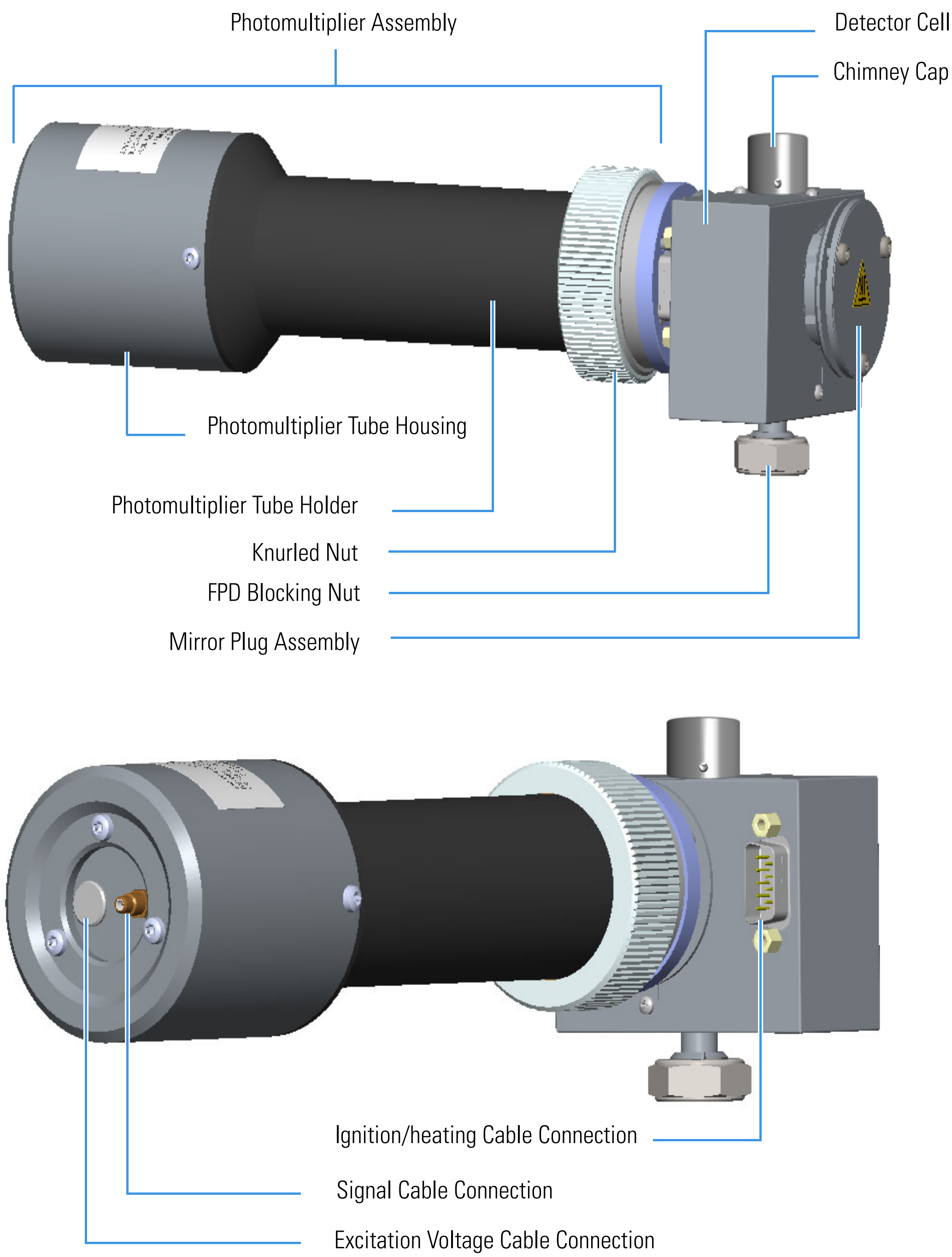
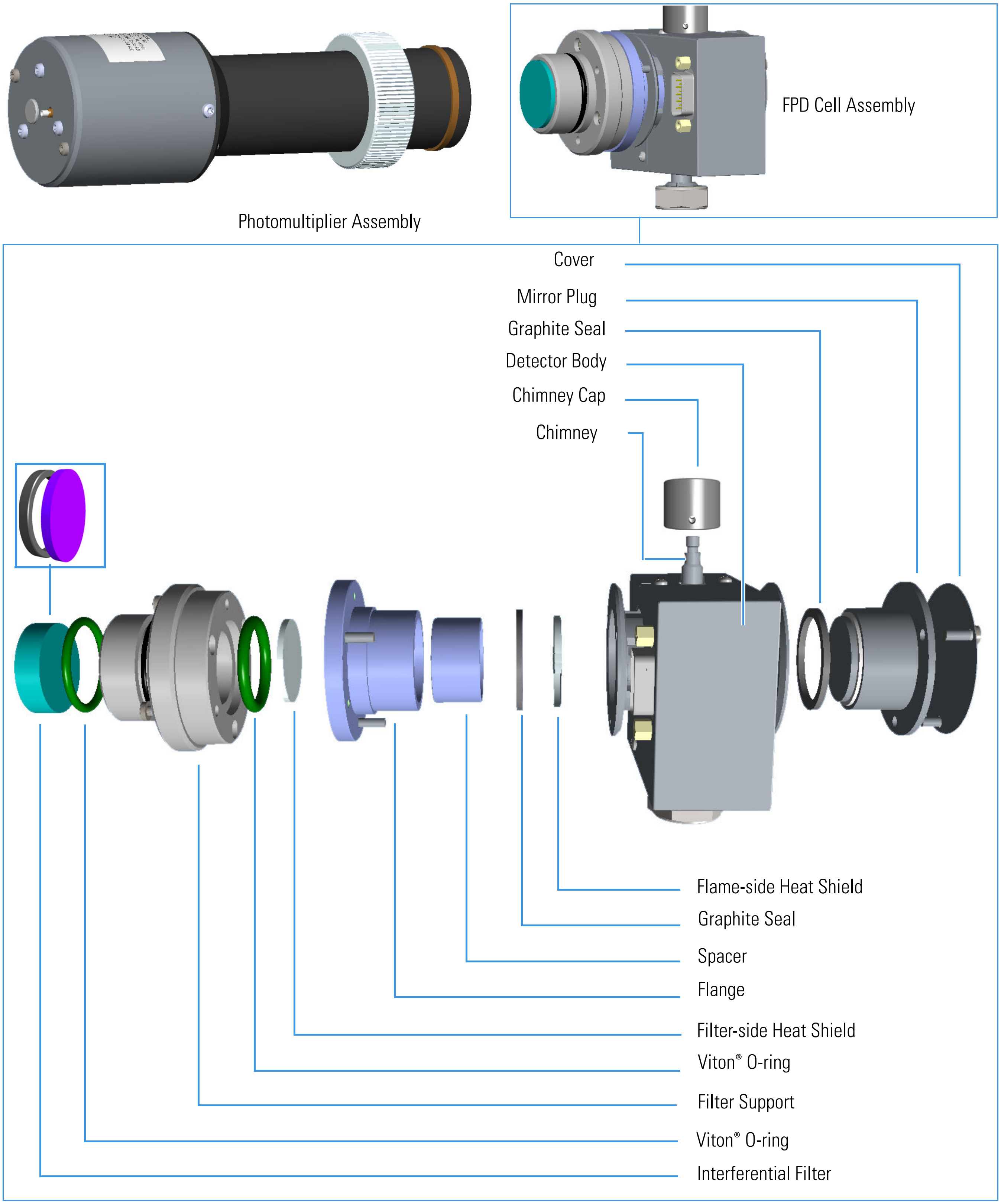


Figure 160. FPD Cell Assembly Components



To ensure optimum performance of the FPD, you must keep it clean and free of dust and deposits. Symptoms such as reduced sensitivity and increased noise indicate that detector cleaning could be necessary.

The FPD detector periodic maintenance includes:

- **Installing the FPD detector**

  See "Installing the FPD Detector" on page 194.

- **Removing the FPD detector**

  See "Removing the FPD Detector" on page 196.

- **Cleaning or replacing the FPD jet**

  You should clean the jet semiannually when you analyze particularly dirty compounds that the flame does not burn properly.

  See "Cleaning or Replacing the FPD Jet" on page 197.

- **Cleaning or replacing the FPD interferential filter**

  See "Cleaning or Replacing the FPD Interferential Filter" on page 201.

- **Replacing the FPD ignition glow-plug**

  This operation is NOT part on the ordinary maintenance. The flame ignition element must be replaced only when defective.

  See "Replacing the FPD Ignition Glow-plug" on page 206.

Before maintaining the detector, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Materials needed to maintain a FPD detector
FPD fixing tool
Gloves
Ultrasonic cleaner
Liquid detergent

Materials needed to maintain a FPD detector
GC-grade methanol
Distilled water
Paper towels
Forceps or tweezers
FPD Jet (if necessary)
Interferential filter for Sulphur PN 28107000 or PN 19050785, (if necessary)
Interferential filter for Phosphorous PN 28107100 or PN 19050785, (if necessary)
Interferential filter for Tin PN 28107001 (optional), (if necessary)
FPD Ignition Glow-plug
T6 Torxhead key
T10 Torxhead screwdriver
5 mm wrench
5/16-in tube wrench

Note For maintaining or replacing any other component not listed in this section, see Chapter 7, "Detectors Advanced Maintenance."

- "Measuring the FPD Gas Flows" on page 313
- "Cleaning or Replacing the FPD Mirror Metal Plug" on page 315
- "Cleaning or Replacing the FPD Filter-side Heat Shields" on page 320
- "Cleaning or Replacing the FPD Flame-side Heat Shields" on page 328
- "Replacing the FPD Photomultiplier Tube" on page 338

Installing the FPD Detector

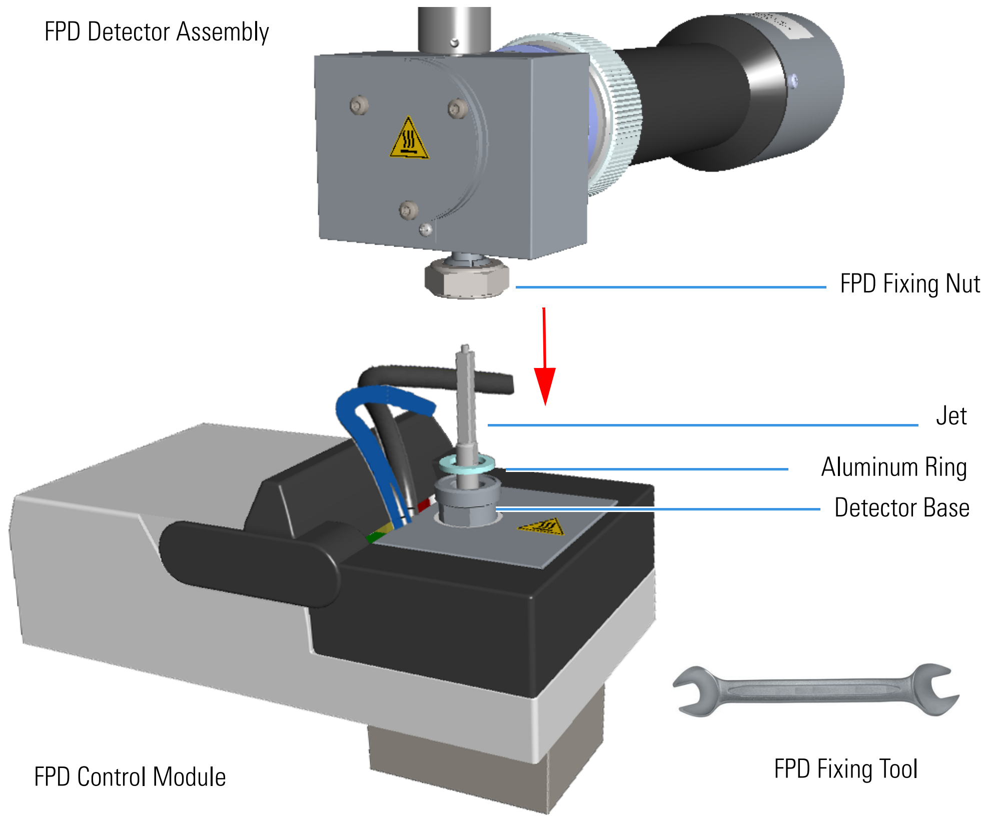
Before proceeding the installation of the FPD detector assembly, make sure that the FPD control module is properly installed into the back detector housing.

❖ **To install the FPD detector assembly on the FPD detector base body**

1. Place the jet into the detector base body housing and tighten it. Ensure the jet is perfectly vertically aligned to avoid damage. Figure 161.

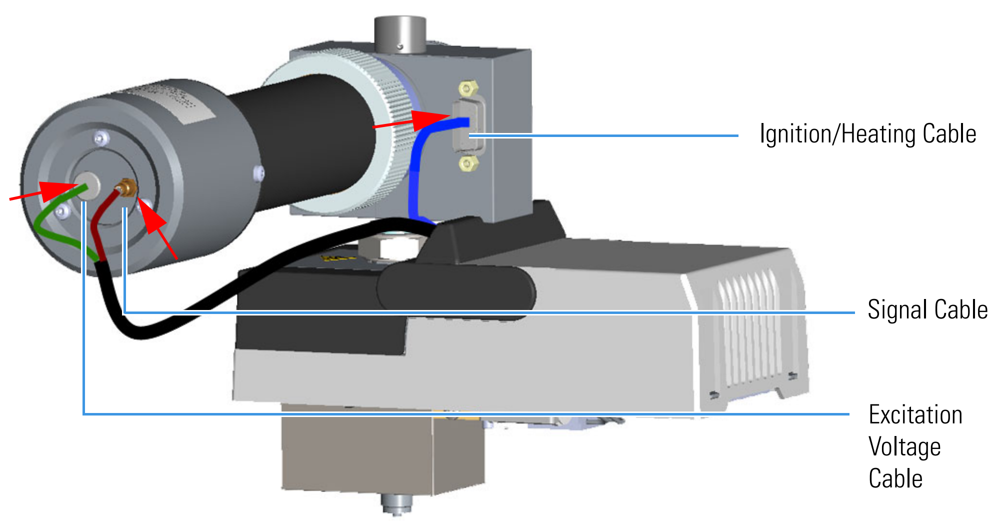
2. Place the FPD on the detector base body, ensuring that the Aluminum ring has been inserted in the correct position. Tighten the fixing nut by using the FPD fixing tool. See Figure 161.

Figure 161. FPD Installation



3. Carefully, connect the signal, excitation voltage, and ignition/heating cables coming from the FPD control module to the FPD detector. See Figure 162.

Figure 162. FPD Cables Connection



Removing the FPD Detector

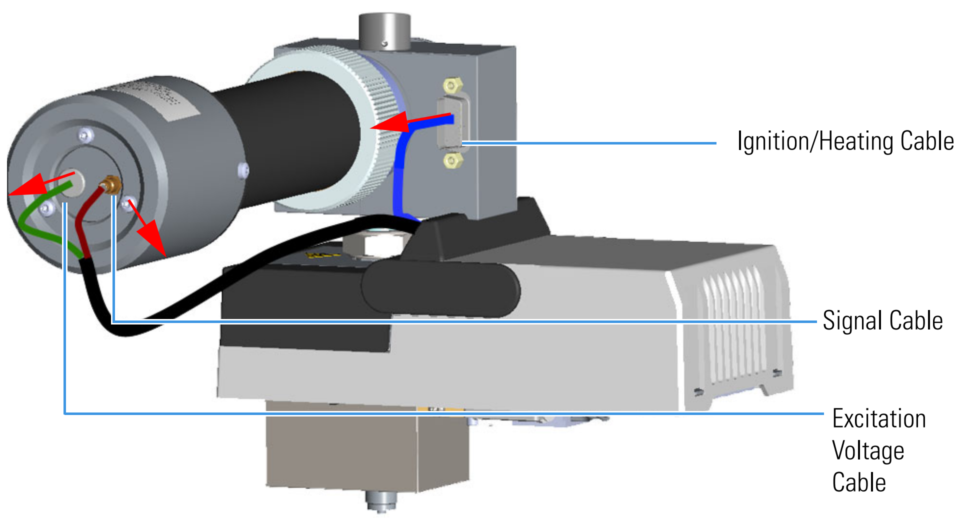
❖ To remove the FPD detector assembly from the FPD detector base body

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

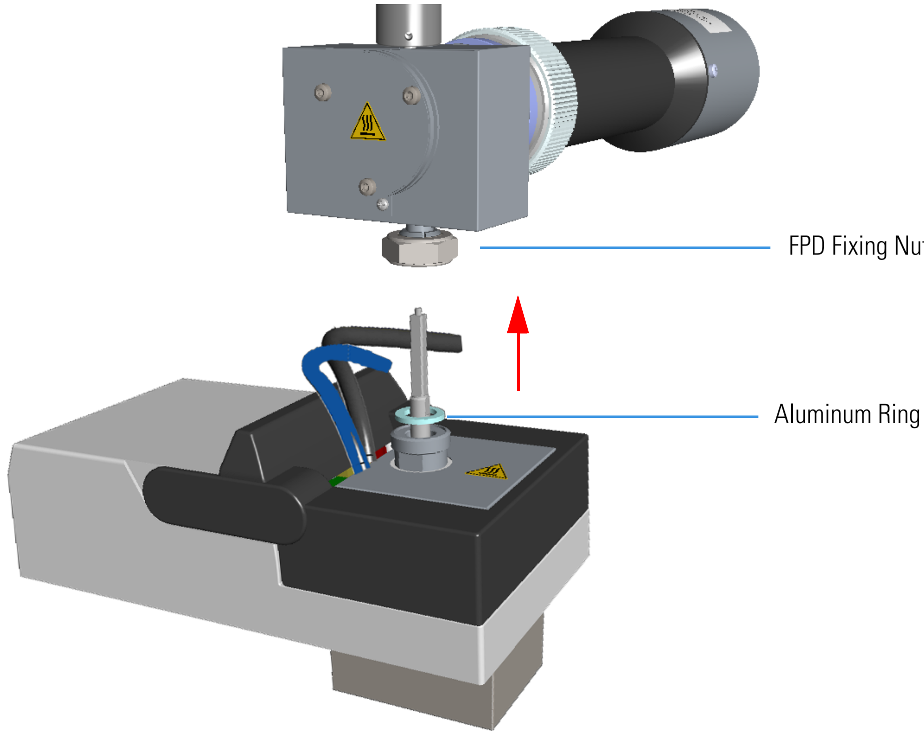
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
6. Remove the FPD detector from the base.
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 163

Figure 163. FPD Cable Disconnection



   b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 164.

Figure 164. FPD Detector Removal



Note Do not lose the Aluminum ring inserted between the detector head and the base body.

Cleaning or Replacing the FPD Jet

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the FPD jet

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

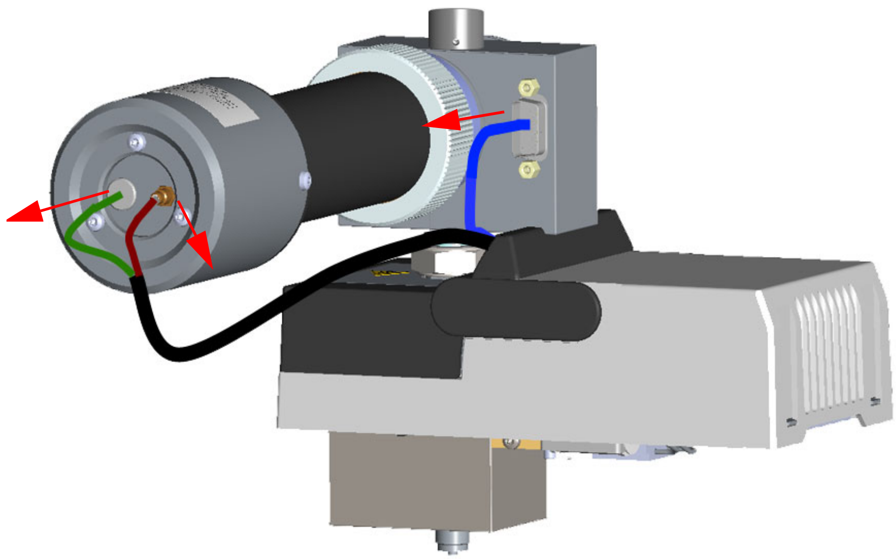
b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

6. Remove the FPD detector from the base.

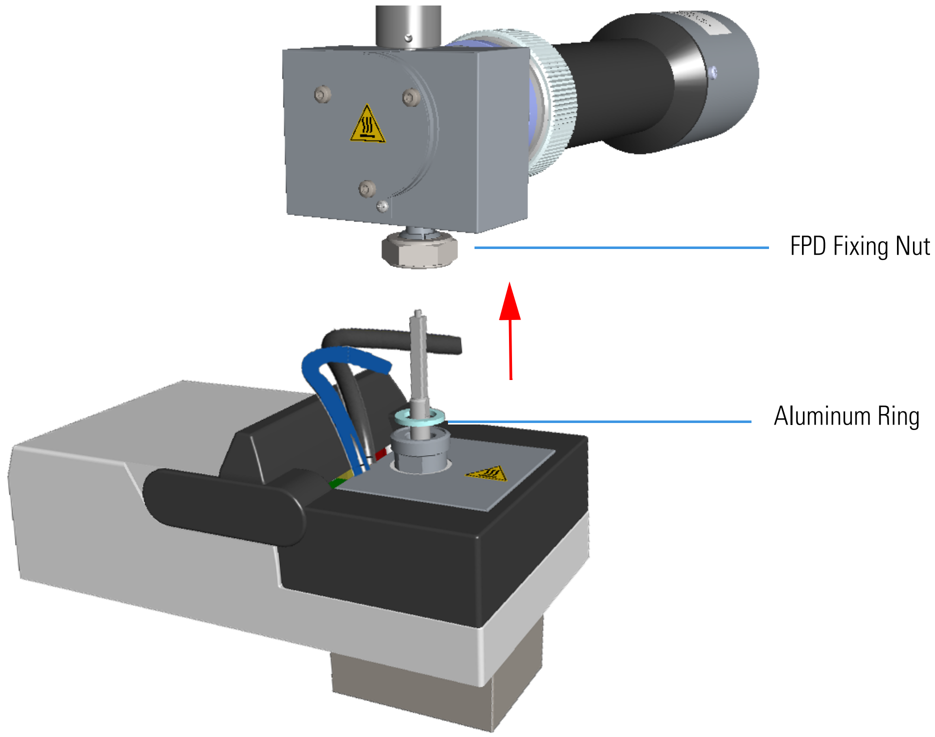
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 165.

Figure 165. FPD Cable Disconnection



   b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 166.

Figure 166. FPD Detector Removal

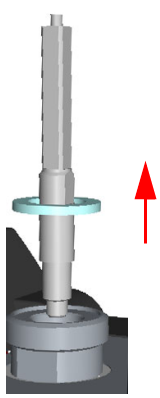


> **Note** Do not lose the Aluminum ring inserted between the detector head and the base body.

7. Clean the FPD Jet.

   a. Using the 5 mm wrench provided with the GC, loosen the jet and remove it from the detector base body. See Figure 167.

   Figure 167. FPD Jet Removal

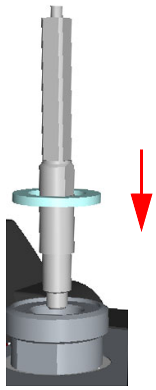
   

   b. Place the jet in the ultrasonic cleaner filled with liquid detergent and clean it for about five minutes.

   c. Handling the jet with forceps or tweezers, rinse the jet with distilled water, then with methanol.

d. Place the jet on a paper towel and let it air dry. When the jet is dry, insert the jet into the detector base body and tighten it. See Figure 168.

Figure 168. FPD Jet Reinstallation

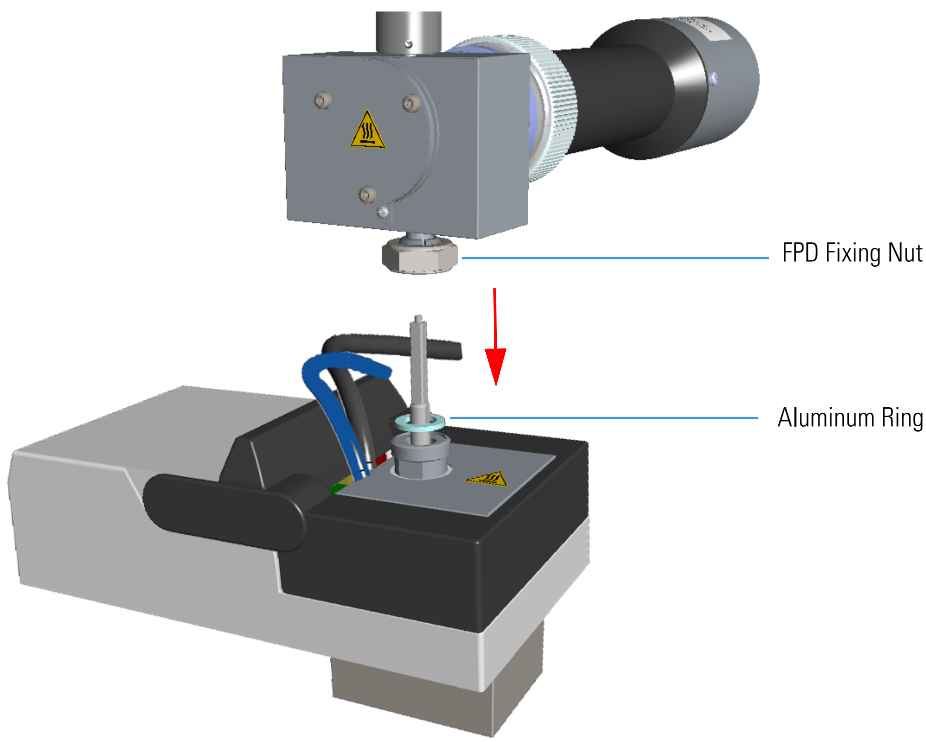


> **Note** If after cleaning the physical condition of the jet does not permit its reuse, replace the jet with a new one.

8. Reinstall the FPD detector on the base.

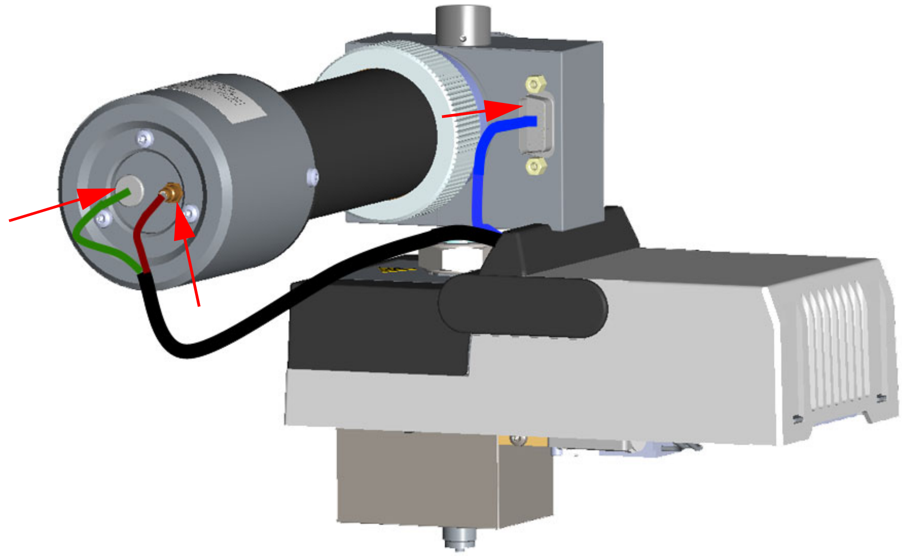
a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 169.

Figure 169. FPD Detector Reinstallation



b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 170.

Figure 170. FPD Cables Connection



9. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

10. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

11. Set the normal working conditions.

Cleaning or Replacing the FPD Interferential Filter

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Before maintaining the detector, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents, you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

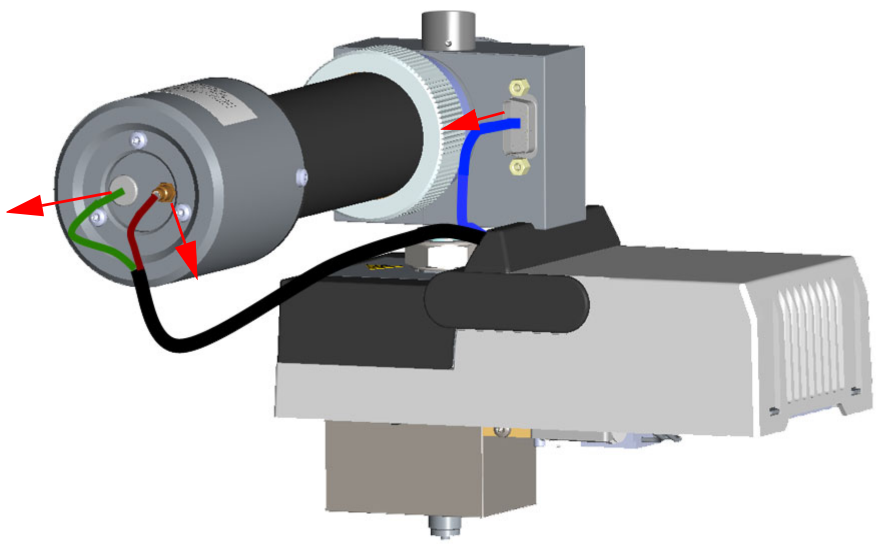
❖ To clean or replace the FPD interferential filter

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

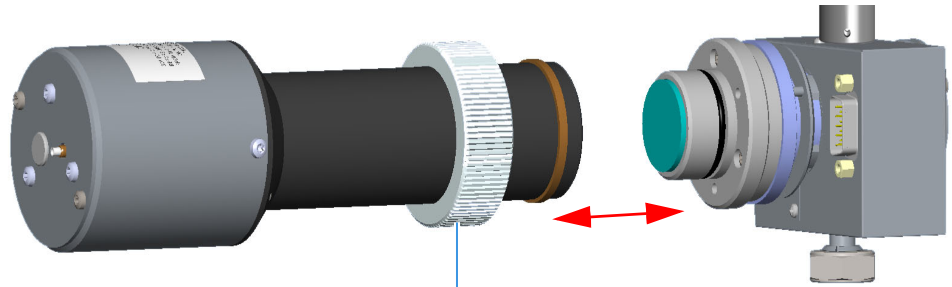
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
6. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 171.

Figure 171. FPD Cables Disconnection



7. Remove the photomultiplier assembly and the filter. See Figure 172.

Figure 172. Photomultiplier Assembly Removal



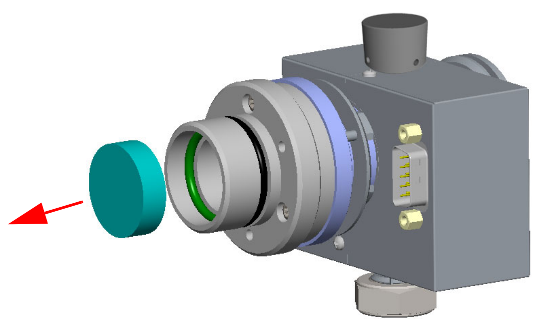
a. Loosen the knurled nut that fixes the photomultiplier assembly and remove it from the detector body.

CAUTION The photomultiplier tube could damage if exposed to ambient light with the excitation voltage On. Make sure the power supply has been switched off before disconnecting the tube from the detector body.

ATTENTION Le tube photomultiplicateur pourrait être endommagé en cas d'exposition à la lumière ambiante alors que la tension d'excitation est activée. Assurez-vous que l'alimentation a été coupée avant de débrancher le tube du corps du détecteur.

b. Remove the interferential filter from its housing, handling it very gently. Keep it using a clean paper towel. See Figure 173.

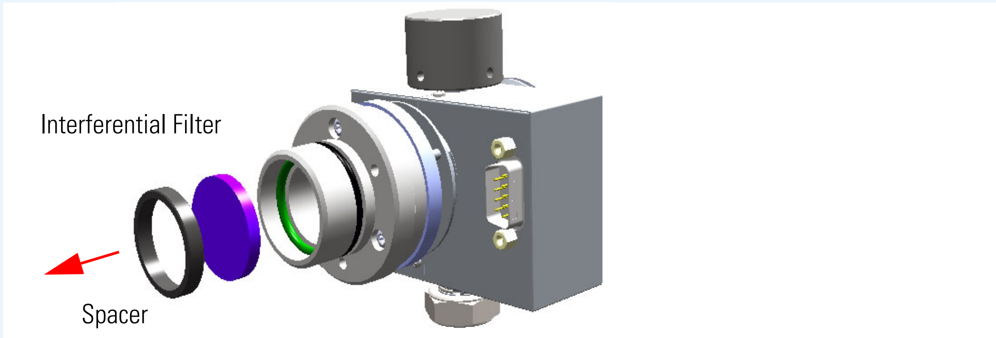
Figure 173. Interferential Filter Removal



CAUTION Filters are fragile. Pay attention not to let the filter fall down and damage.

ATTENTION Les filtres sont fragiles. Assurez-vous de ne pas faire tomber et endommager le filtre.

CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first remove the spacer, and then the interferential filter. Keep them clean using a clean paper towel.



ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), retirez d'abord le filtre, puis l'entretoise.

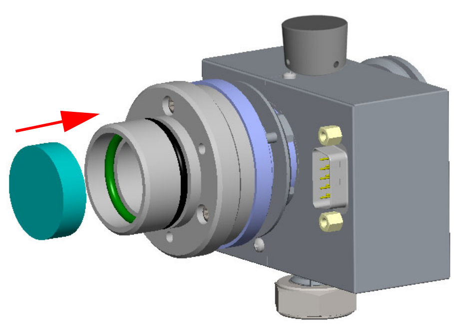
8. Clean the filter.
   a. Using a clean paper towel, clean the filter on both faces.

CAUTION Avoid touching the filter with your fingers. If you see fingerprints on the filter, clean it using GC-grade methanol and air dry before remounting.

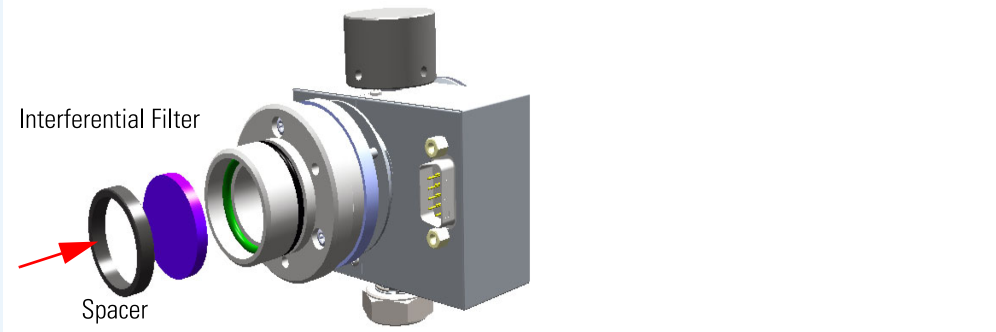
ATTENTION Évitez de toucher le filtre avec vos doigts. Si vous voyez des traces de doigts sur le filtre, nettoyez-le avec du méthanol de qualité GC et séchez-le à l'air avant de le remonter.

9. Reassembly the filter and the photomultiplier assembly.
   a. Insert the cleaned filter or a new filter into its housing. The mirror face must be oriented towards the flame. See Figure 174.

Figure 174. Filter Reinstallation



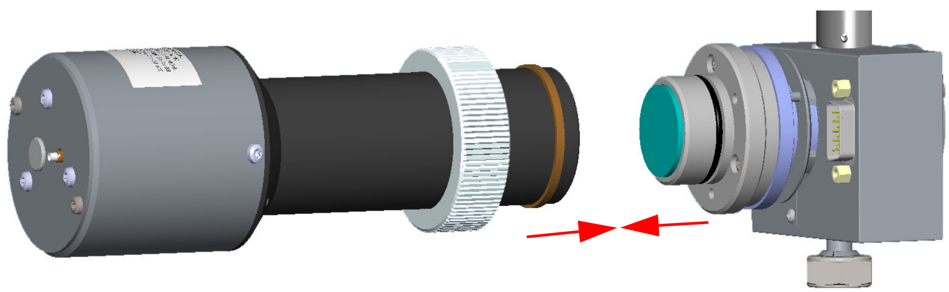
CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first insert the filter, and then the spacer.



ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), insérez d'abord le filtre, puis l'espaceur.

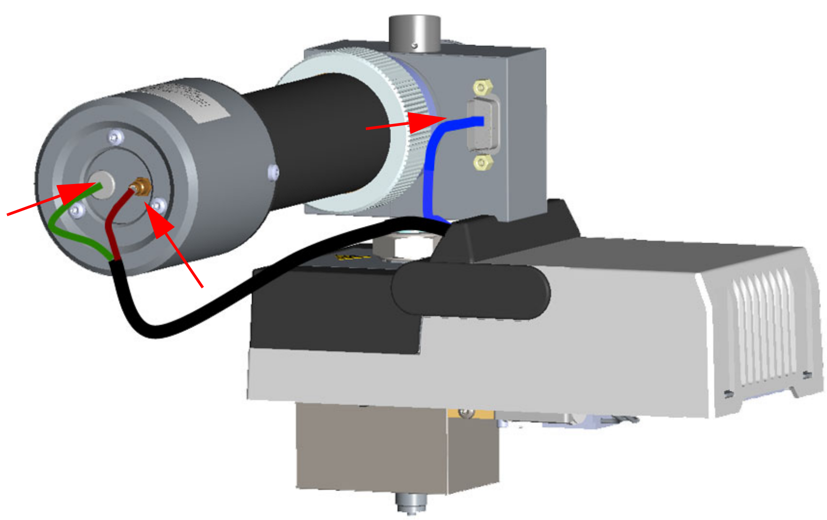
b. Reassembly the photomultiplier assembly and the detector body, then fix them together tightening the knurled nut. See Figure 175.

Figure 175. Photomultiplier Assembly Remounting



10. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 176.

Figure 176. FPD Cables Connection



11. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.
12. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
13. Set the normal working conditions.

Replacing the FPD Ignition Glow-plug

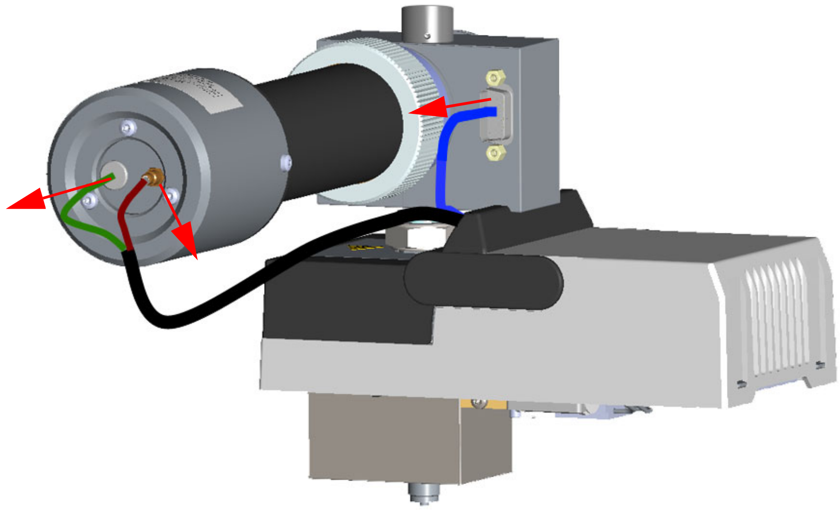
❖ **To replace the FPD ignition glow-plug**

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

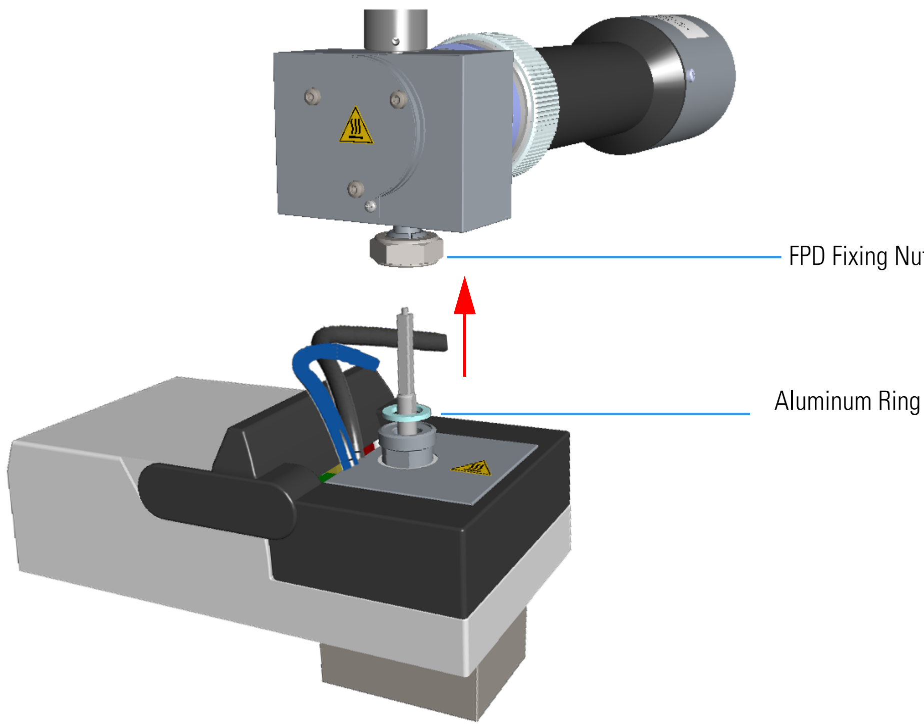
4. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
6. Remove the FPD detector from the base.
    a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 177.

Figure 177. FPD Cables Disconnection



b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 178.

Figure 178. FPD Detector Removal



> **Note** Do not lose the Aluminum ring inserted between the detector head and the base body.

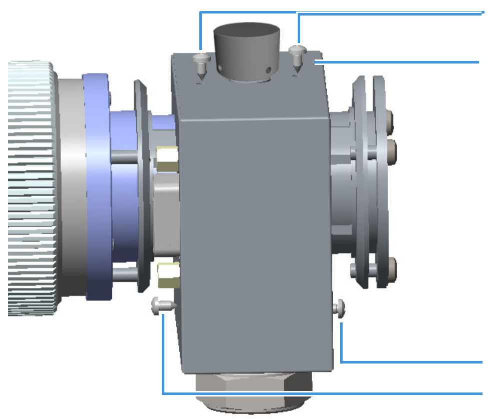
7. Remove the covers of the FPD detector body.

CAUTION When removing the covers, pay attention to the heater element and the temperature probe.

ATTENTION Pendant la dépose / réinstallation des couvercles, faites attention à l'élément chauffant et à la sonde de température.

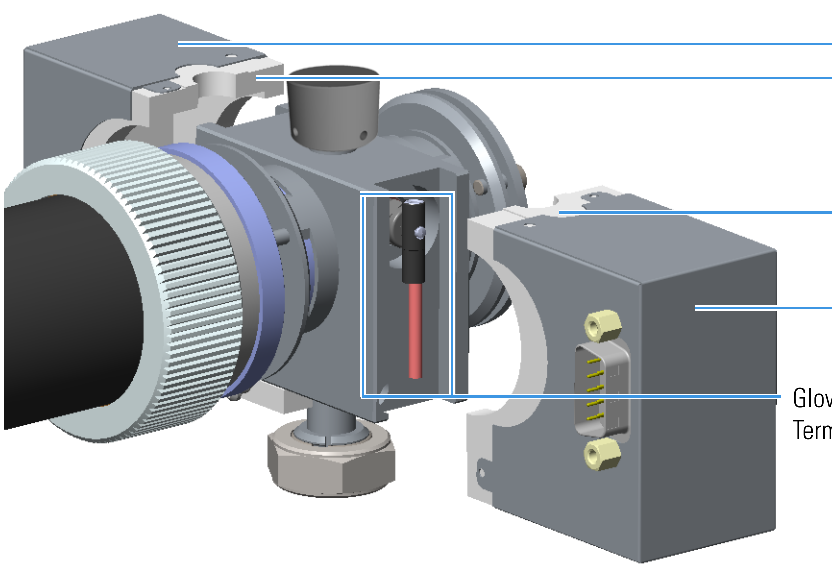
a. Using a 5/16-in tube wrench, remove the two screws on the top of the detector body, and the front and back screws on the lower part of the detector body. See Figure 179.

Figure 179. Detector Body Dismounting (1)



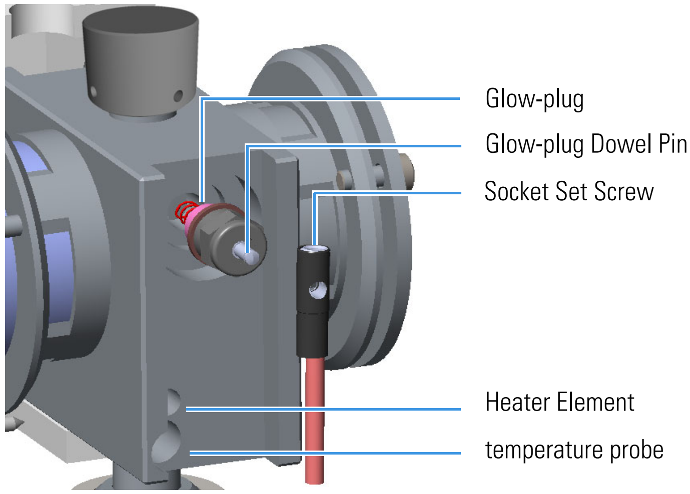
b. Remove the left and right covers of the FPD detector body and the insulating material. The glow-plug is now accessible. See Figure 180.

Figure 180. Detector Body Dismounting (2)



8. Replace the defective glow-plug. See Figure 181.

Figure 181. Glow-plug Replacing



a. Loosen the glow-plug cable socket set screw using a T6 Torxhead screwdriver. Carefully pull out the terminal body of the glow-plug cable from the dowel pin on the glow-plug element.

b. Using an 8-mm wrench, unscrew and remove the defective glow-plug with its washer.

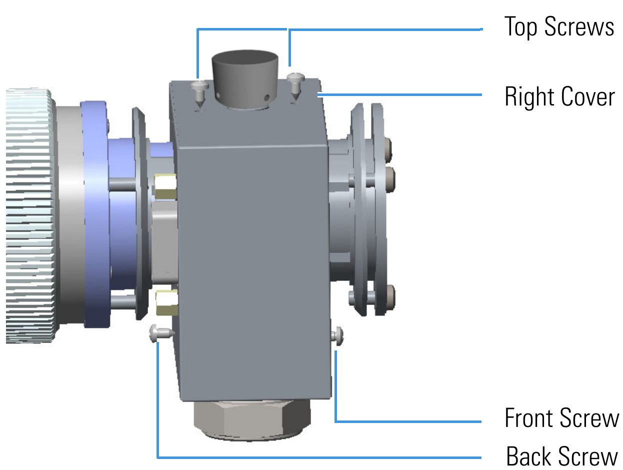
c. Replace the glow-plug with a new one interposing the new washer.

9. Reinstall the left and right covers of the FPD detector body with the insulating material in the original position, and fix them with the four fixing screws. See Figure 182.

CAUTION When removing the covers, pay attention to the heater element and the temperature probe.

ATTENTION Pendant la dépose / réinstallation des couvercles, faites attention à l'élément chauffant et à la sonde de température.

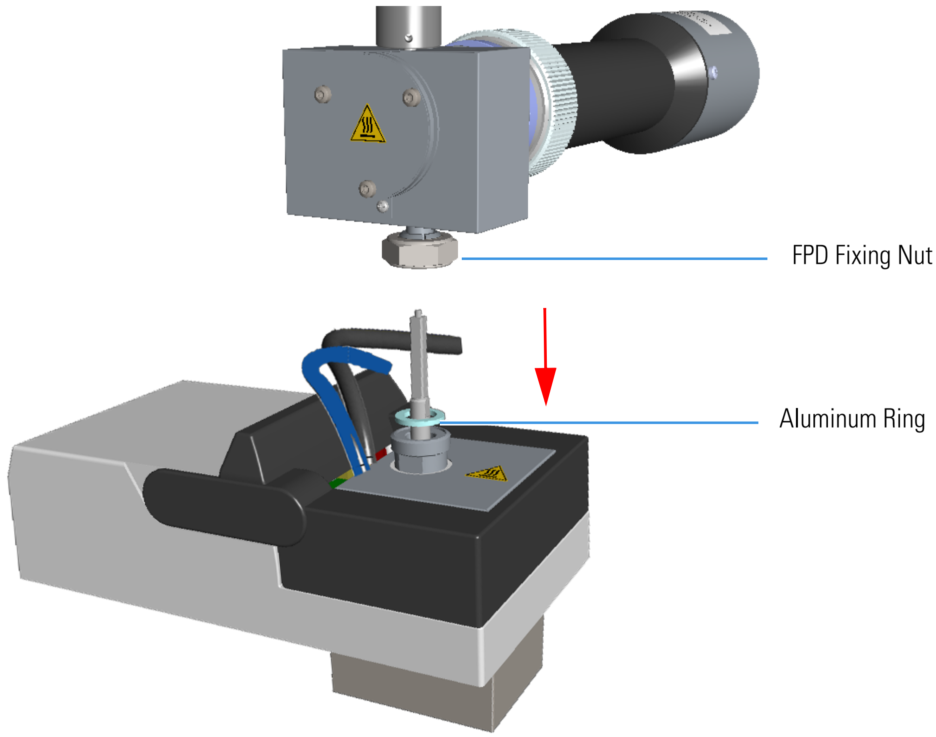
Figure 182. Detector Body Remounting



10. Reinstall the FPD detector on the base.

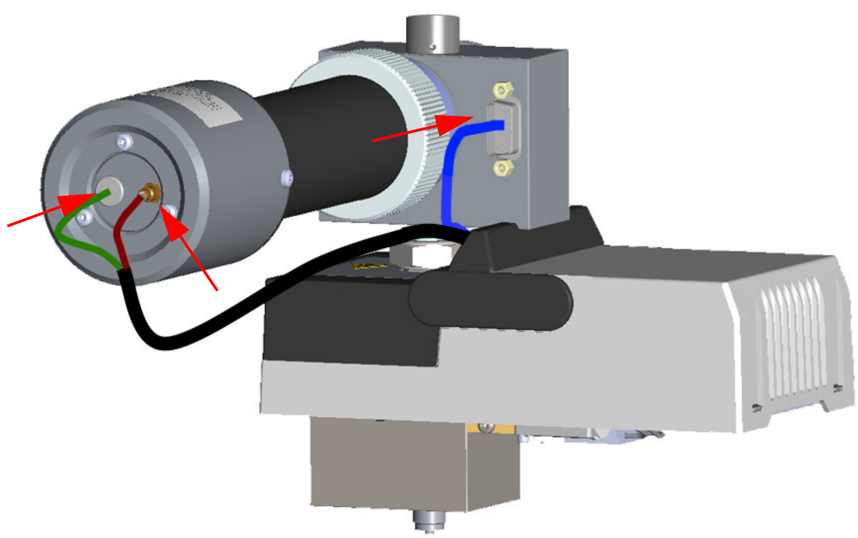
    a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 183.

    Figure 183. FPD Detector Reinstallation



    b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 184.

    Figure 184. FPD Cables Connection



11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
12. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
13. Set the normal detector working conditions.
14. Ignite the flame.

Maintaining a Pulsed Discharge Detector (PDD)

The Pulsed Discharge Detector (PDD) does not require maintenance.

WARNING Under no circumstances should the detector be disassembled. The components of the detector are assembled with special tooling and held under considerable force. Disassembling of the detector may present a safety hazard and will result in its destruction.

5

GC Main Frame Advanced Maintenance

This chapter describes TRACE 1600/1610 GC components that do not require routine maintenance, but they need to be removed or replaced.

Contents

Removing/Replacing the GC Top Cover

Perform this operation for accessing the internal compartments of the GC.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

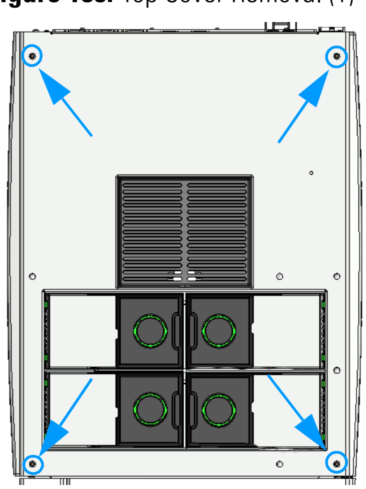
❖ To remove/replace the top cover accessing the top parts of the GC

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

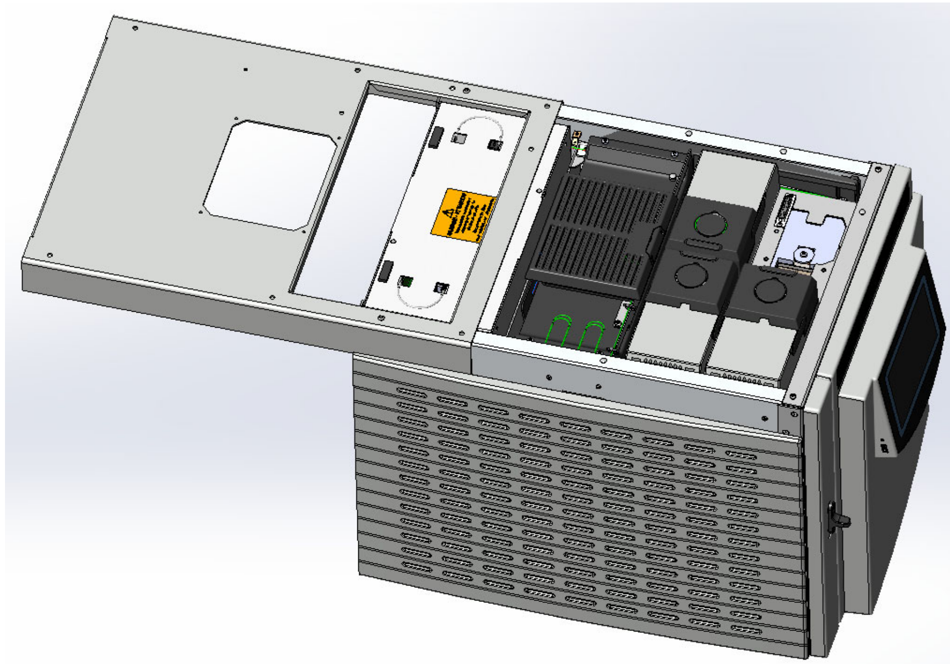
3. Power off the GC.
   a. Close the gas supplies.
   b. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   c. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the autosampler if present.
6. Remove the cover.
   a. Using a T20 Torxhead screwdriver, unscrew the four screws that held it in place. See Figure 185 and Figure 186.

Figure 185. Top Cover Removal (1)



b. Lift the top panel up and off the GC.

Figure 186. Top Cover Removal (2)



7. Replace the top cover by completing the steps in the reverse order in which it was removed.

Removing/Replacing the GC Left Side Panel

❖ **To remove the left side panel with the side panel molded of the GC**

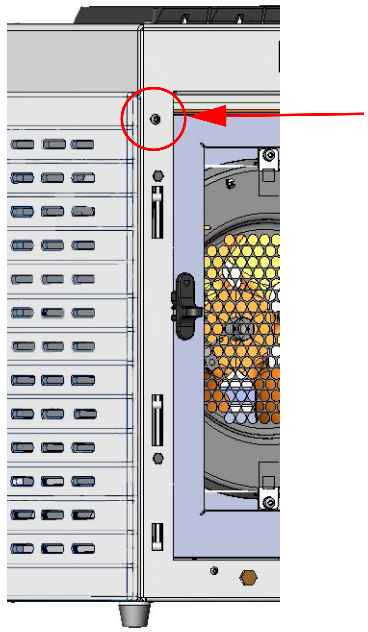
1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the panel.

a. Open the front door of the GC. Using a T20 Torxhead screwdriver, unscrew the left side panel screw from the interior front panel. See Figure 187.

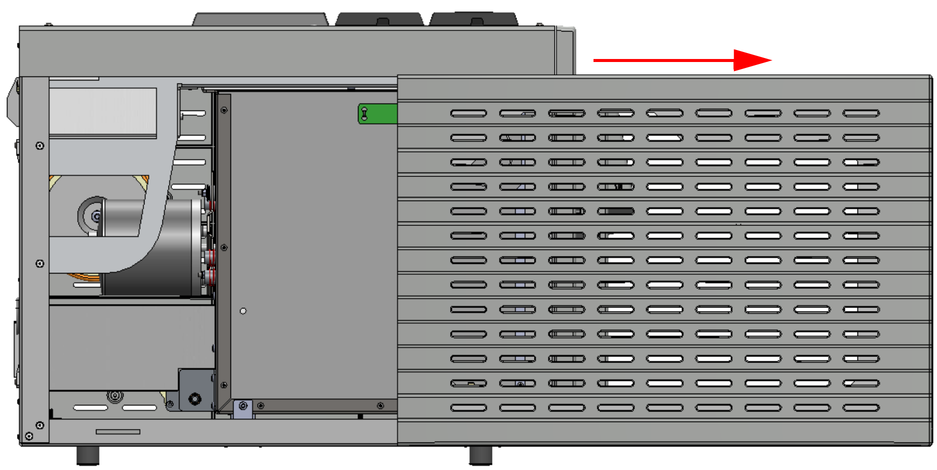
Figure 187. Left Side Panel Fixing Screw



b. Slide the panel towards the back of the instrument up to the stop.

c. Remove the panel pulling it outwards being aware that the ground wire is attached to the panel. See Figure 188.

Figure 188. Left Panel Removal



d. Unplug the ground wire from the panel.

Note Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

6. Replace the panel.
   a. Plug the ground wire to the panel.
   b. Reinstall the panel proceeding in the reverse order in which it was removed.

Removing/Replacing the GC Right Side Panel

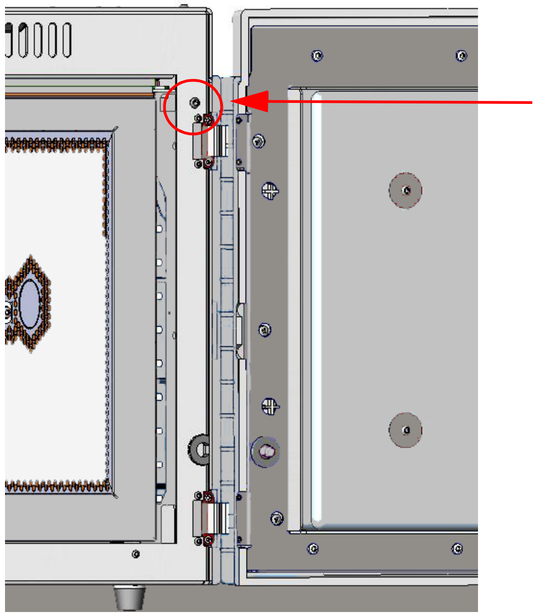
❖ To remove the right side panel with the side panel molded of the GC

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the AI/AS autosampler, if present.
6. Remove the panel.
   a. Open the front door of the GC. Using a T20 Torxhead screwdriver, unscrew the right side panel screw from the interior front panel. See Figure 189.

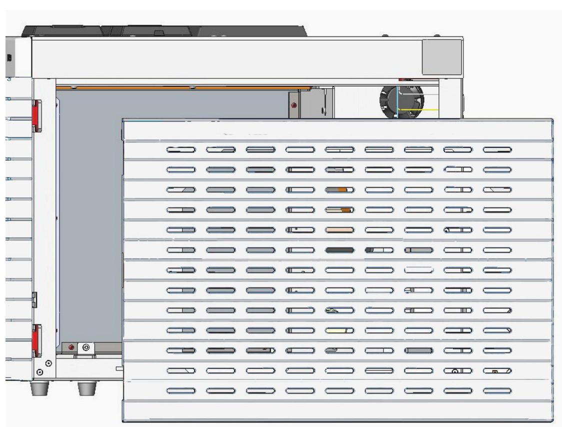
Figure 189. Right Panel Fixing Screw



b. Slide the panel towards the back of the instrument up to the stop.

c. Remove the panel by pulling it outwards. Be aware that the ground wire is attached to the panel. See Figure 190.

Figure 190. Right Panel Removal



d. Unplug the ground wire from the panel.

> **Note** Pay attention to the positioning of the ground wire plug, so it can be reconnected the same way it was removed.

7. Replace the panel.

   a. Plug the ground wire to the panel.

   b. Reinstall the panel proceeding in the reverse order in which it was removed.

Removing/Replacing the GC Back Cover

Remove the back cover for accessing the compartment on the back of the GC.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

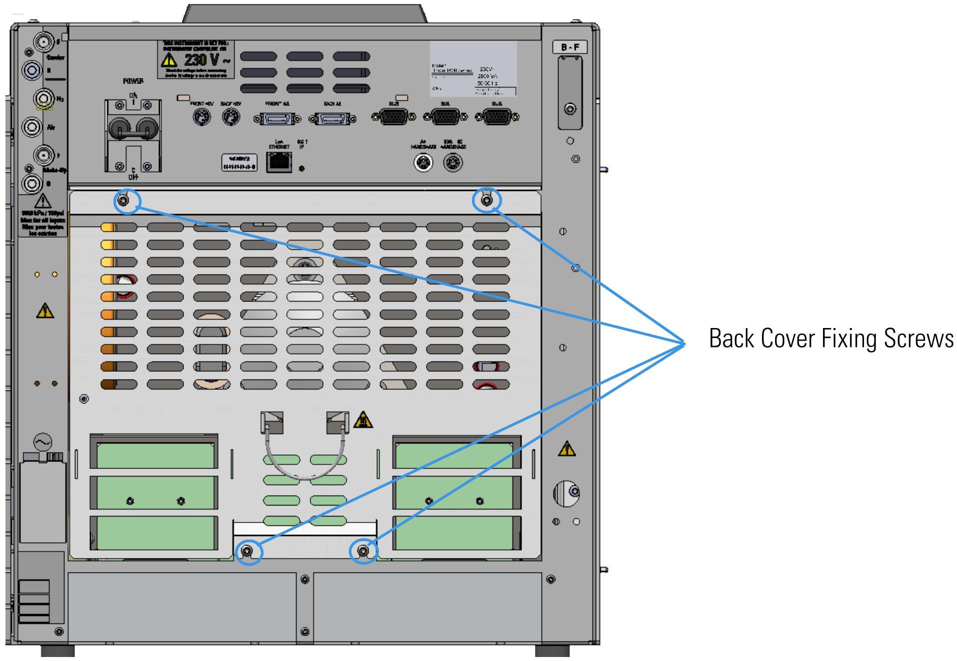
❖ **To remove the back cover**

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

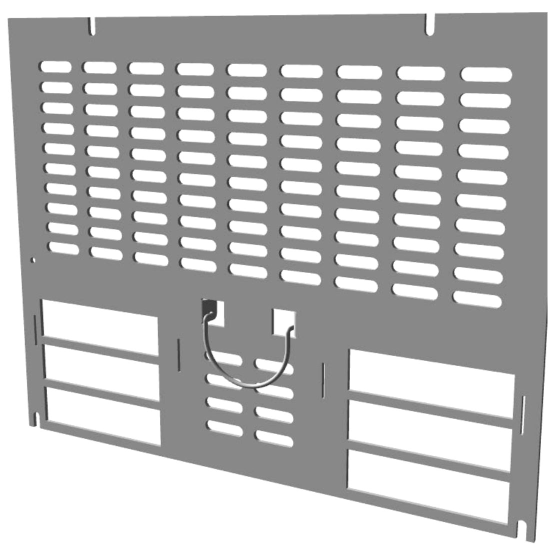
3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the cover.
   a. Using a T20 Torxhead screwdriver, unscrew the four screws that secure the back cover to the GC. See Figure 191.

Figure 191. Back Cover Removal



b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back cover. See Figure 192.

Figure 192. Back Cover



> **Note** Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

6. Reconnect the ground wire to the back cover terminal.

7. Replace the cover proceeding in the reverse order in which it was removed.

Removing/Replacing the GC Front Door Cover

This section provides the instruction for removing or replacing the cover of the front door.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

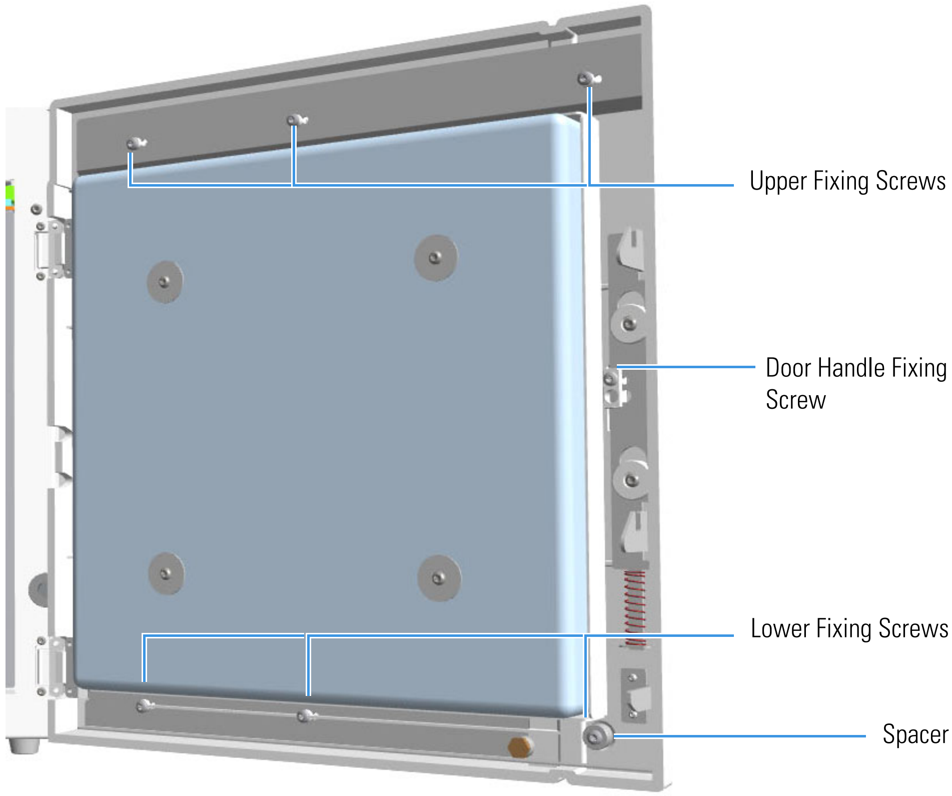
❖ To remove the cover of the front door of the GC

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the door cover.
   a. Open the front door and look for the fixing screws that secure the cover and the door handle to the door. See Figure 193.

Figure 193. Front Door Back View

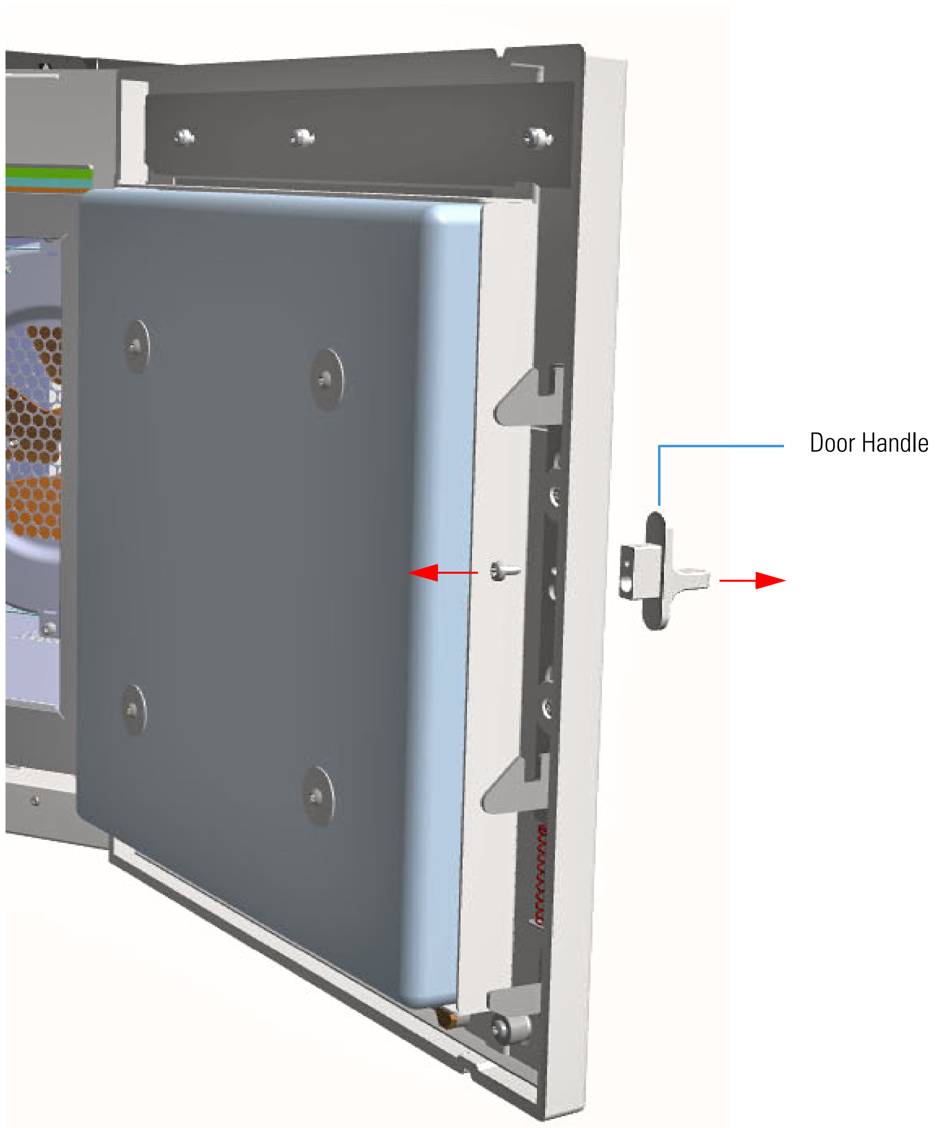


b. Using a T20 Torxhead screwdriver remove the screw that secure the door handle to the front door.

c. Pull the door handle out from the front door. See Figure 194.

IMPORTANT Save the door handle because it must be reused.

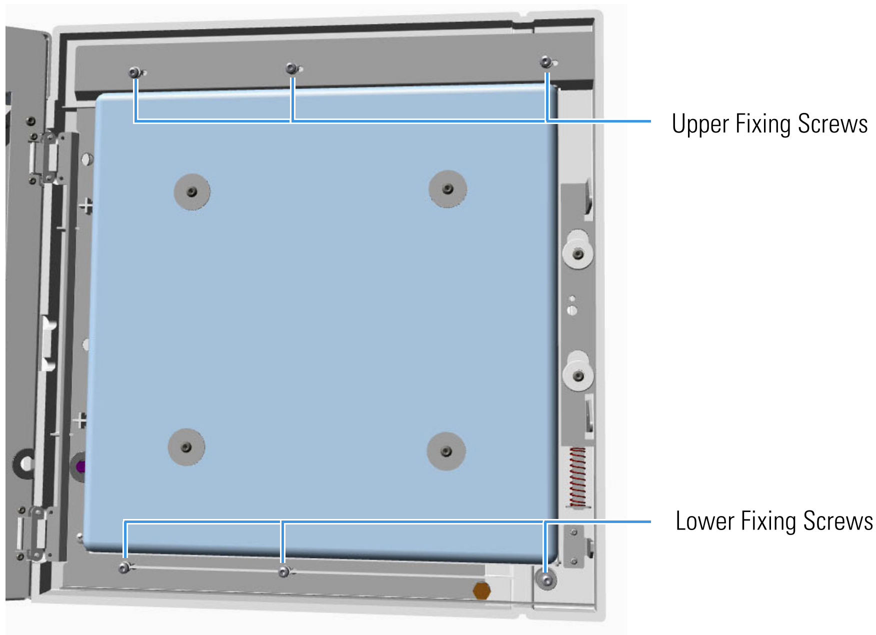
Figure 194. Door Handle Removal



d. Using a T20 Torxhead screwdriver remove the three upper and the three lower screws that secure the cover to the front door. See Figure 195.

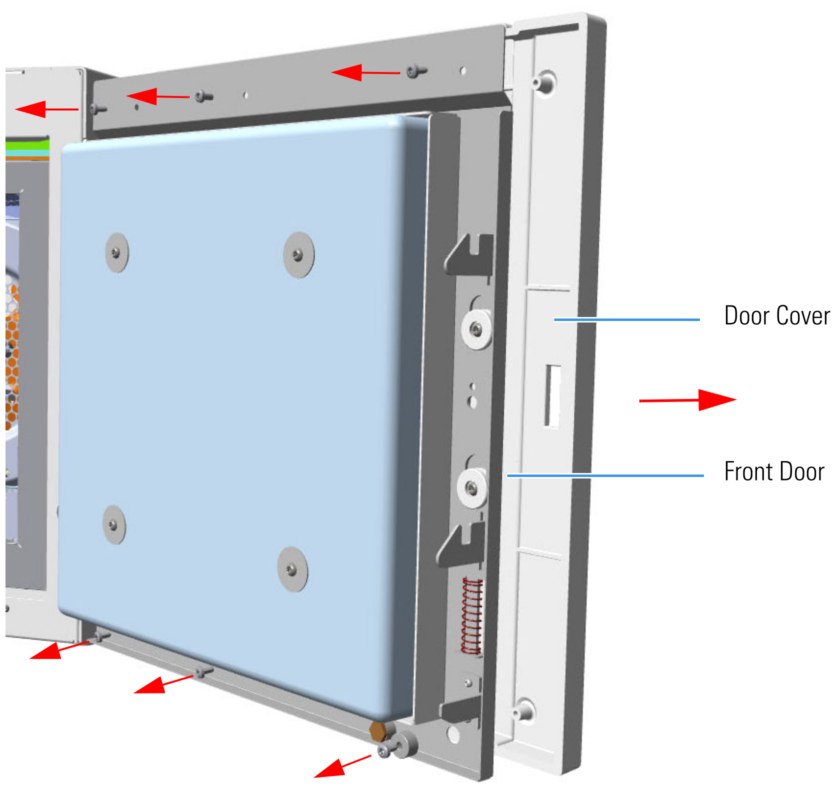
> **Note** The lower screw on the lower right corner is screwed into a spacer.

Figure 195. Door Cover Fixing Screws Removal



e. Carefully pull the door cover off. Pay attention to the cables that connect the status panel to the internal section of the door. See Figure 196.

Figure 196. Front Door Removal



f. Disconnect the cables from the connector located on the front of the door.

- See Figure 197 in case of TRACE 1600.
- See Figure 198 in case of TRACE 1610.

Figure 197. TRACE 1600 Front Door Cables Removal

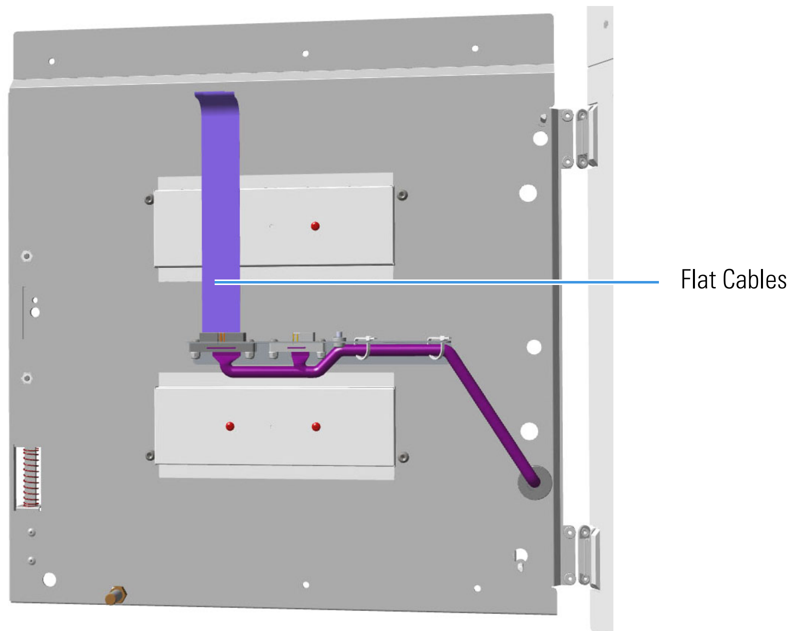
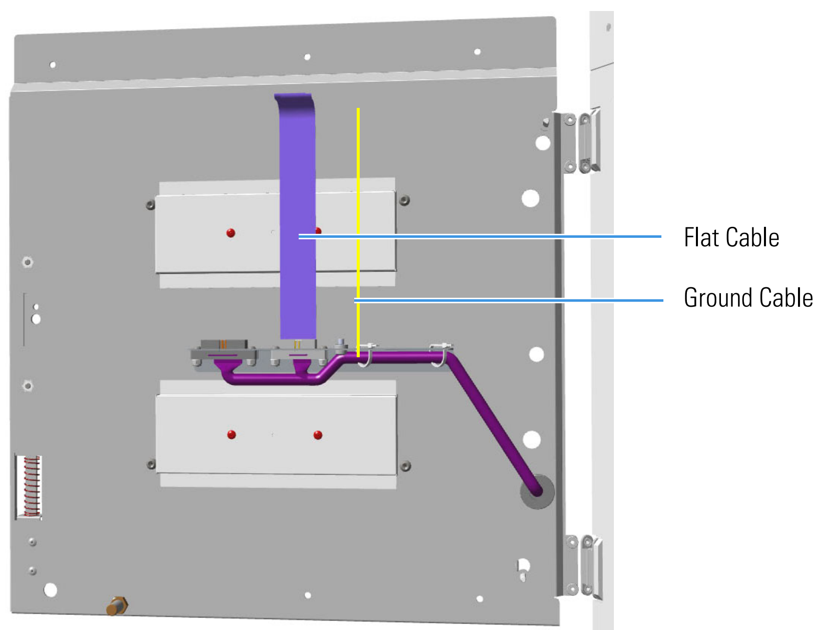


Figure 198. TRACE 1610 Front Door Cables Removal



6. Replace the cover proceeding in the reverse order in which it was removed.
7. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

8. Power on the GC.
   a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
   b. Flip up the power switch (breaker) to the position I.
9. Set the normal injector, detector, and GC working conditions.

Removing/Replacing the Electronic Module

The Electronic Module contains power and electronic circuits for the control of the instrument. A proper module is installed according to 120 Vac or 230 Vac power supply.

WARNING This operation must be carried out only by authorized and trained Thermo Fisher Scientific technical personnel.

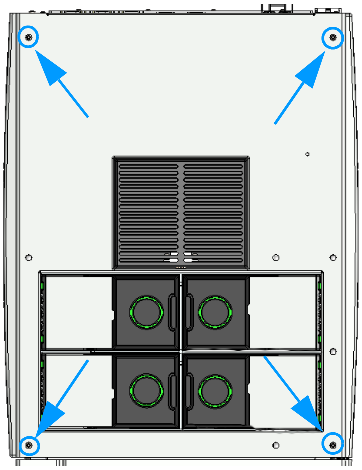
❖ To remove/replace the electronic module

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

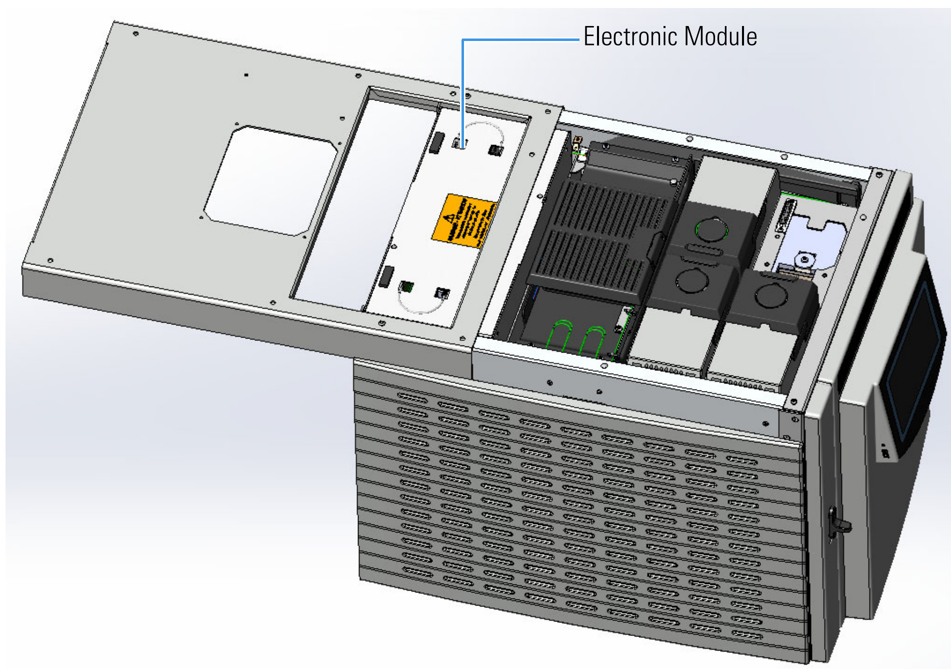
3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Unplug the cables connected to the external interface of the Electronic Module.
6. Remove the autosampler if present.
7. Remove the top cover.
   a. Use a T20 Torxhead screwdriver to remove the screws at the sides of the top cover. See Figure 199.

Figure 199. Top Cover Removal (1)



b. Slide the top panel toward the back of the instrument and lift it off. See Figure 200.

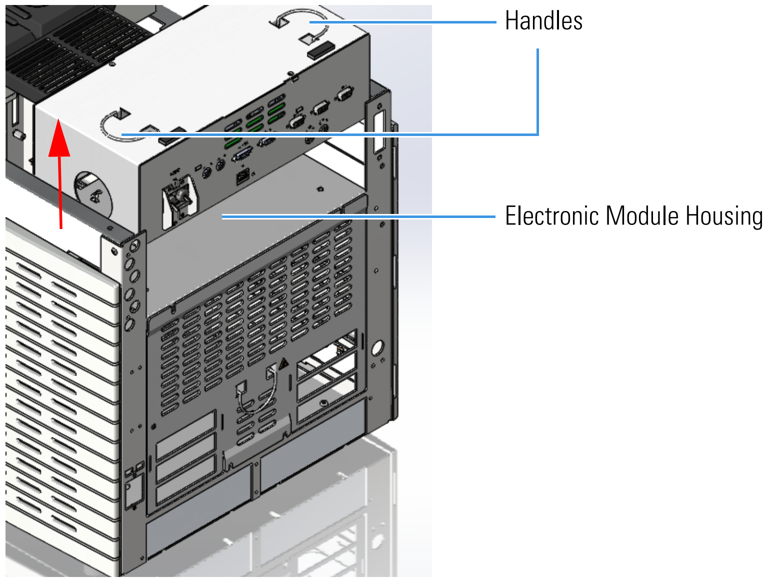
Figure 200. Top Cover Removal (2)



8. Remove the Electronic Module.

   a. Using the two handles on the top cover, pull out module from its housing. See Figure 201.

Figure 201. Electronic Module Extraction



9. Replace the Electronic Module.
   a. Guide the electronic module into its housing.
   b. Push down the module. Be sure to plug the terminal contacts of the mother board into the two slots of the backplane board. See Figure 202 and Figure 203.

Figure 202. Electronic Module Replacement (1)

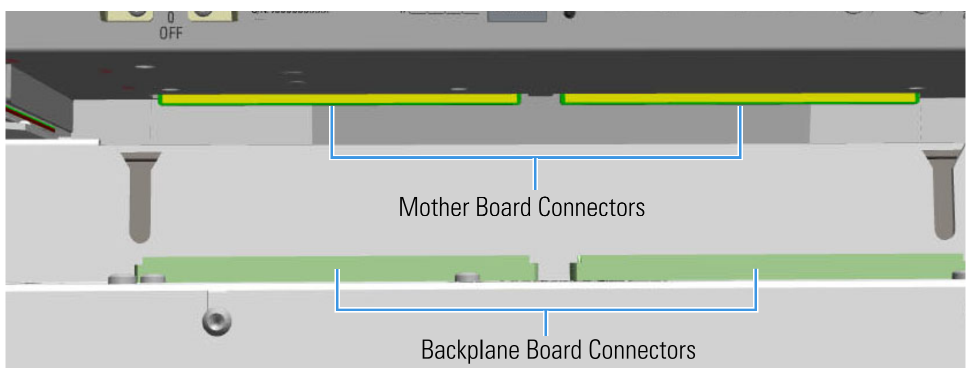
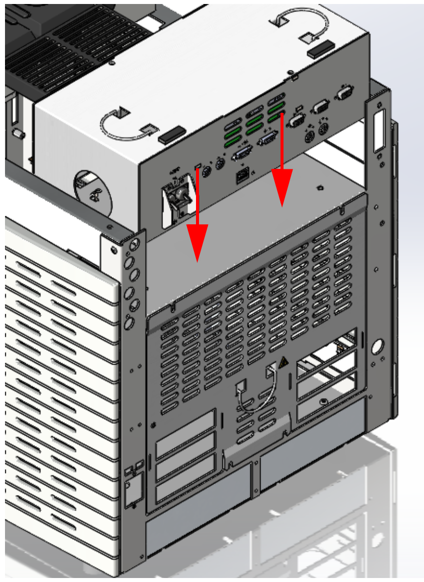


Figure 203. Electronic Module Replacement (2)



10. Reinstall and fix the top cover of the GC.
11. Reinstall the autosampler if present.
12. Plug the cables connected to the external interface of the Electronic Module.
13. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
14. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
15. Set the normal injector, detector, and GC working conditions.

Replacing the Oven Heater Baffle

Removing the oven heater requires replacing the complete oven heater baffle. This includes the plate, heaters, and temperature sensor.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

❖ **To replace the oven heater baffle**

1. Put the GC in standby condition.

2. Cool the oven, injectors and detectors to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.

    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

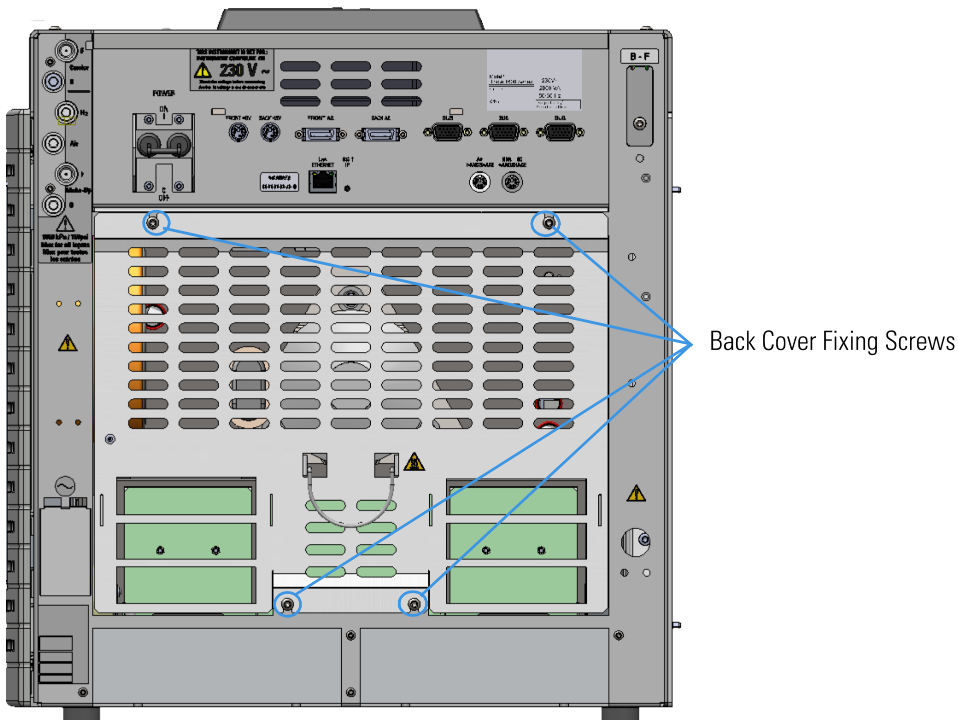
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

5. Remove the back cover.

    a. Using a T20 Torxhead screwdriver, remove the four screws that secure the back cover to the GC. See Figure 204.

Figure 204. Back Cover Removal



    b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back panel.

Note Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

6. Remove the analytical column.

a. Open the front door of the GC.

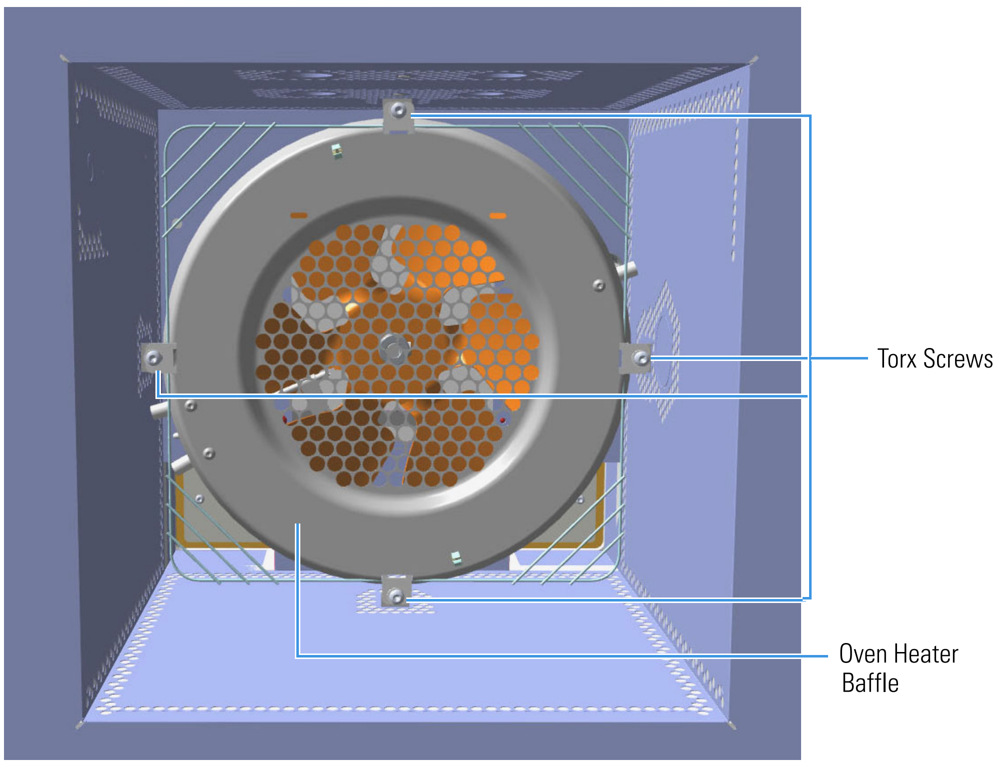
b. Loosen the retaining nut from the injector and detector fitting on the upper interior wall of the GC oven.

c. Remove the analytical column with its nut and ferrule from the bottom of the injector and the detector.

7. Remove the oven heater baffle.

The oven heater baffle is attached to the oven wall by four adjustable tabs. These tabs are attached to the oven heater baffle with four Torx screws. See Figure 205.

Figure 205. Oven Heater Baffle

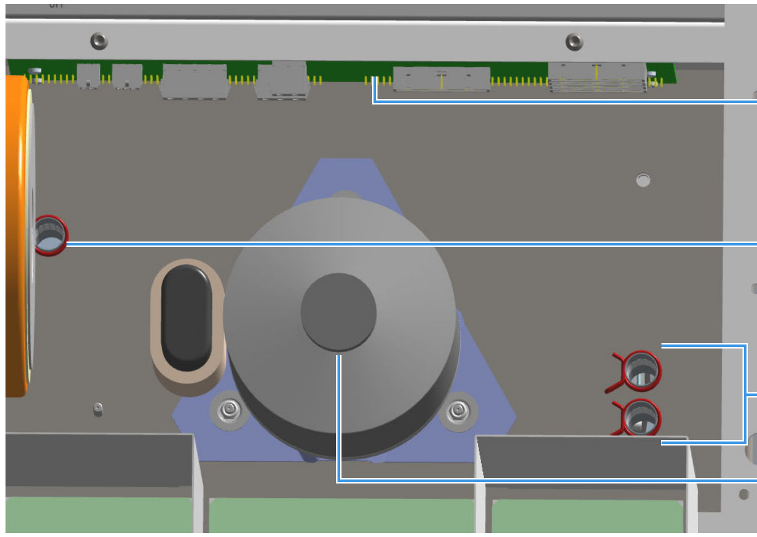


The heater and temperature sensor wires are connected to the backplane board passing through the three pipes provided on the oven back wall.

- The temperature sensor wire is plugged into the connector marked **J4** (Oven PT100)
- The heater wires are plugged into the connector **J23**, **J24**, and **J25** (Oven Heater).

The pipes are plugged by insulation material. See Figure 206.

Figure 206. Pipes



a. Unplug the heater and temperature sensor wires from the relevant connector on the backplane board.

b. Loosen and remove the four Torx screws that secure the tabs to the oven heater baffle. See Figure 205.

8. Pull out the oven heater baffle from the oven, paying attention to guide the heater and temperature sensor wires through the three pipes on the back oven wall.

IMPORTANT During this operation, part of the insulation material drops down into the oven. This material is reused later when a new Oven Heater Baffle is installed.

9. Replace the oven heater baffle in the reverse order in which it was removed.

   a. Guide the heater and temperature sensor wires through the pipes provided on the oven back wall.

   b. Reconnect the temperature sensor and heater wires to the relevant connector **J4**, **J23**, **J24**, and **J25** on the backplane board.

   c. Plug the pipes with the insulation material.

   d. Secure the oven heater baffle to the oven wall with the four Torx screws in the tabs.

   The tab adjustment screws should be loose. Carefully center the oven heater baffle inside of the oven. Be sure that the center hole in the oven heater baffle screen is centered over the blower motor shaft. The tolerance is very small.
   The oven heater baffle will not move left or right, nor up or down more than a couple of millimeters. However, be sure that it is centered in the oven over the blower wheel.

   This will ensure that whenever the GC is turned on, the blower wheel will not be touching the heater element mounted to the oven heater baffle.

10. Reinstall the back cover.
    a. Reconnect the ground wire to the back cover terminal.
    b. Replace the cover proceeding in the reverse order in which it was removed.
11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
12. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
13. Close the front door of the GC. Be sure that the oven blower is running.
    a. Verify that the heater heats, and the fan rotates without contacting the heater element.
14. Open the front door of the GC.
15. Reinstall the column.
16. Set the normal injector, detector and GC working conditions.

Replacing the Oven Heater Temperature Sensor

Removing the oven heater temperature sensor requires removing the complete oven heater baffle.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

❖ To replace the oven heater temperature sensor

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

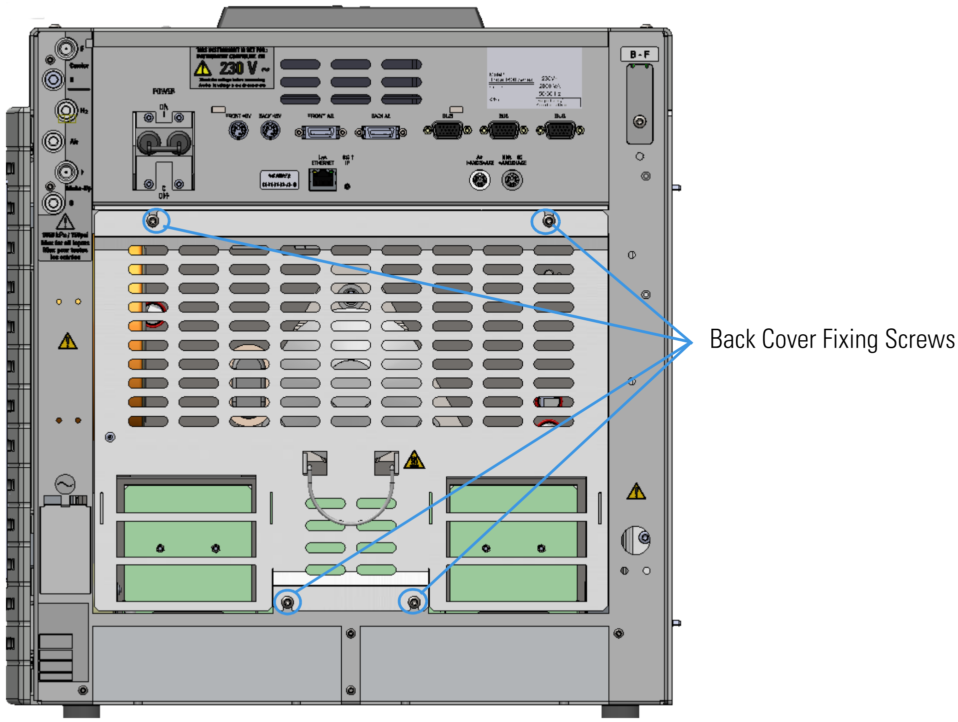
3. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

c. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

4. Remove the back cover.

a. Using a T20 Torxhead screwdriver remove the four screws that secure the back cover to the GC. See Figure 207.

Figure 207. Back Cover Removal



b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back panel.

> **Note** Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

5. Remove the analytical column.

a. Open the front door of the GC.

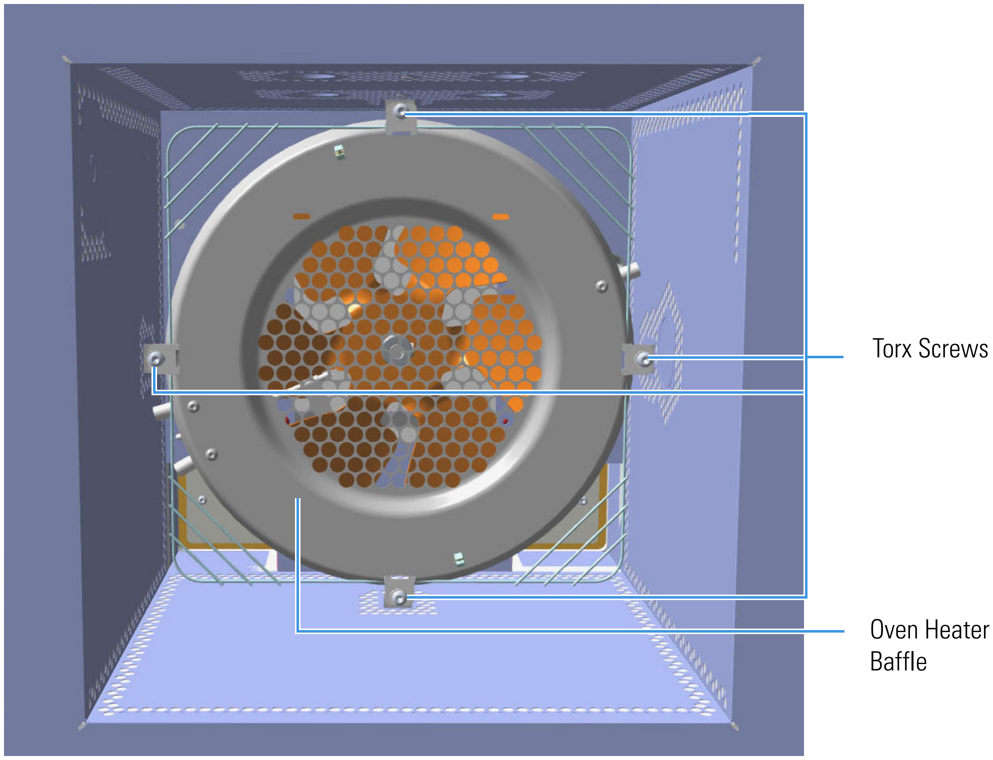
b. Loosen the retaining nut from the injector and detector fitting on the upper interior wall of the GC oven.

c. Remove the analytical column with its nut and ferrule from the bottom of the injector and the detector.

6. Remove the oven heater baffle.

The oven heater baffle is attached to the oven wall by four adjustable tabs. These tabs are attached to the oven heater baffle with four Torx screws. See Figure 208.

Figure 208. Oven Heater Baffle

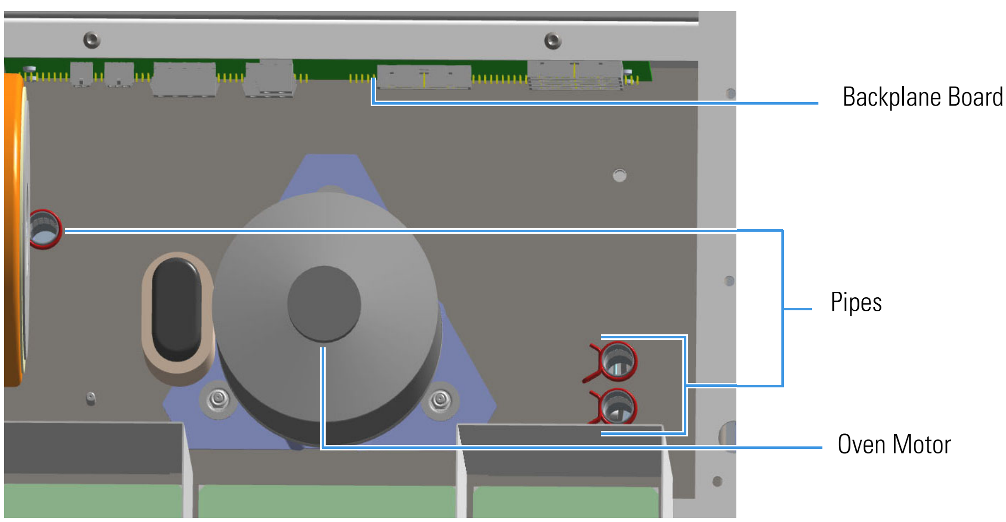


The heater and temperature sensor wires are connected to the backplane board passing through the three pipes provided on the oven back wall.

- The temperature sensor wire is plugged into the connector marked **J4** (Oven PT100)
- The heater wires are plugged into the connector **J23**, **J24**, and **J25** (Oven Heater).

The pipes are plugged by insulation material. See Figure 209.

Figure 209. Pipes



a. Unplug the heater and temperature sensor wires from the relevant connector on the backplane board.

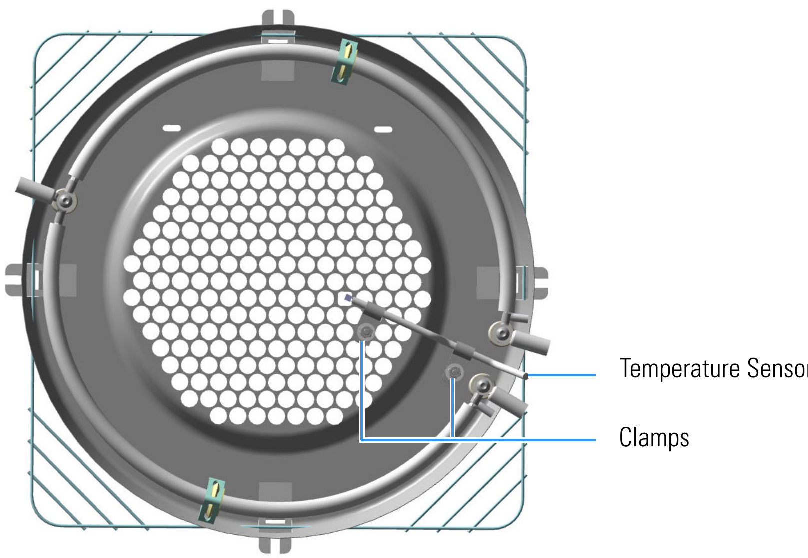
b. Loosen and remove the four Torx screws that secure the tabs to the oven heater baffle. See Figure 208 on page 235.

c. Place the heater baffle on the roof of the oven.

IMPORTANT During this operation, part of the insulation material drops down into the oven. This material is reused later when a new Oven Heater Baffle is installed.

7. Remove the oven heater temperature sensor. See Figure 210.

Figure 210. Oven Heater Temperature Sensor



a. Loosen the two clamps that attaches the oven heater temperature sensor to the oven heater baffle.

b. Remove the temperature sensor.

WARNING Pay attention to not damage the sensitive element.

8. Replace the oven heater temperature sensor in the reverse order in which it was removed.

9. Replace the oven heater baffle in the reverse order in which it was removed.

a. Guide the heater and temperature sensor wires through the pipes provided on the oven back wall.

b. Reconnect the temperature sensor and heater wires to the relevant connector **J4**, **J23**, **J24**, and **J25** on the backplane board.

c. Plug the pipes with the insulation material.

d. Secure the oven heater baffle to the oven wall with the four Torx screws in the tabs.

   The tab adjustment screws should be loose. Carefully center the oven heater baffle inside of the oven. Be sure that the center hole in the oven heater baffle screen is centered over the blower motor shaft. The tolerance is very small. The oven heater baffle will not move left or right, nor up or down more than a couple of millimeters. However, be sure that it is centered in the oven over the blower wheel. This will ensure that whenever the GC is turned on, the blower wheel will not be touching the heater element mounted to the oven heater baffle.

10. Reinstall the back cover.

    a. Reconnect the ground wire to the back cover terminal.

    b. Replace the cover proceeding in the reverse order in which it was removed.

11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

12. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

13. Close the front door of the GC. Be sure that the oven blower is running.

    a. Verify that the heater heats, and the fan rotates without contacting the heater element.

14. Open the front door of the GC.

15. Reinstall the column.

16. Set the normal detector and GC working conditions.

Replacing the Oven Motor

Removing the oven motor requires the removal of several parts and assemblies.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

❖ To replace the oven motor

1. Put the GC in standby condition.

2. Cool the oven, injectors and detectors to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.

   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

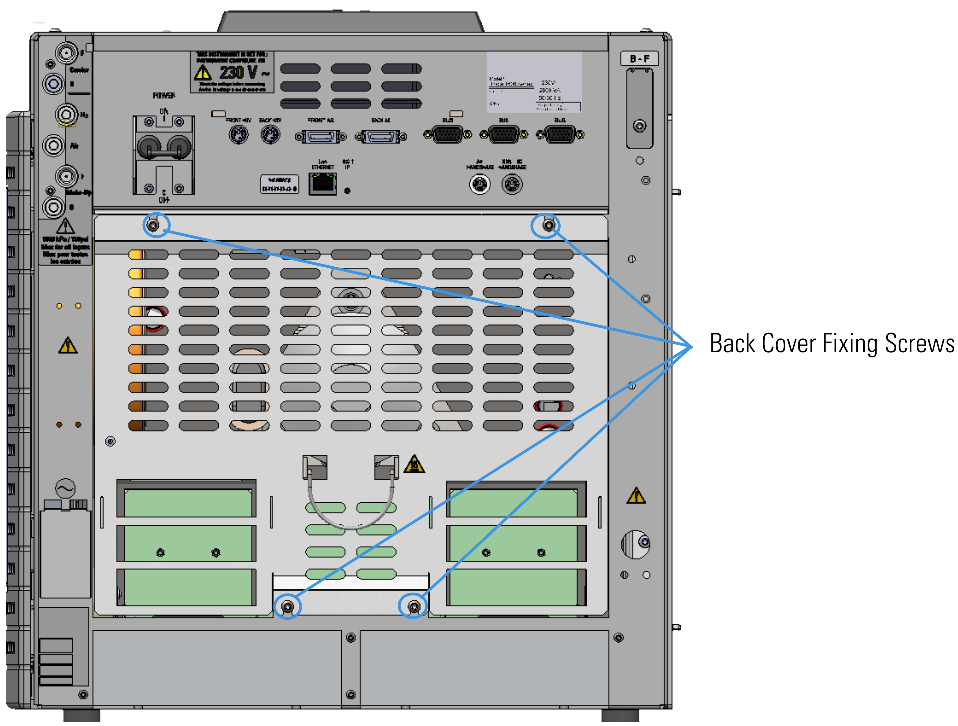
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

5. Remove the back cover.

   a. Using a T20 Torxhead screwdriver remove the four screws that secure the back cover to the GC. See Figure 211.

Figure 211. Back Cover Removal



   b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back panel.

Note Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

6. Remove the analytical column.

   a. Open the front door of the GC.

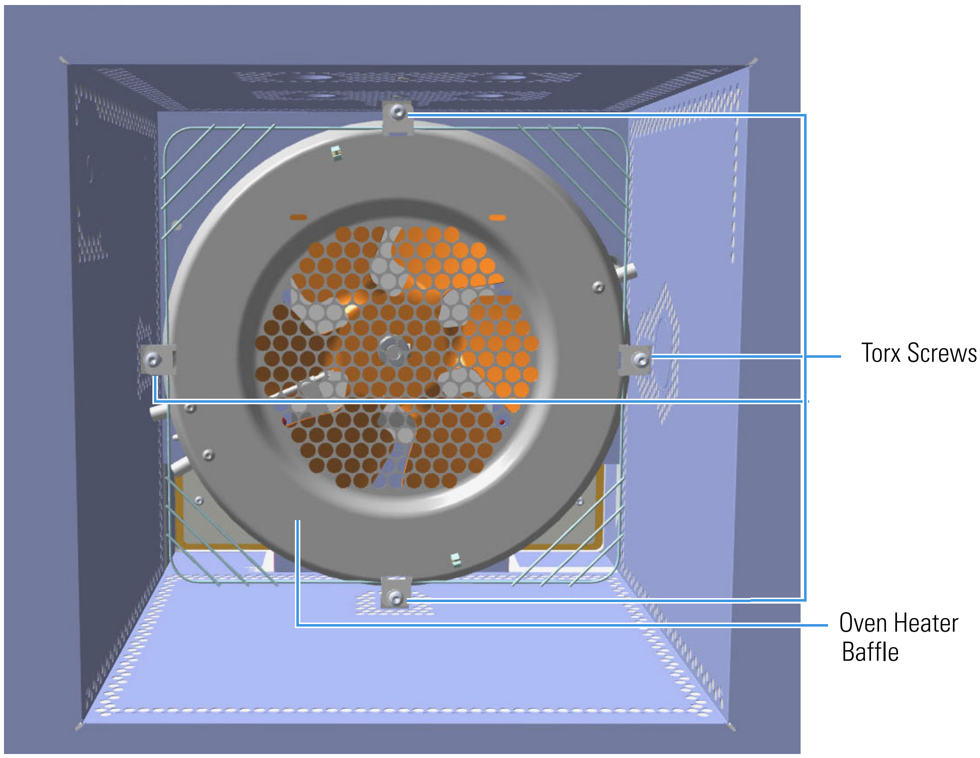
b. Loosen the retaining nut from the injector and detector fitting on the upper interior wall of the GC oven.

c. Remove the analytical column with its nut and ferrule from the bottom of the injector and the detector.

7. Remove the oven heater baffle.

The oven heater baffle is attached to the oven wall by four adjustable tabs. These tabs are attached to the oven heater baffle with four Torx screws. See Figure 212.

Figure 212. Oven Heater Baffle

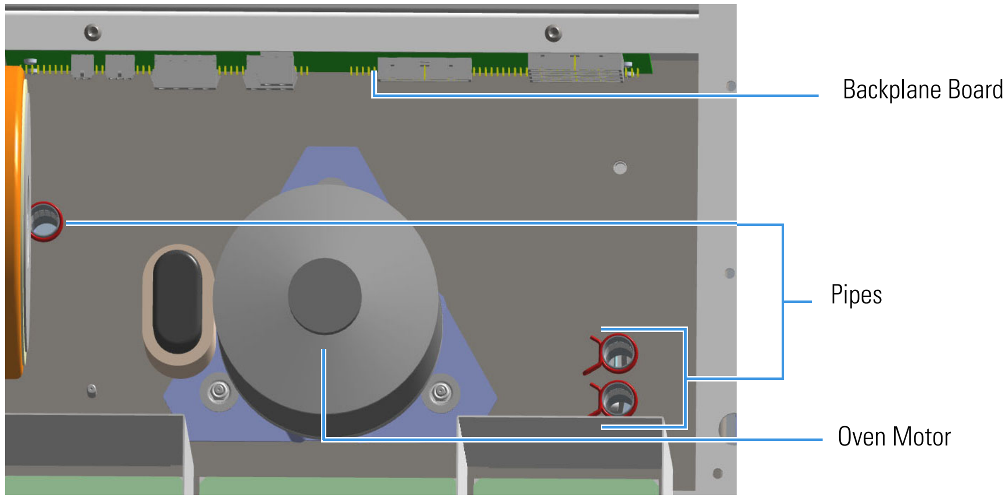


The heater and temperature sensor wires are connected to the backplane board passing through the three pipes provided on the oven back wall.

- The temperature sensor wire is plugged into the connector marked **J4** (Oven PT100)
- The heater wires are plugged into the connector **J23**, **J24**, and **J25** (Oven Heater).

The pipes are plugged by insulation material. See Figure 213.

Figure 213. Pipes



a. Unplug the heater and temperature sensor wires from the relevant connector on the backplane board.

b. Loosen and remove the four Torx screws that secure the tabs to the oven heater baffle. See Figure 212 on page 239.

c. Place the heater baffle on the roof of the oven.

IMPORTANT During this operation, part of the insulation material drops down into the oven. This material is reused later when a new Oven Heater Baffle is installed.

8. Remove the blower fan.

The oven blower fan is attached to the shaft of the oven blower motor with an Allen screw. See Figure 214.

Figure 214. Oven Blower Fan

a. Loosen the Allen screw. Carefully remove the oven fan from the blower motor shaft.

9. Remove the blower motor.

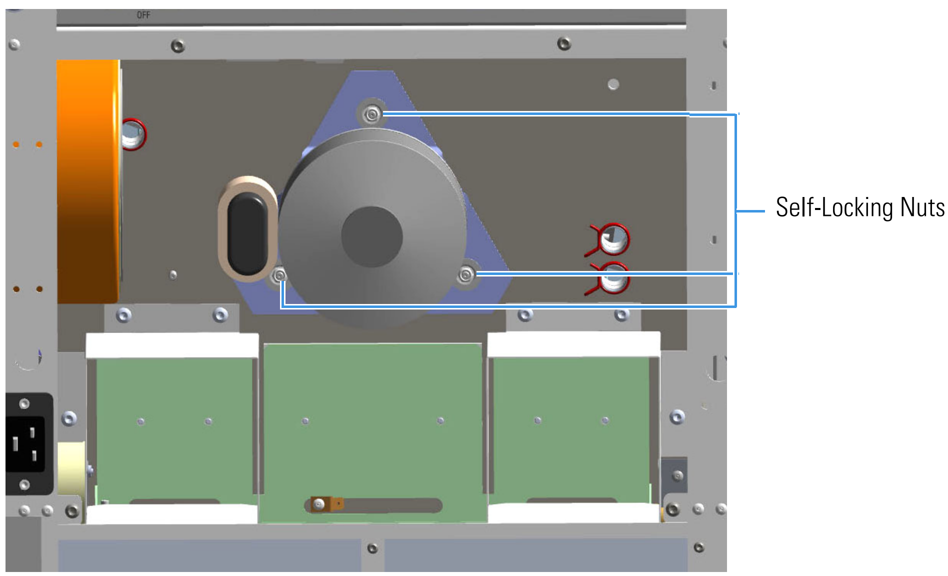
   a. The blower motor plugs into the connector marked **J7** (Motor fan) on the Backplane board. Unplug the blower motor electrical plug by pushing down on the plug tab and pulling out.

   b. The ground strap from the motor is secured to chassis ground on a terminal just below the starting capacitor. Locate this terminal.

   c. Remove the terminal nut using a 4-mm nut driver or unplug the connector. Remove the ground wire.

   d. The blower motor is secured to the back of the oven wall with three #4 self-locking nuts. Remove these nuts using the same 4-mm nut driver. See Figure 215.

Figure 215. Removal the Oven Blower Motor



   e. Locate and note the orientation of the six shoulder washers on each side of the three grommets, before removing the blower motor.

   f. Locate the three flat washers between the locking nut and the shoulder washers. Remove and retain these washers for reassembly.

   g. Remove the blower motor from the oven by pulling outward.

10. Assemble the oven motor

The replacement blower motor contains the mounting brackets with the three grommets in place. The existing blower motor will have a total of six shoulder washers.
Three shoulder washers are installed on each side of the grommets.

   a. Remove all of the shoulder washers from the old blower motor.

   b. Place three of the shoulder washers over the mounting studs located on the back oven wall.

c. Install the motor on the studs.

d. Place the remaining three shoulder washers over the studs, mating them with the grommets and the blower motor mounting bracket.

e. Place the three flat washers over the studs and against the shoulder washers.

f. Carefully screw the locking nuts back onto the studs, after all of the washers are in place.

g. Tighten the locking nuts until the grommets are flat. Loosen each locking nut by one complete turn.

h. Attach the ground wire to the grounding terminal on the back oven wall. Secure it with the locking nut.

i. Connect the blower motor electrical plug to **J7**.

11. Reassemble the remaining components on the back of the GC in the reverse order in which they were removed.

12. Reinstall the blower fan onto the shaft.

    a. The fan should be even with the beveled edge on the motor shaft. The motor shaft should not extend more than 3 mm beyond the blower fan.

    b. Secure the fan to the motor shaft using the M4 Allen wrench. Be sure that the setscrew is in place on the flat side of the blower motor shaft.

13. Replace the oven heater baffle in the reverse order in which it was removed.

    a. Guide the heater and temperature sensor wires through the pipes provided on the oven back wall.

    b. Reconnect the temperature sensor and heater wires to the relevant connector **J4**, **J23**, **J24**, and **J25** on the backplane board.

    c. Plug the pipes with the insulation material.

    d. Secure the oven heater baffle to the oven wall with the four Torx screws in the tabs.

       The tab adjustment screws should be loose. Carefully center the oven heater baffle inside of the oven. Be sure that the center hole in the oven heater baffle screen is centered over the blower motor shaft. The tolerance is very small. The oven heater baffle will not move left or right, nor up or down more than a couple of millimeters. However, be sure that it is centered in the oven over the blower wheel. This will ensure that whenever the GC is turned on, the blower wheel will not be touching the heater element mounted to the oven heater baffle.

14. Reinstall the back cover.

    a. Reconnect the ground wire to the back cover terminal.

    b. Replace the cover proceeding in the reverse order in which it was removed.

15. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

16. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
17. Close the front door of the GC. Be sure that the oven blower is running.
    a. Verify that the heater heats, and the fan rotates without contacting the heater element.
18. Open the front door of the GC.
19. Reinstall the column.
20. Set the normal injector, detector and GC working conditions.

Replacing the Flap Motor

To replace the oven flap motor, you must remove the complete motor flap and cooling duct assembly. The flap motor plugs into the motherboard on the GC. Therefore, you must remove the right side panel of the GC.

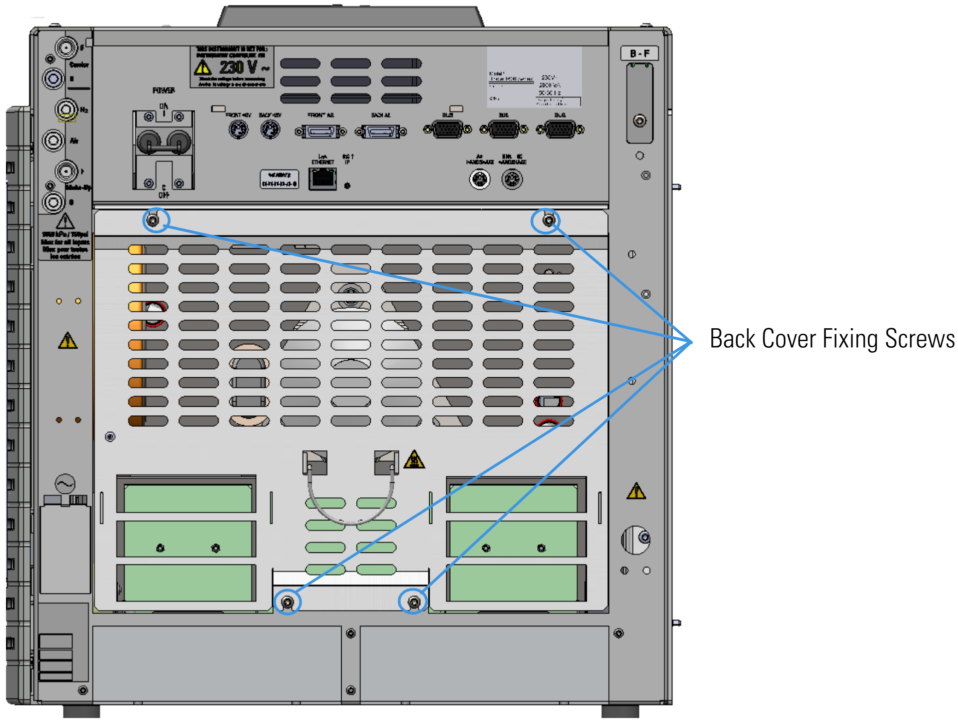
❖ To replace the flap motor

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the back cover.
    a. Using a T20 Torxhead screwdriver, remove the four screws that secure the back cover to the GC. See Figure 216.

Figure 216. Back Cover Removal



b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back panel.

> **Note** Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

6. Remove the AI/AS autosampler if present.

7. Remove the right panel.

   a. Open the front door of the GC.

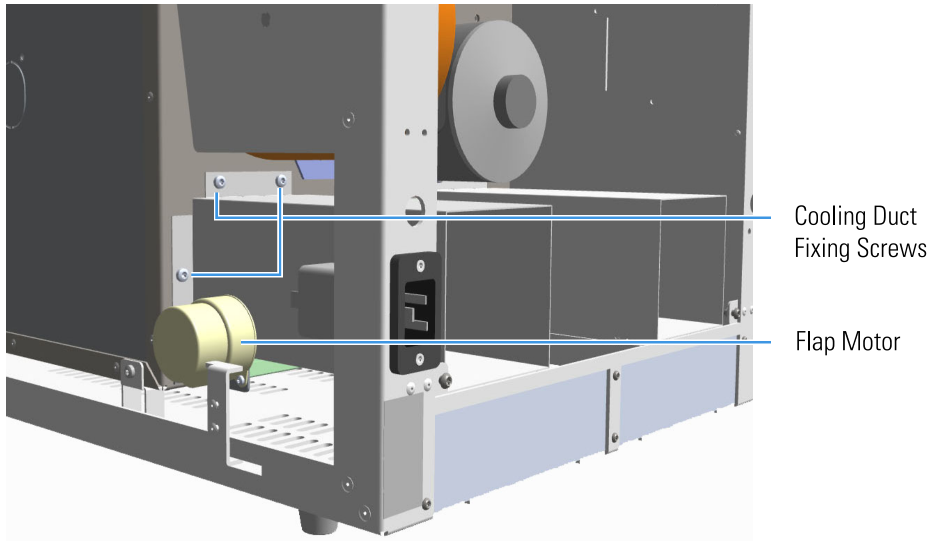
   b. Using a T20 Torxhead screwdriver remove the screw located on the upper right corner of the frontal frame.

   c. Slide the panel towards the back of the instrument. Tilt the top of the right panel outwards.

   d. Continue to slide the panel towards the back of the GC and lift it off.

8. Remove the cooling duct. See Figure 217.

Figure 217. Cooling Duct Removal



a. Locate the three screws that secure the cooling duct to the oven wall. Remove these screws.

b. Remove the cooling duct from the back of the GC.

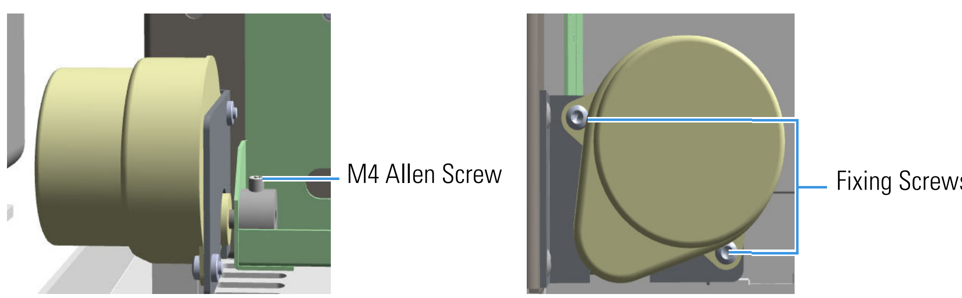
9. Remove the flap motor.

   a. Disconnect the oven flap motor electrical plug from **J10** (Flap Motor) on the backplane board.

   b. Loosen the M4 Allen screw the secure the flap motor shaft to the railing that attaches to the flaps.

   c. Remove the two fixing screws that secure the flap motor to its support plate. See Figure 218.

   Figure 218. Flap Motor Removal (1)

   d. Remove the flap motor paying attention to not rotate it.

10. Reinstall the new motor.

11. Align the flat side of the motor shaft with the Allen screw.

12. Reassemble the flap motor and cooling duct assembly in the reverse order in which it was removed.

13. Reconnect the power plug to connector **J10** on the backplane board.
14. Reinstall the back cover.
    a. Reconnect the ground wire to the back cover terminal.
    b. Replace the cover proceeding in the reverse order in which it was removed.
15. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
16. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
17. Set the normal injector, detector and GC working conditions.

6

Injectors Advanced Maintenance

This chapter describes TRACE 1600/1610 injector modules that do not require routine maintenance, but troubleshooting may indicate they need to be cleaned or replaced.

Contents

Baking-out Contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF Injectors

Perform this operation to bake-out contaminants from SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF injectors.

❖ **To bake-out contaminants from the injector**

1. Put the inlet into **Split** injection mode.
2. Select **Constant Flow** mode and enter the normal operating **Column flow** value.
3. Set **Split flow** to 200 mL/min.
4. Purge the column with carrier flow for at least 10 minutes before heating the oven.
5. If the column is connected to the detector, set the detector 25 °C above normal operating temperature. If the column is not attached to the detector, cap the detector fitting.
   In case of PDD detector, it is strongly recommended disconnecting the column from the detector.
6. Set the injector temperature to 300 °C or 25 °C above the normal operating temperature to bake out contaminants from the injector, mostly through the split vent.
7. Set the oven temperature 25 °C above the GC method final oven temperature to bake contaminants from the column. Do not exceed the column manufacturer's maximum temperature limit.
8. Bake-out for 30 minutes or until the detector baseline is free of contamination peaks.

Removing/Replacing an Injector Module

This section provides the instructions for removing/replacing a front/back injector module.

Figure 219. Example of Injector Module

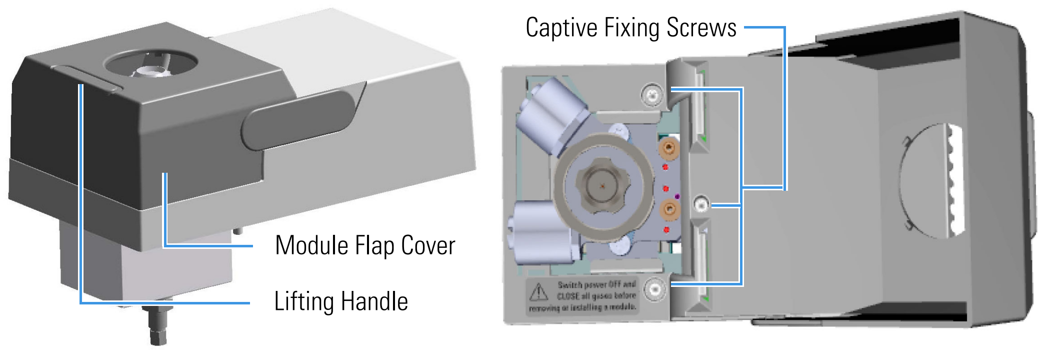


Figure 220. Replacing a Front Injector Module

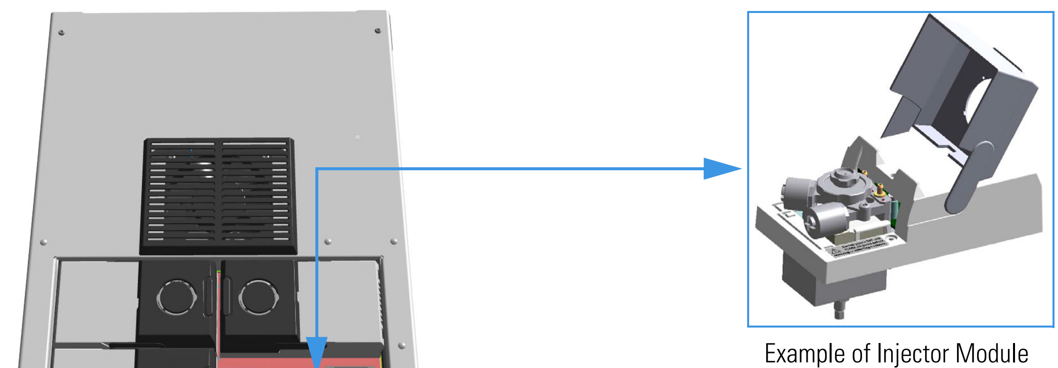
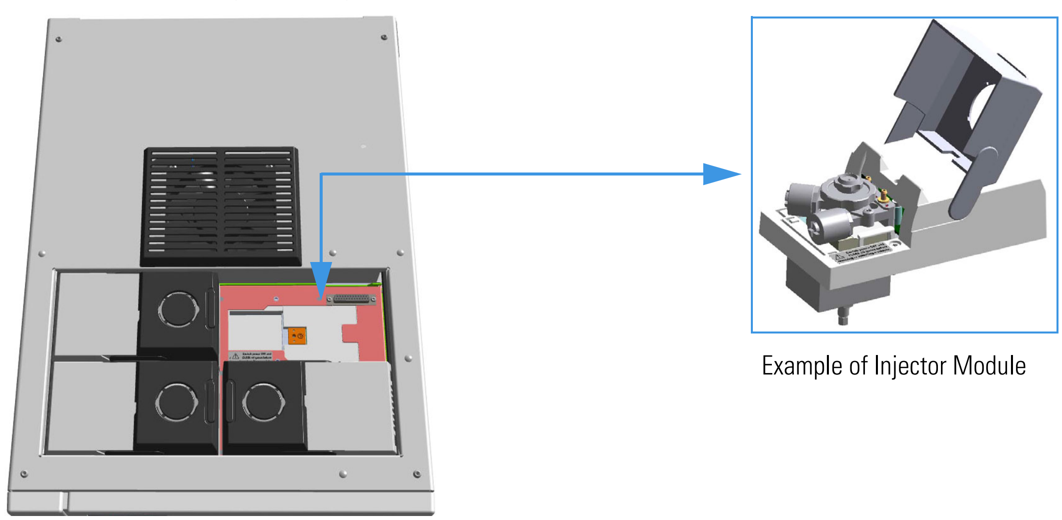


Figure 221. Replacing a Back Injector Module

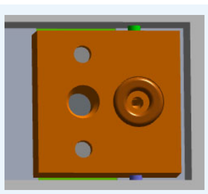


❖ To remove/replace a front/back injector module

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector on the back of the GC, and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Close the gas supplies.
6. Remove the column end from the injector.
   a. Open the front door of the GC.
   b. Loosen the retaining nut from the injector fitting on the upper interior wall of the GC oven.
   c. Remove the analytical column with its nut and ferrule from the bottom of the injector.
7. Put the autosampler away if present.
   a. If an AI/AS autosampler is present, move the sampler support to the right.
   b. If a TriPlus or a TriPlus RSH autosampler is present, move the turret/head until enough free space is created around the module.
8. Remove the injector module.
   a. Open the module flap cover.
   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.
   c. Keeping the module flap cover open, lift up the module from its seat in the injector housing.
   d. Place the module on a clean surface.



WARNING Make sure the O-ring is placed into its seat on the gas connection plate.

Do not install the module if the O-ring is missing.

9. Replace the injector module.
   a. Open the module flap cover.
   b. Keeping the module flap cover open, place it in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.
   c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

   d. Close the module flap cover.
   e. Keep the plug connected to the bottom.
10. Open the gas supplies.
11. Check the gas supply for leaks.
   a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.
   b. If you detect a leak, tighten the connection, and retest it.
   c. Repeat this process until all connections are leak free.
12. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
13. Power on the GC.
   a. Plug the power cable to the AC Input connector on the back of the GC, and to the wall outlet.
   b. Flip up the power switch (breaker) to the position I.
14. Pressurize the module with the carrier gas.
15. Check the module gas connections for leaks.
16. Remove the plug from the bottom.
17. Reconnect the column end to the injector, and verify the connection point.
18. Close the front door of the GC.
19. If present, move the autosampler towards the module to restore the original alignment.

Cleaning the SSL Injector Body

Perform this operation when a more efficient cleaning of the injector body is desired or required due to contaminants.

> **Note** Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean the injector body

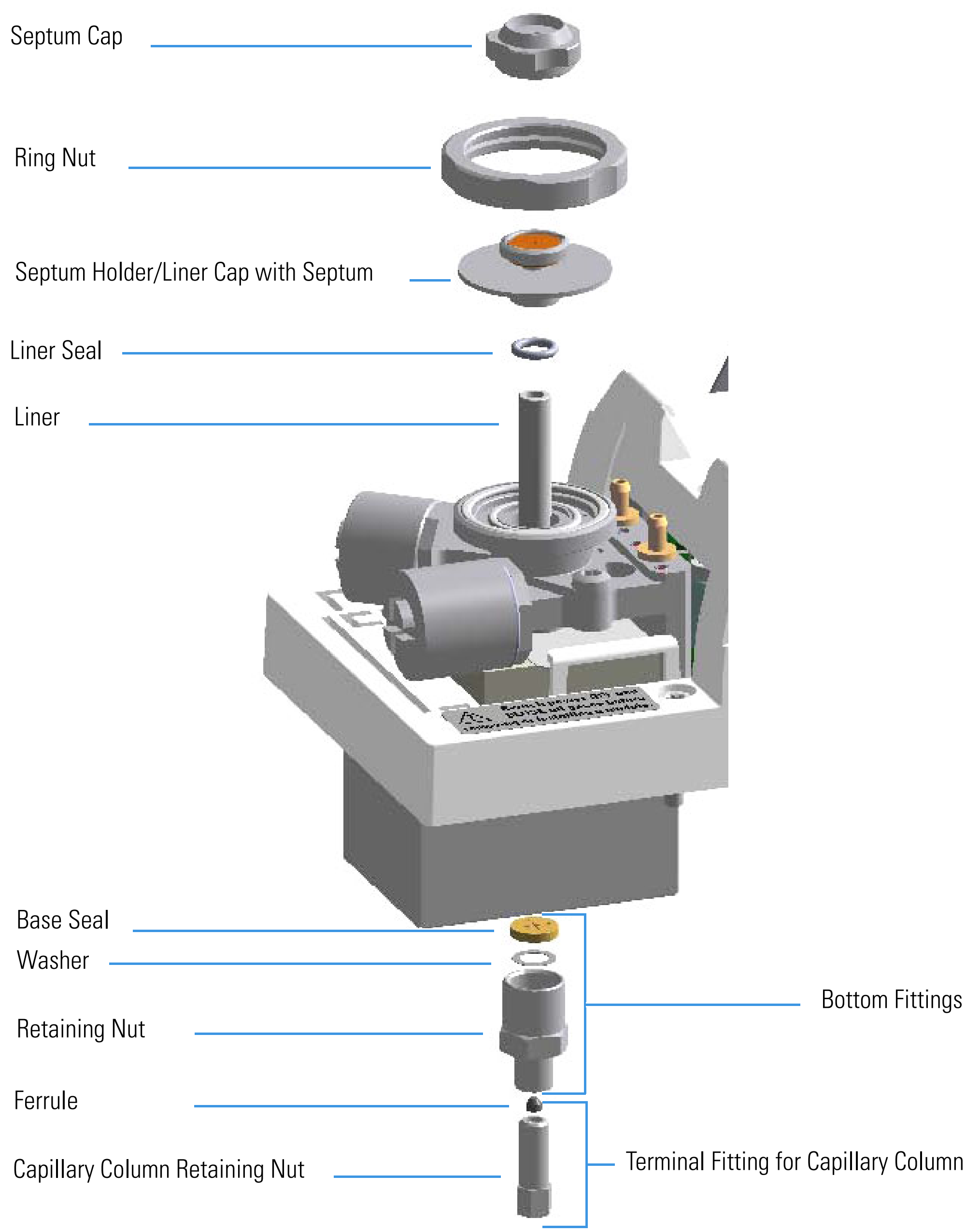
Materials needed
Ultrasonic cleaning bath
Methanol/acetone mixture 1:1
GC-grade methanol
T20 Torxhead screwdriver
Forceps or tweezers

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   > **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector. See Figure 222.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Remove the liner. See Figure 222.
   a. Use tweezers to remove the liner with the liner seal from the injector.
8. Remove the bottom parts of the injector. See Figure 222.
   a. Unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.
   b. Unscrew the retaining nut with the washer and the base seal.

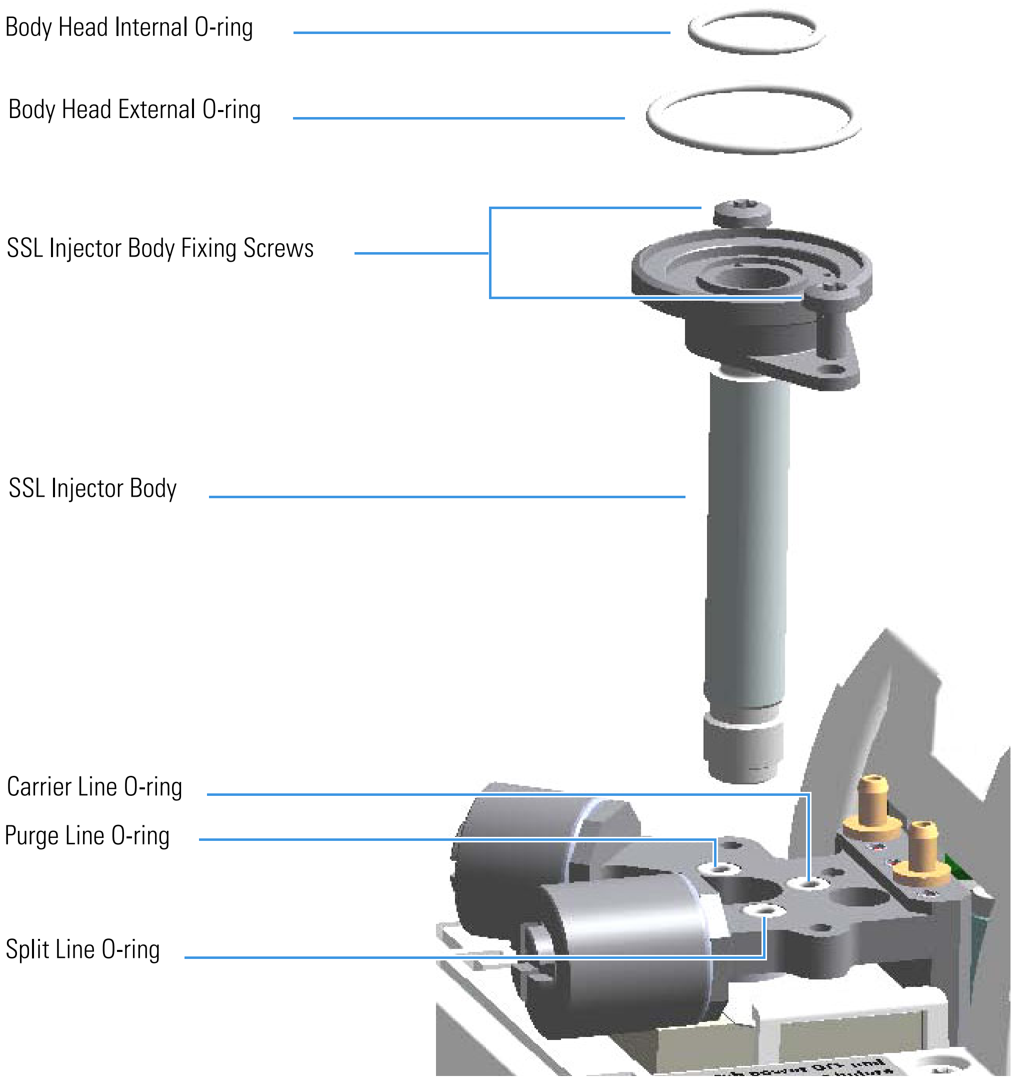
Figure 222. SSL Injector Components



9. Remove the body head O-rings. See Figure 223.
   a. Using tweezers, remove both the internal and external body head O-rings.
   b. Place and keep all the removed components on a clean surface.
10. Remove the injector body. See Figure 223.
    a. Using a T20 Torxhead screwdriver, undo the two injector body fixing screws, and extract the injector body from its housing.

Note Do not remove the carrier, split and purge lines O-rings.

Figure 223. SSL Injector Body Cleaning



11. Clean the injector body.
    a. Put the injector body into an ultrasonic cleaner, filled with a methanol/acetone mixture (1:1).
    b. Sonicate the injector body for about half an hour.
    c. Using tweezers, remove the injector body from the bath, and dry it with an inert gas.
12. Reinstall the injector body.
    a. Reinstall and fix the injector body into its housing by screwing the two fixing screws.
    b. Using tweezers, replace both the internal and external body head O-rings.

13. Reinstall the bottom parts of the injector.
    a. Reinstall the retaining nut with the washer and the base seal.
    b. Reinstall the analytical column.
14. Reinstall the liner
    a. Using tweezers, place the liner seal over the liner, insert the liner into the injector, and push it gently towards the bottom of the injector.
15. Reinstall the top parts of the injector.
    a. Place the septum holder/liner cap with the septum on the body head of the injector. Fix them by screwing the ring nut.
    b. Screw and tighten the injector cap to finger tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

16. Close the module flap cover.
17. If present, move the autosampler towards the module to restore the original alignment.
18. Turn the carrier gas on.
19. Set the normal oven and injector working conditions.

Cleaning the SSLBKF Injector Body

Perform this operation when a more efficient cleaning of the injector body is desired or required, due to contaminants.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean the injector body

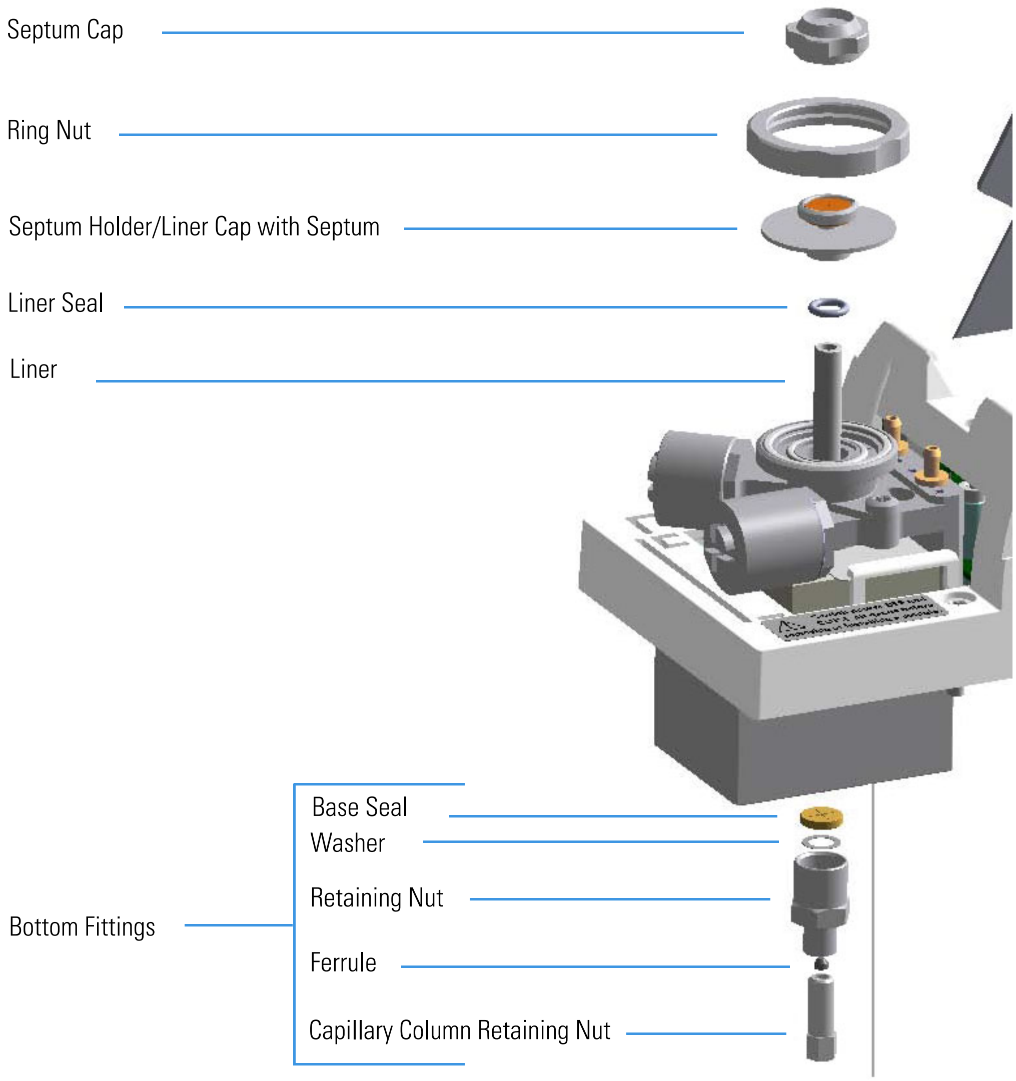
Materials needed
Ultrasonic cleaning bath
Methanol/acetone mixture 1:1
GC-grade methanol
1/8-inch -wrench
T20 Torxhead screwdriver
Forceps or tweezers

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the top parts of the injector. See Figure 224.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Remove the liner. See Figure 224.
   a. Use tweezers to remove the liner with the liner seal from the injector.
8. Remove the bottom parts of the injector. See Figure 224.
   a. Unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.
   b. Unscrew the retaining nut with the washer and the base seal.

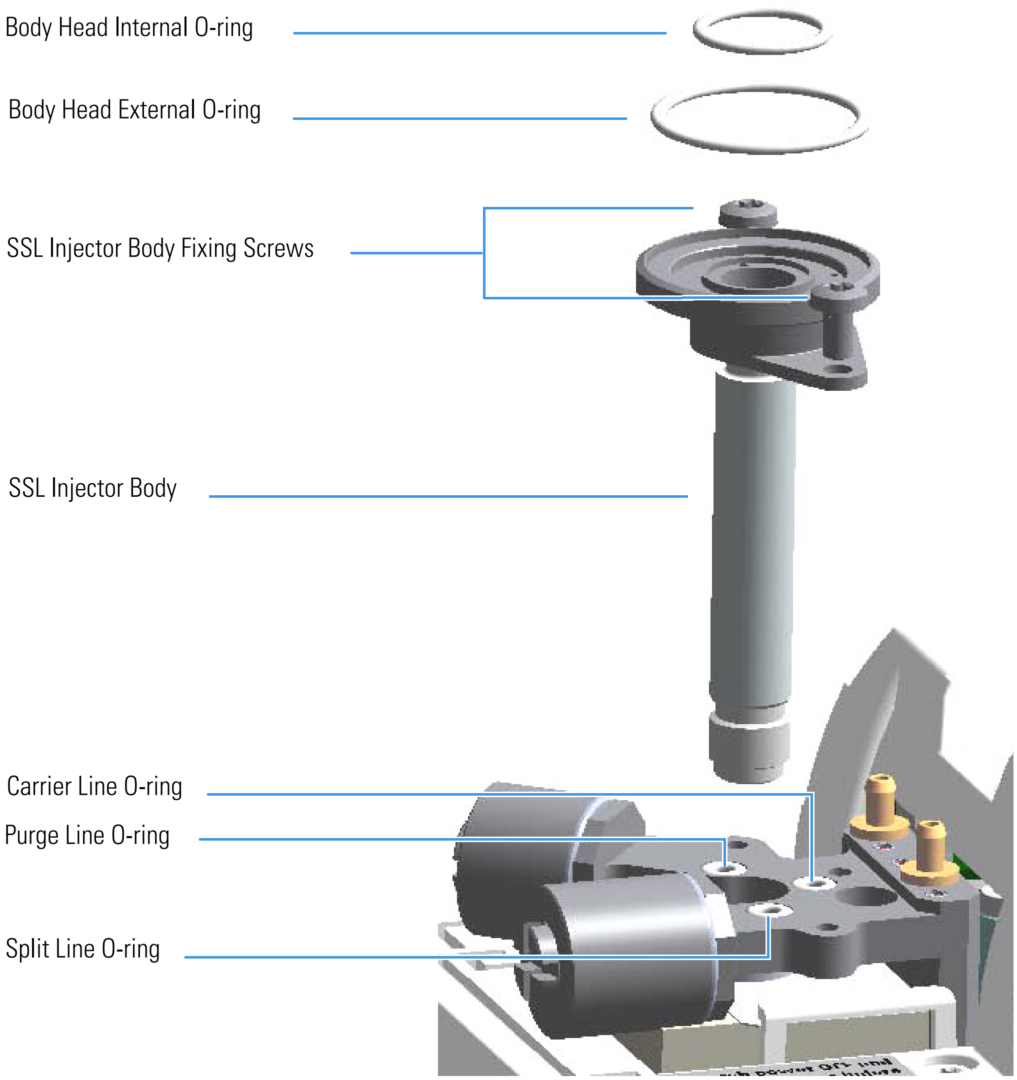
Figure 224. SSLBKF Injector Components



9. Remove the body head O-rings. See Figure 225.
   a. Using tweezers, remove both internal and external body head O-rings.
   b. Place and keep all the removed components on a clean surface.
10. Remove the injector body. See Figure 225.
    a. Using a T20 Torxhead screwdriver, undo the two injector body fixing screws, and extract the injector body from its housing.

> **Note** Do not remove the carrier, split, and purge lines' O-rings.

Figure 225. SSLBKF Injector Body Cleaning



11. Clean the injector body.

    a. Put the injector body into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).

    b. Sonicate the injector body for about half an hour.

    c. Using tweezers, remove the injector body from the bath, and dry it with an inert gas.

12. Reinstall the injector body.

    a. Reinstall and fix the injector body into its housing by screwing the two fixing screws.

    b. Using tweezers, replace both the internal and external body head O-rings.

13. Reinstall the bottom parts of the injector.

    a. Reinstall the retaining nut with the washer and the base seal.

   b. Reinstall the analytical column.

14. Reinstall the liner

   a. Place the liner seal over the liner, then, Using tweezers, insert the liner into the injector and push it gently towards the bottom of the injector.

15. Reinstall the top parts of the injector.

   a. Place the septum holder/liner cap with the septum on the body head of the injector. Fix them by screwing the ring nut.

   b. Screw and tighten the injector cap.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

16. Close the module flap cover.

17. If present, move the autosampler towards the module to restore the original alignment.

18. Turn the carrier gas on.

19. Set the normal oven and injector working conditions.

Cleaning the HeS-S/SL Injector Body

Over time, contamination of the Instant Connect Helium Saver Injector Module will occur due to the deposition of cored septum particles or other material not captured by the glass wool of the injection port liner. In this case, the injector insert should be removed and cleaned according to the following procedure.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean the Instant Connect Helium Saver Injector Module injector body

Materials needed
Ultrasonic cleaning bath
Methanol/acetone mixture 1:1
GC-grade methanol
Methylene chloride
Hexane
T20 Torxhead screwdriver
Forceps or tweezers

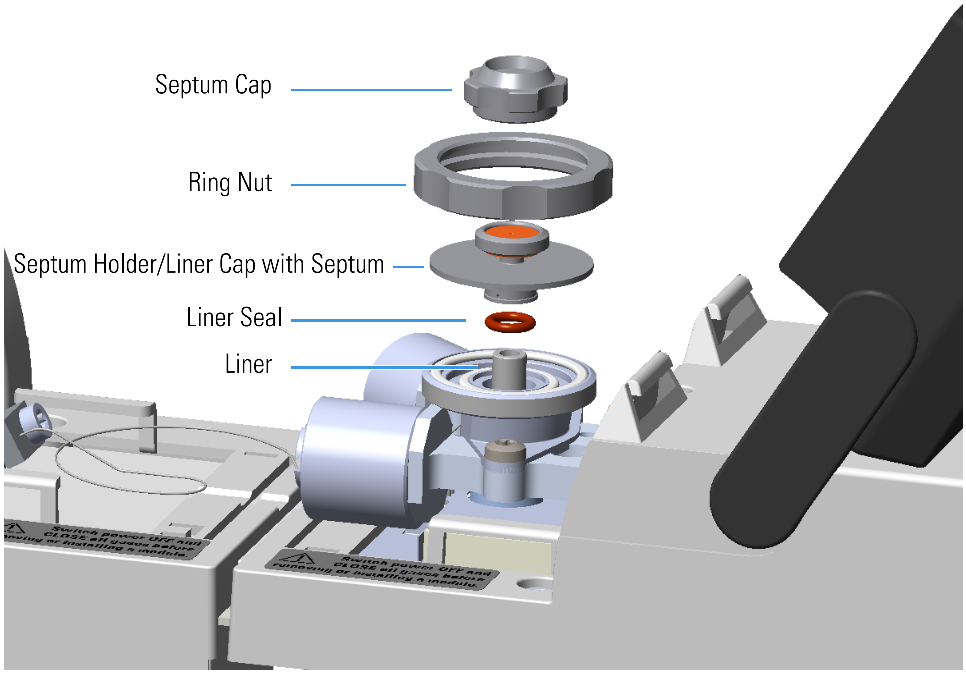
1. Put the GC in standby condition.
2. Cool the GC oven, injector, transfer line, and ion source.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Vent the mass spectrometer and set the inlet flow rate (nitrogen) to **Off**. Keep the helium enabled and pressurized as usual.
4. Put the autosampler away if present.
5. Open the module flap covers.
6. Remove the top parts of the injector. See Figure 226.
   a. Unscrew the septum cap of the injector.
   b. Unscrew the ring nut.
   c. Remove the septum holder/liner cap with septum from the injector body head.
7. Remove the liner. See Figure 226.
   a. Use tweezers to remove the liner with the liner seal from the injector.
8. Remove the analytical column.

a. Unscrew the capillary column retaining nut, then remove the analytical column with its ferrule from the bottom of the injector.

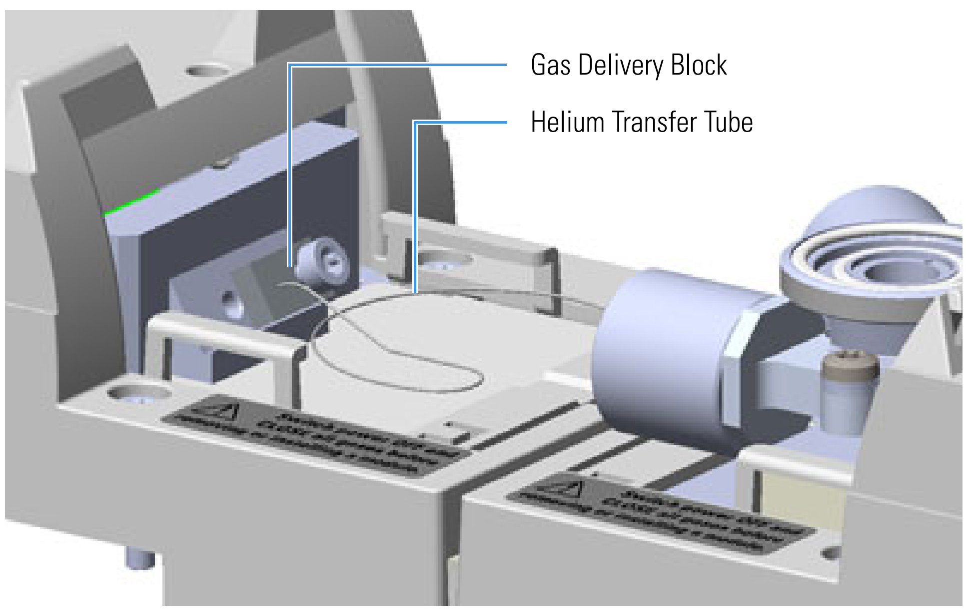
Figure 226. Instant Connect Helium Saver Injector Module: Cleaning the Injector Body (1)



9. Disconnect the helium transfer tube See Figure 227.

   a. Loosen the captive screw of the helium transfer tube and remove the tube from the gas delivery block.

Figure 227. Instant Connect Helium Saver Injector Module: Cleaning the Injector Body (2)



10. Remove the body head O-rings. See Figure 228.

    a. Using tweezers, remove both the internal and external body head O-rings.

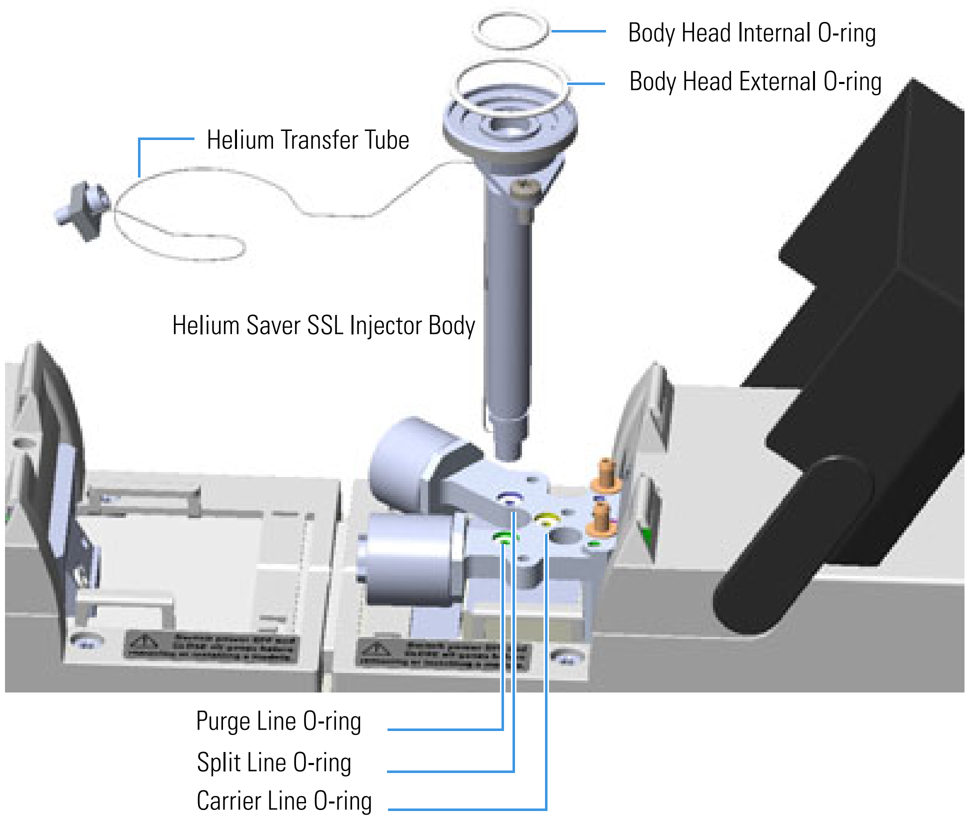
    b. Place and keep all the removed components on a clean surface.

11. Remove the injector body. See Figure 228.

    a. Using a T20 Torxhead screwdriver, undo the two injector body fixing screws, and extract the injector body from its housing.

    Note Do not remove the carrier, split and purge lines O-rings.

Figure 228. Instant Connect Helium Saver Injector Module: Cleaning the Injector Body (3)



12. Clean the injector body.

    a. Ultrasonically clean the injector insert using a warm 1% Liquinox™ solution (or equivalent).

    b. Thoroughly rinse the insert then ultrasonically clean in chromatographic grade methanol or acetone followed by solvents of lower polarity such as methylene chloride and hexane. Limit ultra-sonication to 5 min in each solvent.

    c. Blow dry the insert using high purity gas (do not use compressed house air as it contains residual oils from the compressor) then assemble in the reverse order of removal.

Note Do not use abrasives, cleaning wires, or brushes on the inlet insert as these will damage the passivation treatment layers. Be especially careful not to bend the short segment of tubing at the base of the insert interior. Nothing should be inserted into the bore of the insert other than glass liners.

13. Reinstall the injector body.
    a. Reinstall and fix the injector body into its housing by screwing the two fixing screws.
    b. Using tweezers, replace both the internal and external body head O-rings.
14. Reconnect the additional helium carrier gas line mating block.
15. Reinstall the liner.
    a. Using tweezers, place the liner seal over the liner, insert the liner into the injector, and push it gently towards the bottom of the injector.
16. Reinstall the analytical column.
17. Reinstall the top parts of the injector.
    a. Place the septum holder/liner cap with the septum on the body head of the injector. Fix them by screwing the ring nut.
    b. Screw and tighten the injector cap to finger tight.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

18. Close the module flap covers.
19. If present, move the autosampler towards the module to restore the original alignment.
20. Wait two or three minutes for helium to purge the inlet.
21. Turn the inlet flow back on and enable the inlet heater.
22. Set the normal injector, detector, and GC working conditions.

Cleaning the PTV Injector Head Assembly

Perform this operation when cleaning the injector head assembly is desired or required, due to contaminants.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean the injector head assembly

Materials needed
Ultrasonic cleaning bath
GC-grade methanol/acetone mixture 1:1
1/8-inch -wrench
5.5 x 25 mm Slotted Stubby Driver
T10 Torxhead screwdriver
Forceps or tweezers

1. Put the GC in standby condition.
2. Cool the oven, injectors, and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Pull down on the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector on the back of the GC, and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Close the gas supplies.
6. Put the autosampler away if present.
7. Remove the top parts of the injector. See Figure 229.

a. Unscrew the septum cap of the injector.

b. Using tweezers, remove the septum from the top of the injector head assembly.

8. Remove the liner. See Figure 229.

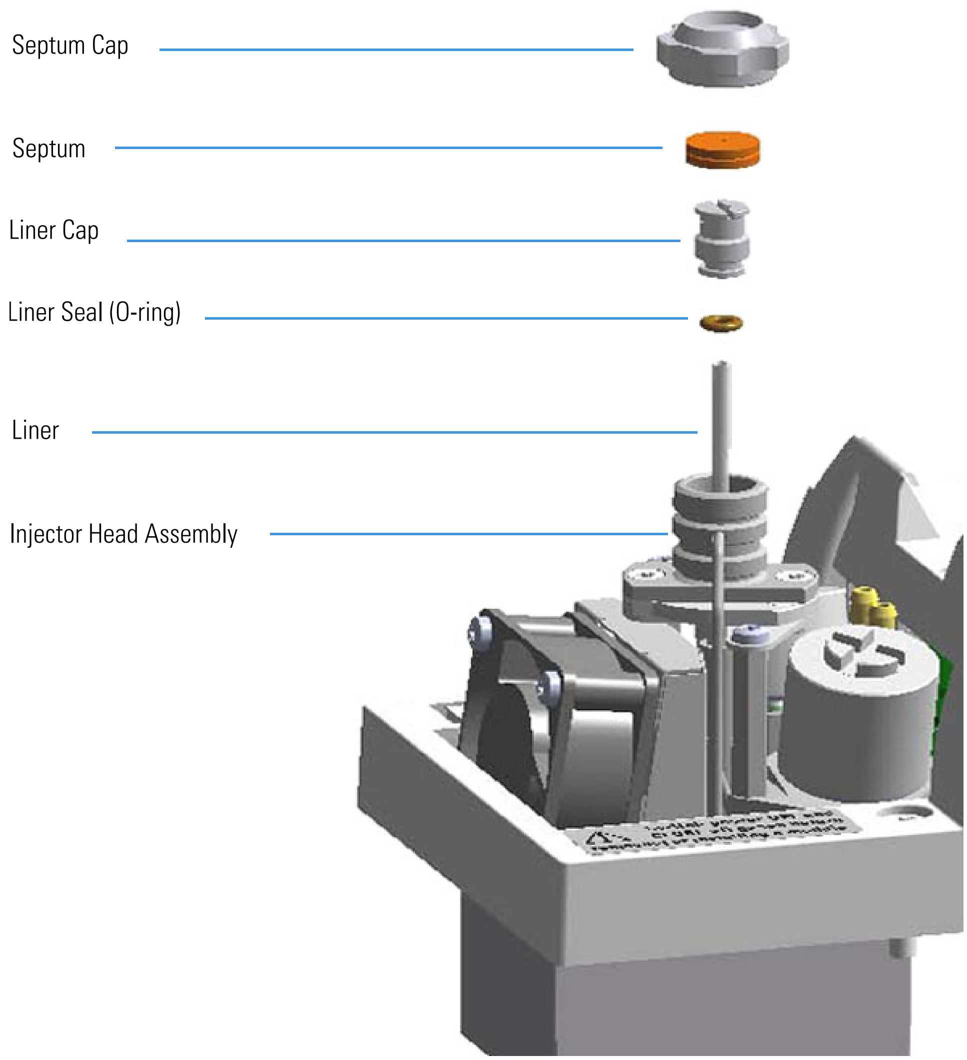
a. Using the slotted stubby driver provided, unscrew and remove the liner cap.

b. Use tweezers to remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, follow the instructions for “Replacing the PTV Broken Liner” on page 136.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez “Remplacement d’un liner PTV cassé”.

Figure 229. PTV Top Parts and Liner Removal

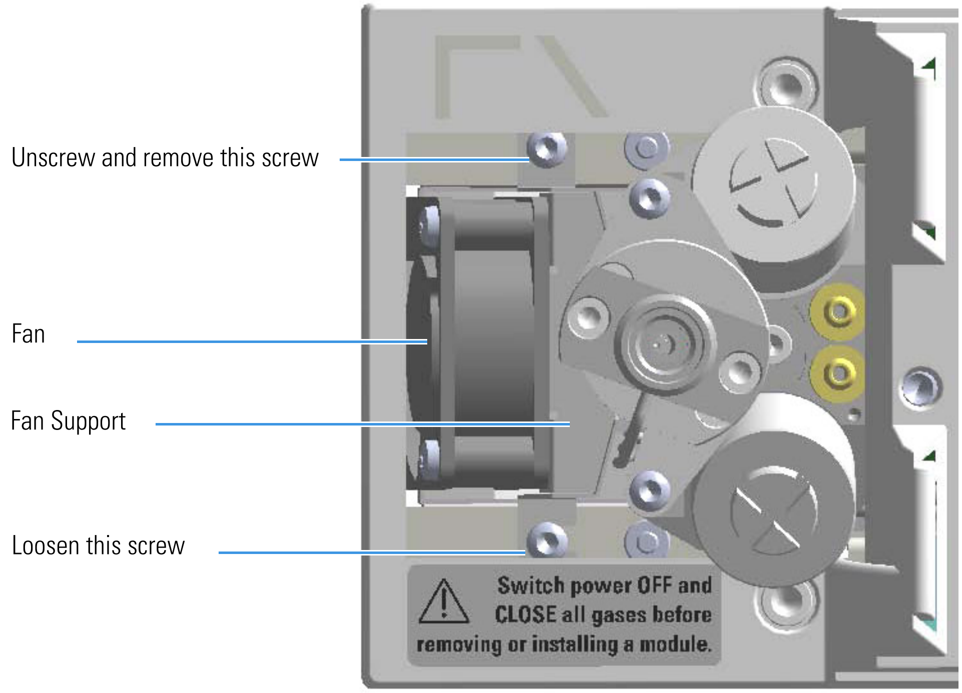


9. Remove the fan assembly.

   The fan is fixed on a support. Do not remove the fan from its support but remove the assembly proceeding as follows:

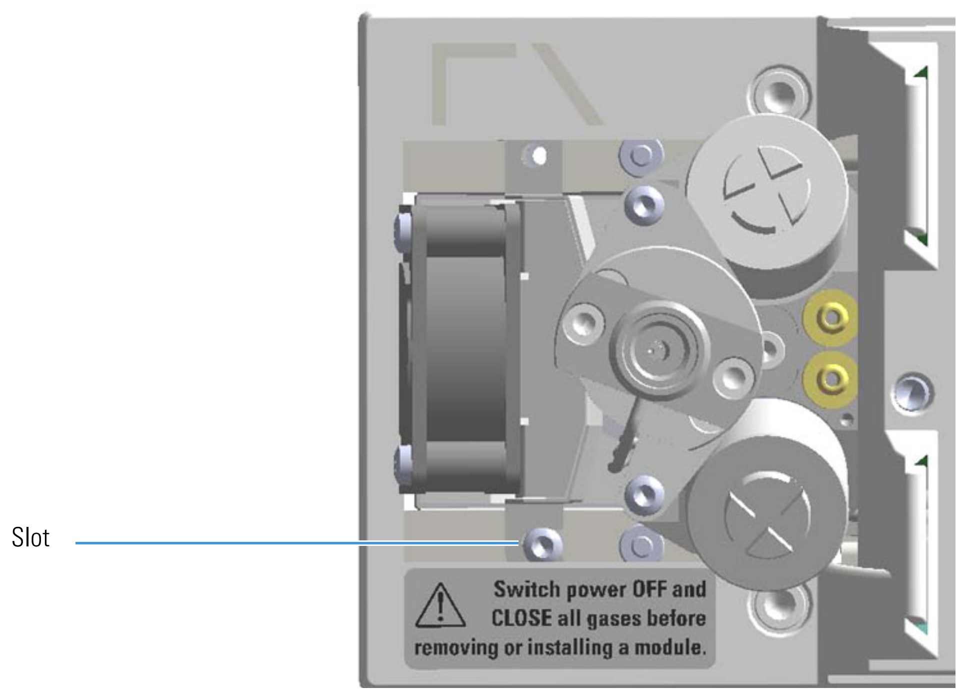
   a. Using tweezers and a T10 Torxhead screwdriver, unscrew the left fixing screw of the support, then unscrew the right fixing screw. See Figure 230.

Figure 230. PTV Module: Fan Assembly



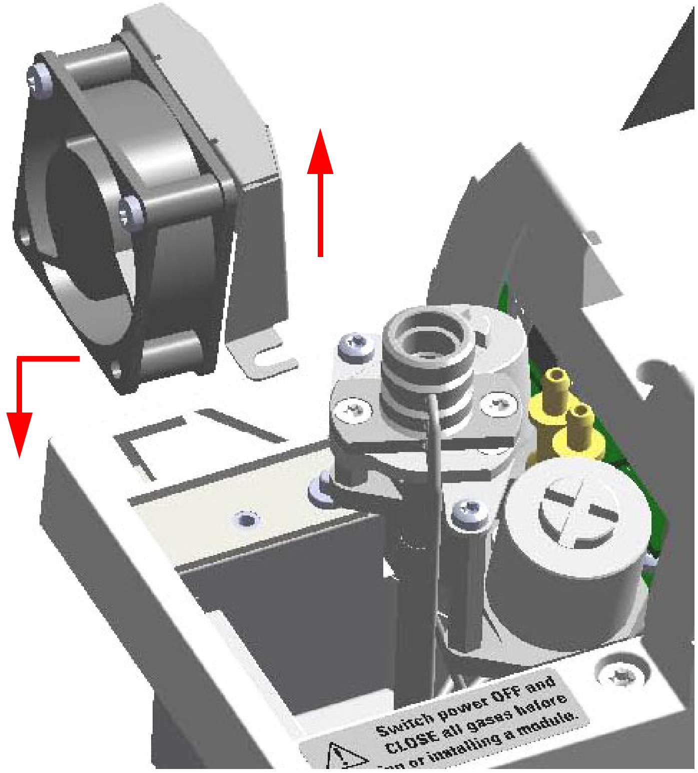
b. Carefully turn the fan assembly slightly to access the slot on the right base of the support from the right fixing screw. See Figure 231.

Figure 231. PTV Module: Fan Assembly Removal (1)



c. Carefully extract the fan assembly from its seat, and place it sideways to the module. Be sure to not damage the two wires. See Figure 232.

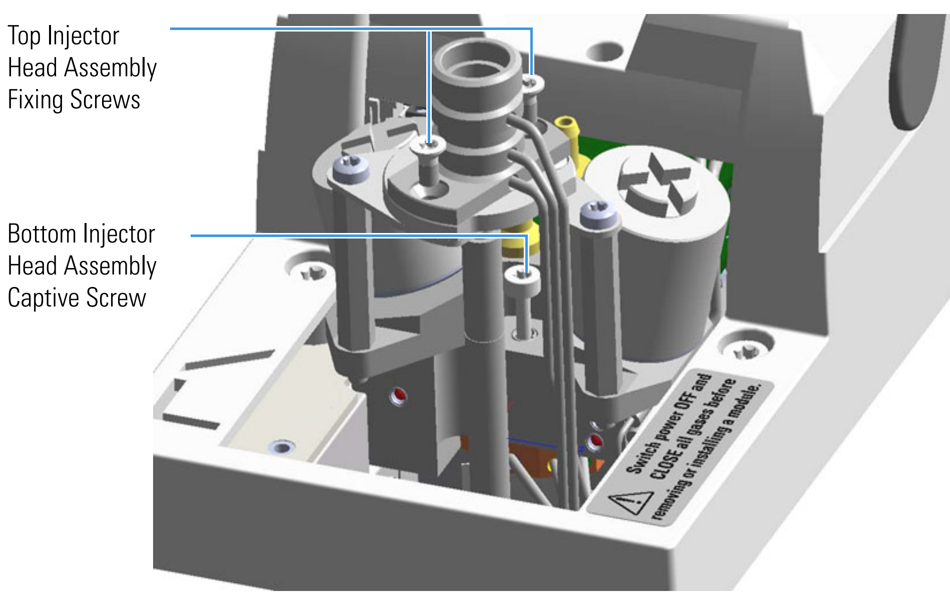
Figure 232. PTV Module: Fan Assembly Removal (2)



10. Remove the injector head.

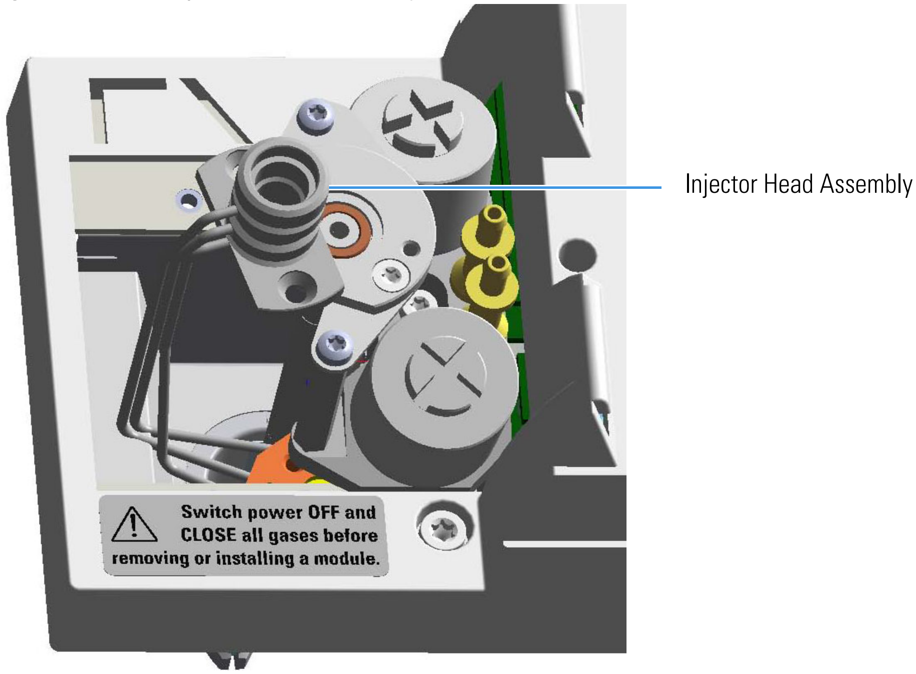
    a. Using the T10 Torxhead screwdriver, unscrew the two fixing screws, and the captive screw that respectively fix the top and the bottom of the injector head assembly. See Figure 233.

Figure 233. PTV Injector Head Assembly



b. Holding the top of the injector head assembly with your thumb, index, and middle fingers, turn the assembly clockwise. See Figure 234.

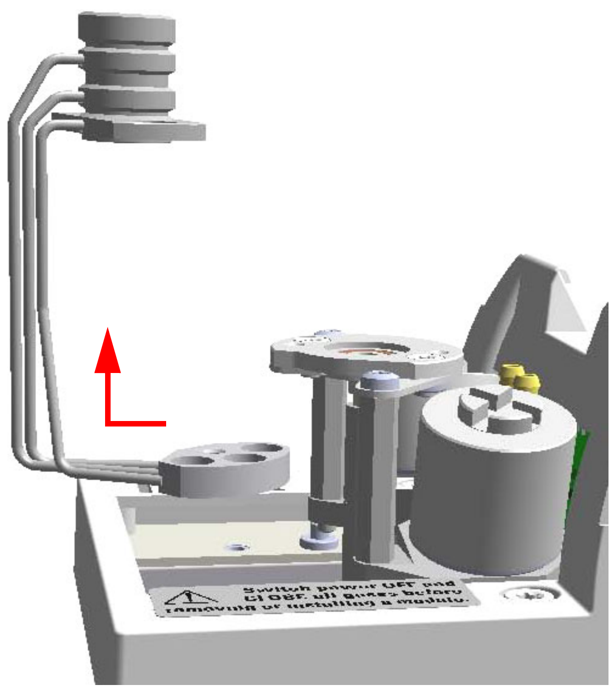
Figure 234. PTV Injector Head Assembly Removal (1)



c. Extract the assembly sideways from its housing. See Figure 235.

Note Do not remove the carrier, split, and purge lines' O-rings on the plate.

Figure 235. PTV Injector Head Assembly Removal (2)



11. Clean the injector head.
    a. Put the injector head assembly into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).
    b. Sonicate the injector head assembly for about half an hour.
    c. Using tweezers, remove the injector head assembly from the bath, and dry it with compressed clean air.
12. Reinstall the injector head.
    a. Carefully reinstall the injector head assembly into its housing proceeding in the reverse order in which it was removed.
    b. Screw the two fixing screws and the captive screw fixing the top and the bottom of the injector head assembly respectively.
13. Remount the fan assembly.
    a. Carefully reinsert the fan assembly in its seat into the module.
    b. Move the assembly for inserting the slot on the right base of the support slightly under the head of the right fixing screw, and for aligning the hole on the left base with the corresponding fixing hole.
    c. Using tweezers, reinsert the left fixing screw previously removed.
    d. Using a T10 Torxhead screwdriver tighten both the left and right fixing screws.
14. Reinsert the liner.
    a. Place the liner seal over the liner.
    b. Using tweezers, insert the liner into the injector, and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.
15. Reinstall the upper parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

    b. Screw and tighten the septum cap.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

16. Close the module flap cover.
17. If present, move the autosampler towards the module to restore the original alignment.
18. Open the gas supplies.
19. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
20. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
21. Set the normal oven, injectors, and detectors working conditions.

Cleaning the PTVBKF Injector Head Assembly

Perform this operation when cleaning the injector head assembly is desired or required, due to contaminants.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Field Service Engineers.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean the injector head assembly

Materials needed
Ultrasonic cleaning bath
GC-grade methanol/acetone mixture 1:1
1/8-inch -wrench
5.5 x 25 mm Slotted Stubby Driver
T10 Torxhead screwdriver
Forceps or tweezers

1. Put the GC in standby condition.
2. Cool the oven, injectors, and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

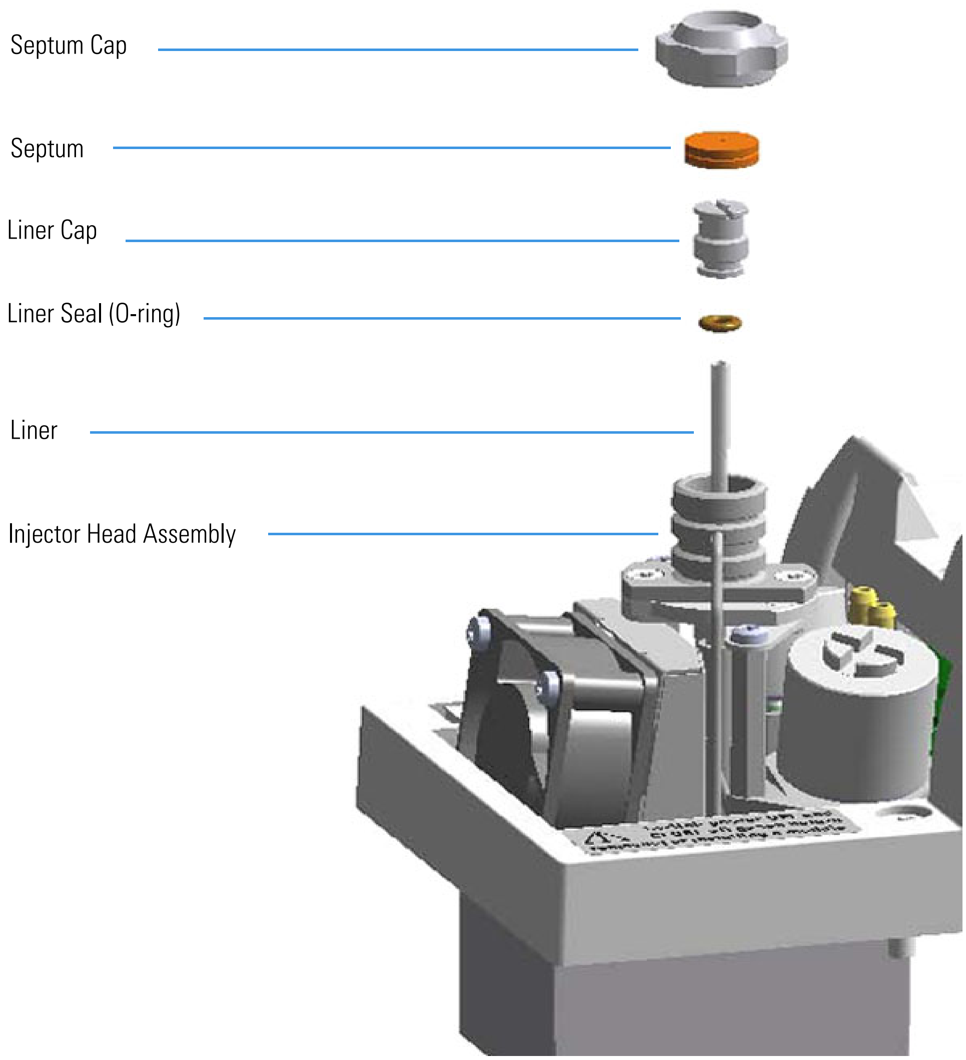
3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Close the gas supplies.
6. Put the autosampler away if present.
7. Open the module flap cover.

8. Remove the top parts of the injector. See Figure 236.
   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the top of the injector head assembly.
9. Remove the liner. See Figure 236.
   a. Using the slotted stubby driver provided, unscrew and remove the liner cap.
   b. Use tweezers to remove the liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters might fall into the lower part of the vaporization chamber. If the glass liner breaks, follow the instructions for "Replacing the PTVBKF Broken Liner" on page 147.

ATTENTION Veillez à ne pas briser le liner en verre pendant son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation. En cas de rupture du liner en verre, consultez "Remplacement d'un liner PTVBKF cassé".

Figure 236. PTVBKF Top Parts and Liner Removal

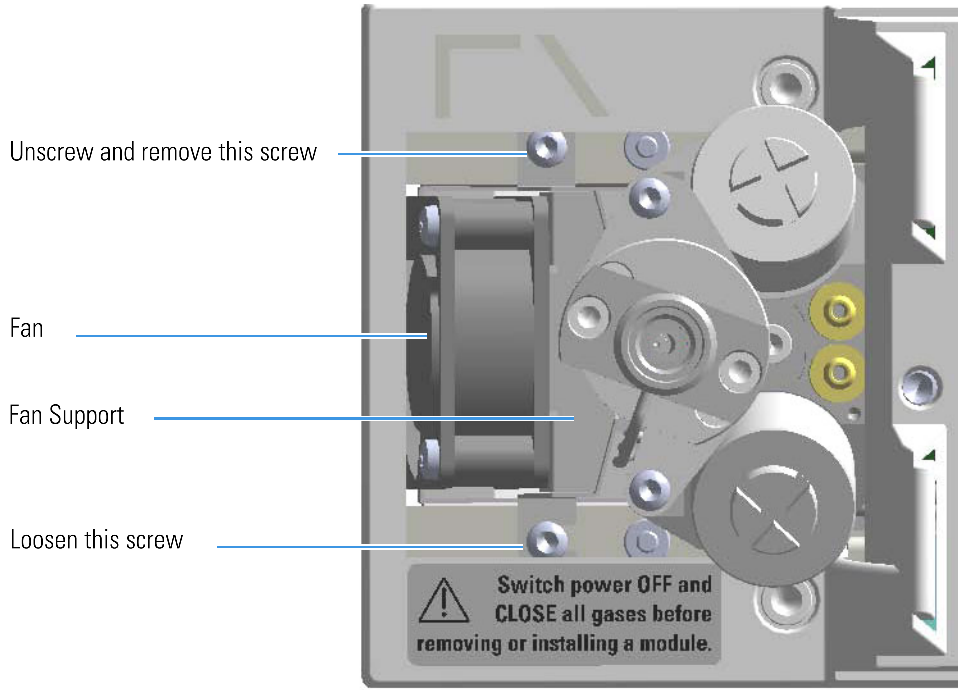


10. Remove the fan assembly.

    The fan is fixed on a support. Do not remove the fan from its support, but remove the assembly by proceeding as follows:

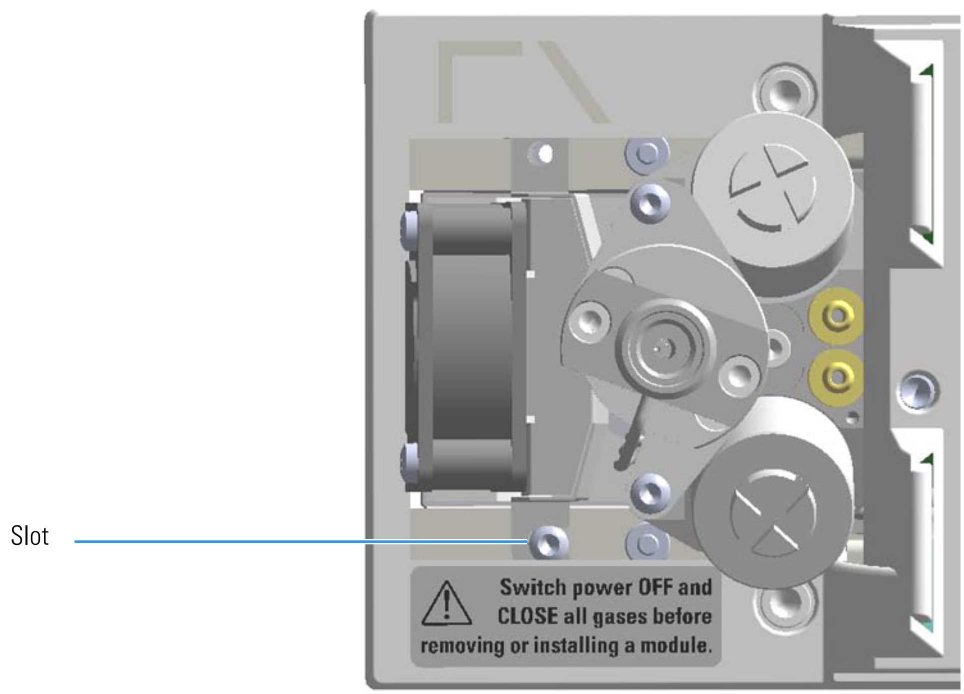
    a. Using tweezers, and a T10 Torxhead screwdriver, unscrew and remove the left fixing screw of the support, then unscrew and remove the right fixing screw. See Figure 237.

Figure 237. PTVBKF Module: Fan Assembly



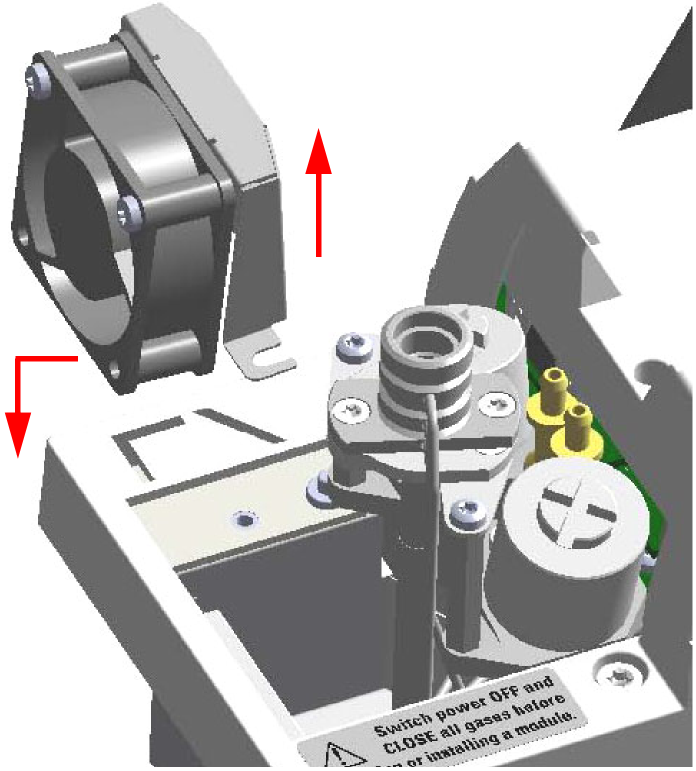
b. Carefully turn the fan assembly slightly to access the slot on the right base of the support from the right fixing screw. See Figure 238.

Figure 238. PTVBKF Module: Fan Assembly Removal (1)



c. Carefully extract the fan assembly from its seat, and place it sideways to the module. Be sure to not damage the two wires. See Figure 239.

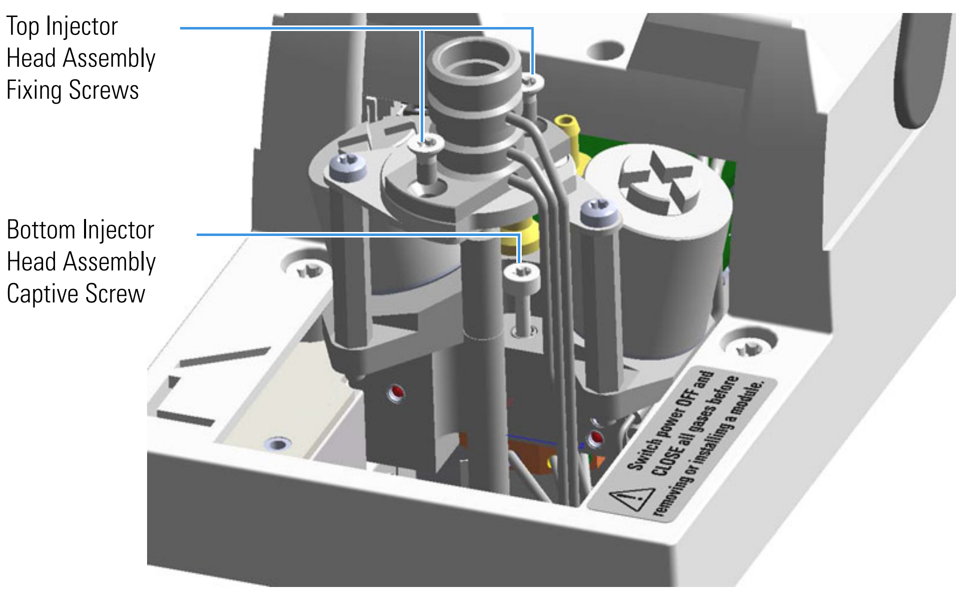
Figure 239. PTVBKF Module: Fan Assembly Removal (2)



11. Remove and clean the injector head.

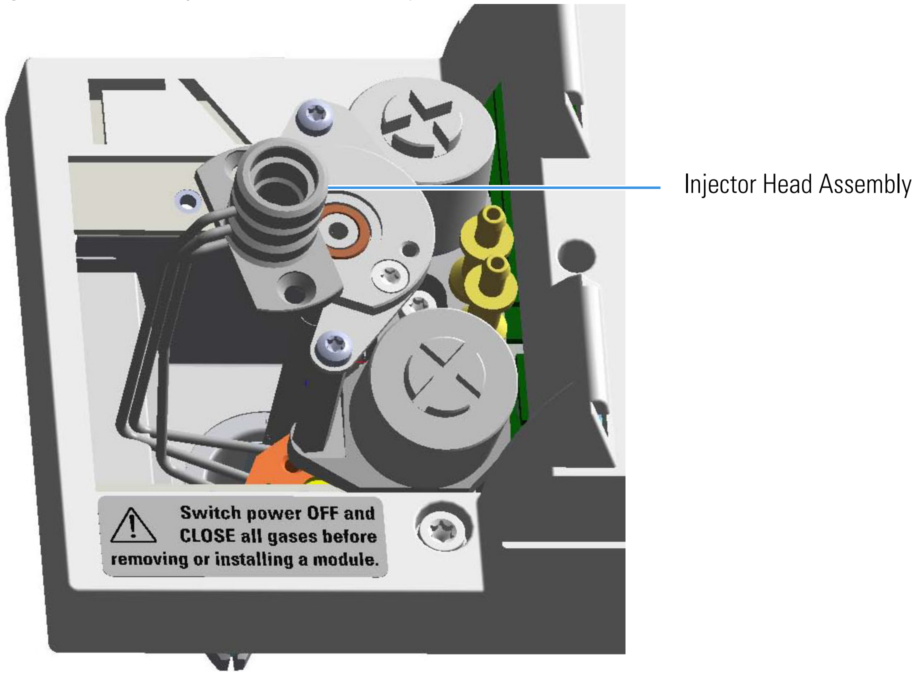
    a. Using the T10 Torxhead screwdriver, unscrew the two fixing screws, and the captive screw that respectively fix the top and the bottom of the injector head assembly. See Figure 240.

Figure 240. PTVBKF Injector Head Assembly



b. Holding the top of the injector head assembly with your thumb, index, and middle fingers, turn the assembly clockwise. See Figure 241.

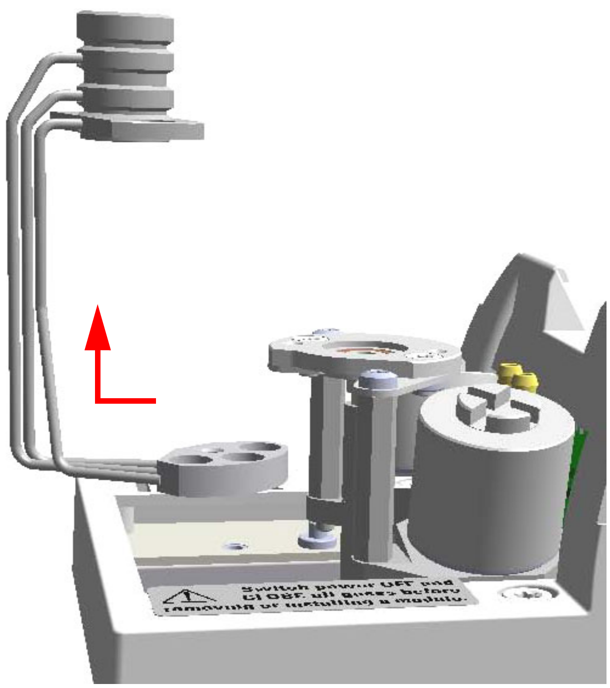
Figure 241. PTV Injector Head Assembly Removal (1)



c. Extract the assembly sideways from its housing. See Figure 242.

Note Do not remove the carrier, split, and purge lines' O-rings on the plate.

Figure 242. PTVBKF Injector Head Assembly Removal (2)



12. Clean the injector head.
    a. Put the injector head assembly into an ultrasonic cleaner filled with a methanol/acetone mixture (1:1).
    b. Sonicate the injector head assembly for about half an hour.
    c. Using tweezers, remove the injector head assembly from the bath and dry it with compressed clean air.
13. Reinstall the injector head.
    a. Carefully reinstall the injector head assembly into its housing proceeding in the reverse order in which it was removed.
    b. Screw the two fixing screws and the captive screw fixing the top, and the bottom of the injector head assembly respectively.
14. Remount the fan assembly.
    a. Carefully reinsert the fan assembly in its seat into the module.
    b. Move the assembly slightly to position the slot on the right base of the support under the head of the right fixing screw, and for aligning the hole on the left base with the corresponding fixing hole.
    c. Using tweezers, reinsert the left fixing screw previously removed.
    d. Using a T10 Torxhead screwdriver, tighten both the left and right fixing screws.
15. Reinsert the liner.
    a. Place the liner seal over the liner.
    b. Using tweezers, insert the liner into the injector and push it gently towards the bottom of the injector.
    c. Reinsert and screw the liner cap using the slotted stubby driver.
16. Reinstall the upper parts of the injector.
    a. Place the septum into the injector head assembly.

CAUTION It is suggested to replace the septum with a new one.

ATTENTION Il est recommandé de remplacer le septum par un modèle neuf.

    b. Screw and tighten the septum cap.

CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

17. Close the module flap cover.
18. If present, move the autosampler towards the module to restore the original alignment.
19. Open the gas supplies.
20. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
21. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
22. Set the normal oven, injectors, and detectors working conditions.

7

Detectors Advanced Maintenance

This chapter describes TRACE 1600/1610 detector modules that do not require routine maintenance, but troubleshooting may indicate they need to be cleaned or replaced.

Contents

Removing/Replacing a Detector Module

This section provides the instruction for removing/replacing a front/back detector module.

Figure 243. Example of Detector Module

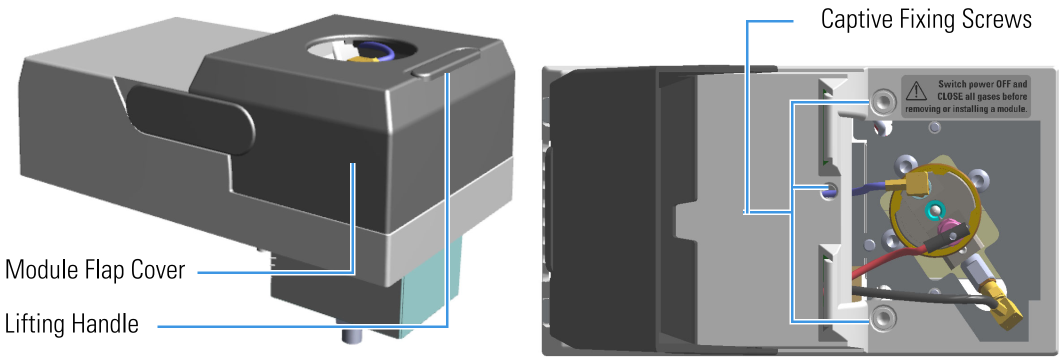


Figure 244. Replacing a Front Detector Module

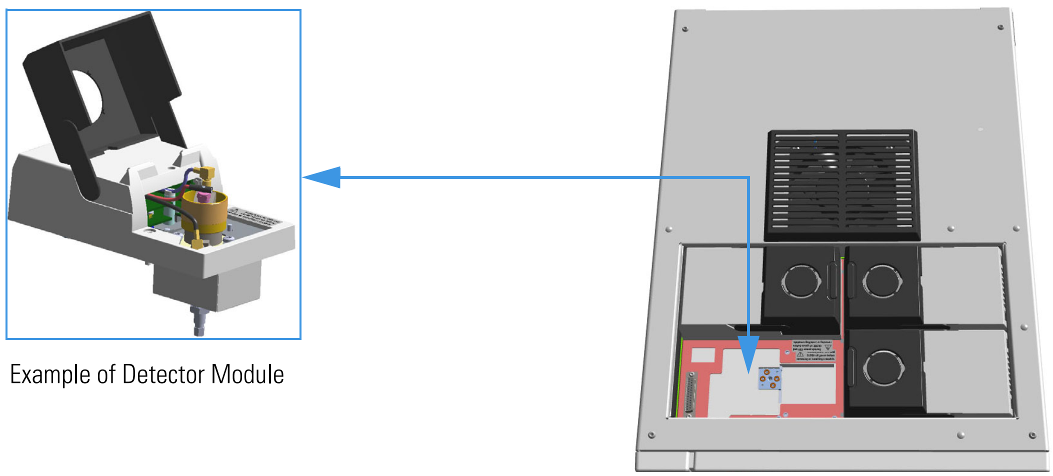
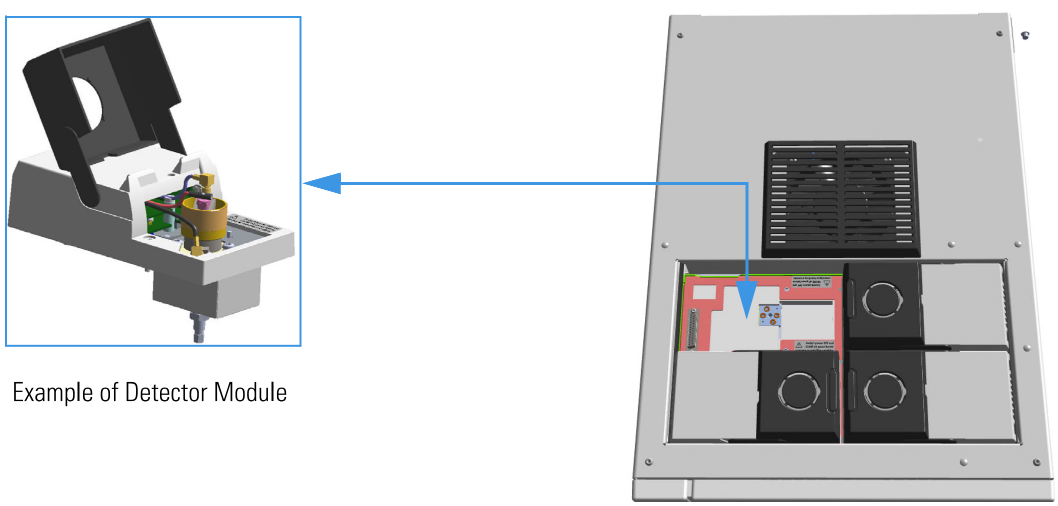


Figure 245. Replacing a Back Detector Module



❖ To remove/replace a front/back detector module

1. Put the GC in standby condition.

2. Cool the oven, injectors and detectors to room temperature.

3. Close the gas supplies.

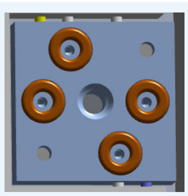
Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector on the back of the GC, and from the wall outlet.

5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

6. Remove the column from the detector.
   a. Open the front door of the GC.
   b. Loosen the retaining nut from the detector fitting on the upper interior wall of the GC oven.
   c. Remove the analytical column with its nut and ferrule from the bottom of the detector.

7. Remove the detector module.
   a. Open the module flap cover.
   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.
   c. Keeping the module flap cover open, lift up the module from its seat in the injector housing.
   d. Place the module on a clean surface.



WARNING Make sure all four O-rings are placed into their seat on the gas connection.

Do not install the module if the O-rings are missing.

8. Replace the detector module.
   a. Open the module flap cover.
   b. Keeping the module flap cover open, place it in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.
   c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment, screws must be tightened in turn. Tighten each screw a small amount before moving to the next screw. Repeat this process until all screws are secure.

   d. Close the module flap cover.

9. Remove the plug, and reconnect the column end to the detector.
10. Open the gas supplies.
11. Check the gas supply for leaks.
    a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.
    b. If you detect a leak, tighten the connection and retest it.
    c. Repeat this process until all connections are leak free.
12. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
13. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
14. Check the module gas connections for leaks.
15. Close the front door of the GC.

Measuring the FID Gas Flows

Use this procedure for manually measuring the FID fuel and make-up gases.

❖ **To manually measure the FID flow rates**

Materials needed
Forceps or tweezers
T10 Torxhead screwdriver
Measuring Tool - Flowmeter Adapter
Electronic flowmeter (Thermo Scientific GFM Pro Flowmeter, or equivalent)

1. Put the GC in standby condition.
2. Turn the flame off. The fuel gases, hydrogen, and air are automatically closed.
3. Cool the detector to room temperature.

4. Turn the make-up gas off.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC, and from the wall outlet.
6. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet
7. Open the module flap cover.
8. Disconnect the signal, glow-plug, and polarizing cables from their contacts on the cell top cover. See Figure 246 and Figure 247.

Figure 246. FID Cables

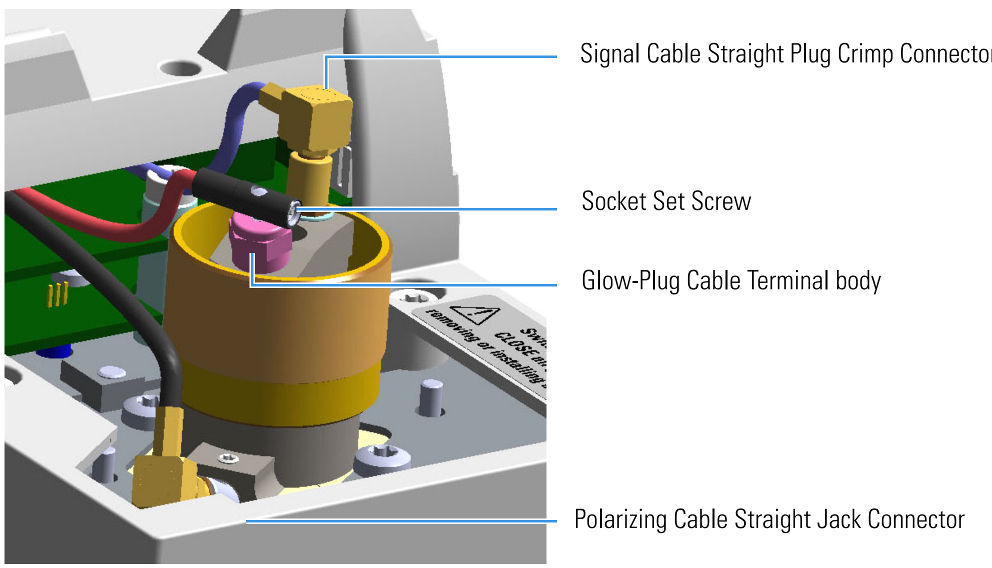
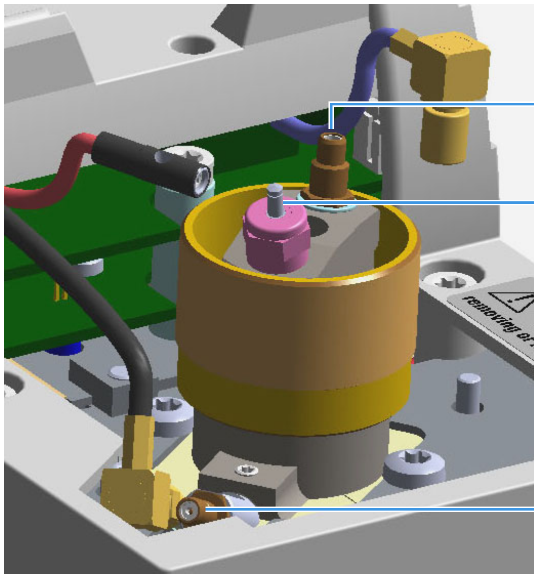


Figure 247. FID Cables Disconnection



a. Loosen the glow-plug cable socket set screw using a T10 Torxhead screwdriver. Carefully pull out the terminal body of the glow-plug cable from the dowel pin on the glow-plug element.

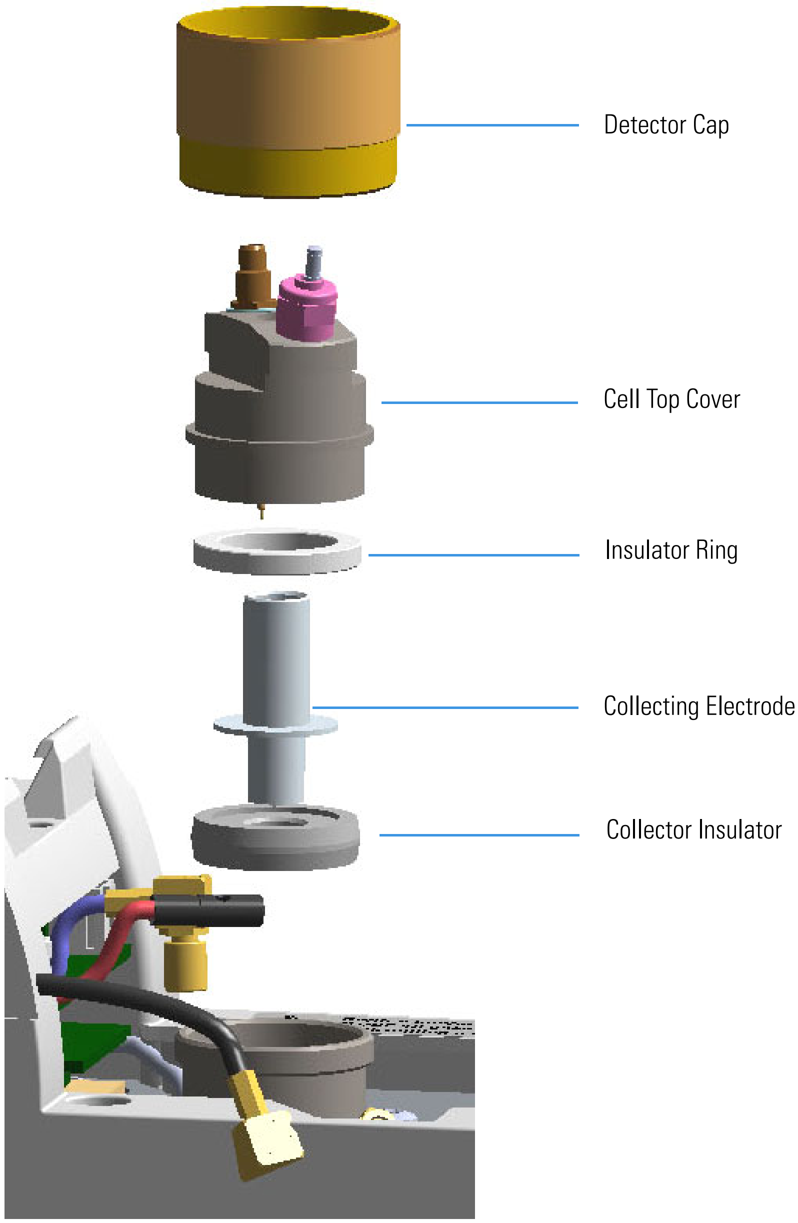
b. Unscrew and pull out the straight plug crimp connector of the signal cable from the collecting electrode bulkhead jack.

c. Pull out the quick coupling straight jack connector of the polarizing cable from the polarizing electrode bulkhead jack.

d. Carefully move the cables in order to have free space for handling the detector.

9. Remove the top parts of the detector. See Figure 248.

Figure 248. FID Top Parts Removal



a. Unscrew and remove the detector cap, paying attention to not rotate the cell top cover.

b. Remove the cell top cover and put it in a safe place. Do not damage the FID collecting electrode pin.

10. Remove the electrode. See Figure 248.

a. Using forceps or tweezers, carefully extract the collecting electrode, the insulator ring and the collector insulator through the top of the detector cell. Place all the parts removed on a clean surface.

WARNING The collector insulator must be stored somewhere it can stay clean.

b. Loosen the polarizing electrode fixing screw using a T10 Torxhead screwdriver, and extract the polarizing electrode from its seat.

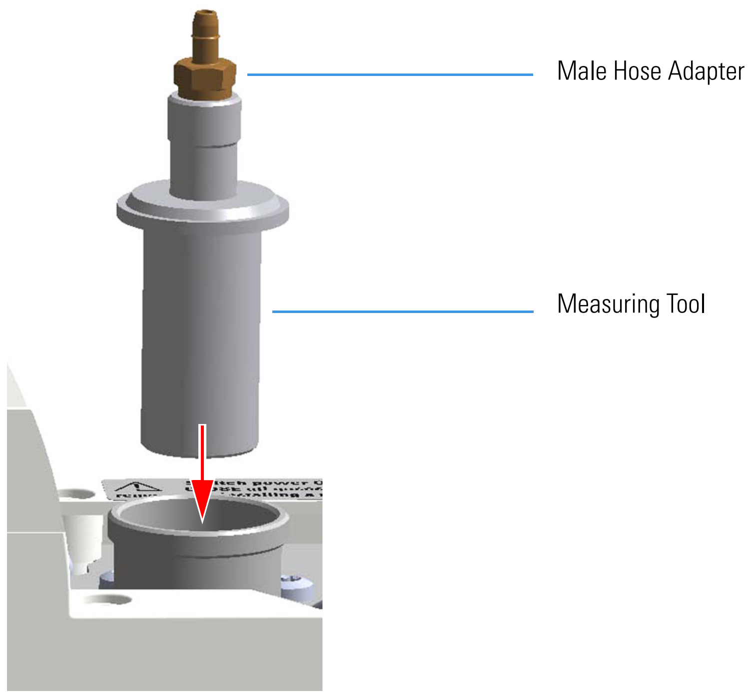
c. Place the polarizing electrode on a clean surface.

11. Insert the FID gases measuring tool. See Figure 249.

a. Insert the measuring tool into the detector body.

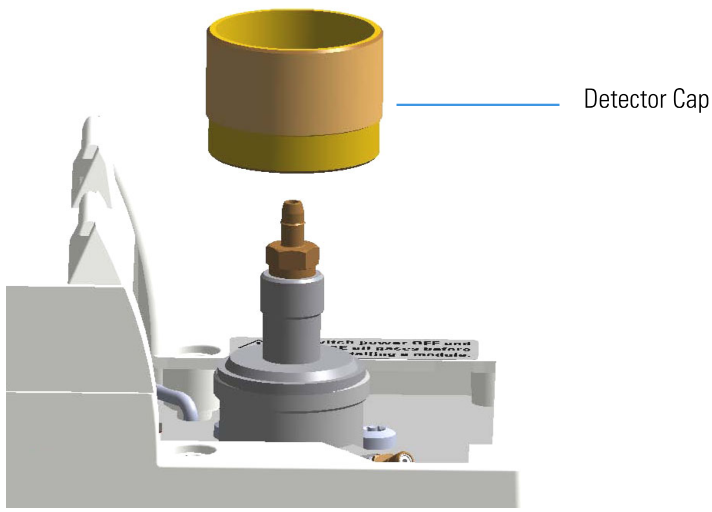
b. Push the measuring tool downwards until it stops.

Figure 249. FID Gases Measuring Tool



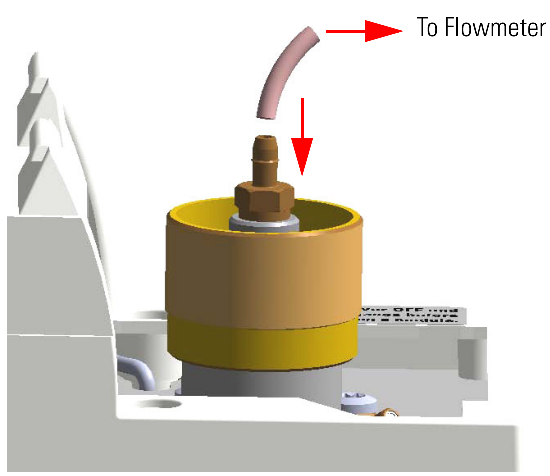
c. Screw the detector cap onto the measuring tool. See Figure 250.

Figure 250. FID Gases Measuring Tool Assembling



d. Place the flowmeter tubing over the male hose adapter of the measuring tool to begin measuring flows. See Figure 251.

Figure 251. Measuring Tool to Flowmeter Connection



12. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

13. Measure the gas flow rate.

    a. Open the GC user interface.

    b. Turn the **Hydrogen** flow On.

        i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.

c. Turn the hydrogen flow Off.

d. Turn the **Air** supply On.

   i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.

e. Turn the Air flow Off.

f. Turn the **Makeup** gas flow On.

   i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.

g. Turn the Makeup Off.

14. Power off the GC.

    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

    b. Unplug the power cable from the AC Input connector into the back of the GC, and from the wall outlet.

15. Unscrew the detector cap, then remove the measuring tool from the detector body.

16. Reinstall the electrodes.

    a. Reinsert the polarizing electrode into its seat pushing while screwing it, then screw the fixing screw.

    b. Remount the collector insulator, the collecting electrode, and its insulator ring.

17. Remount the top parts of the detector.

    a. Remount the cell top cover.

    b. Screw the detector cap paying attention to not rotate the cell top cover.

    c. Reconnect the signal, glow-plug, and polarizing cables.

18. Close the module flap cover.

19. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

20. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

21. Turn the make-up gas on.

22. Set the normal oven and detector working conditions.

23. Ignite the flame. The fuel gases, hydrogen and air, are automatically opened.

Cleaning or Replacing the FID Jet

It is good practice to clean the jet semi-annually when you are analyzing particularly dirty compounds that can cause the flame to not burn properly. In case of actual damage, the jet must be replaced.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the FID ceramic jet

Materials needed
GC-grade methanol
Distilled water
Screwdriver?
Forceps or tweezers
T10 Torxhead screwdriver
Elbowed box wrench, 8-mm
Ceramic jet (if necessary)

1. Put the GC in standby condition.
2. Turn the flame off. The fuel gases, hydrogen, and air are automatically closed.
3. Cool the detector to room temperature.
4. Turn the make-up gas off.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC, and from the wall outlet.
   c. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Open the module flap cover.
7. Disconnect the signal, glow-plug, and polarizing cables from their contacts on the cell top cover. See Figure 252 and Figure 253.

Figure 252. FID Cables

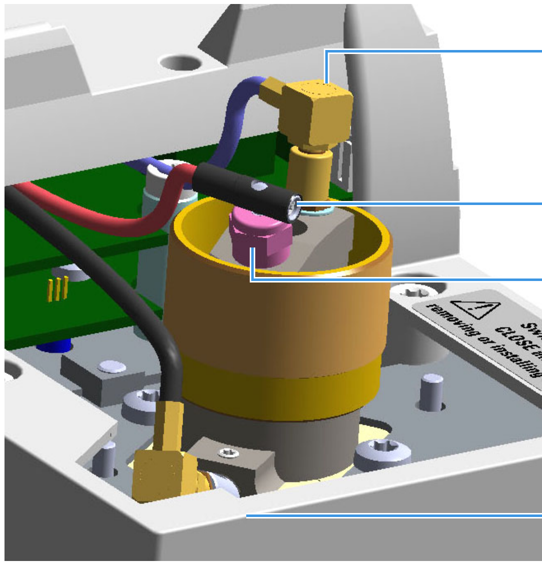
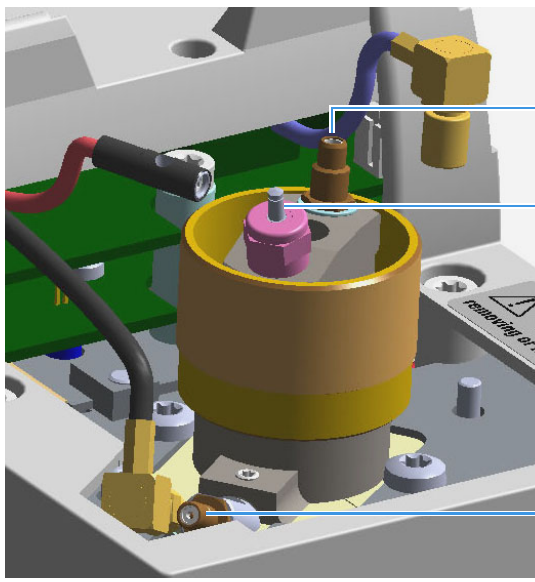


Figure 253. FID Cables Disconnection



a. Loosen the glow-plug cable socket set screw using a T10 Torxhead screwdriver. Carefully pull out the terminal body of the glow-plug cable from the dowel pin on the glow-plug element.

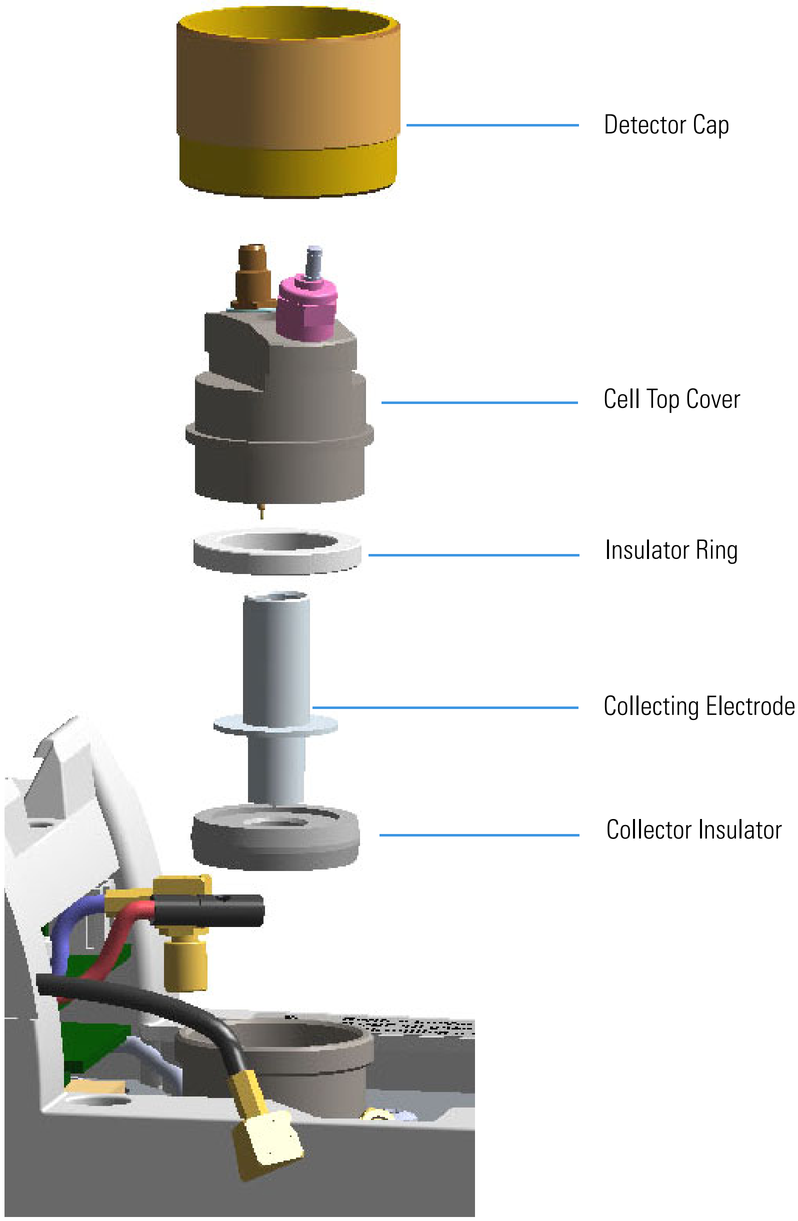
b. Unscrew and pull out the coaxial straight plug crimp connector of the signal cable from the collecting electrode bulkhead jack.

c. Pull out the quick coupling coaxial straight jack connector of the polarizing cable from the polarizing electrode bulkhead jack.

d. Carefully move the cables in order to have free space for handling the detector.

8. Remove the top parts of the detector. See Figure 254.

Figure 254. FID Top Parts Removal



a. Unscrew and remove the detector cap paying attention to not rotate the cell top cover.

b. Remove the cell top cover and put it in a safe place. Do not damage the FID collecting electrode pin.

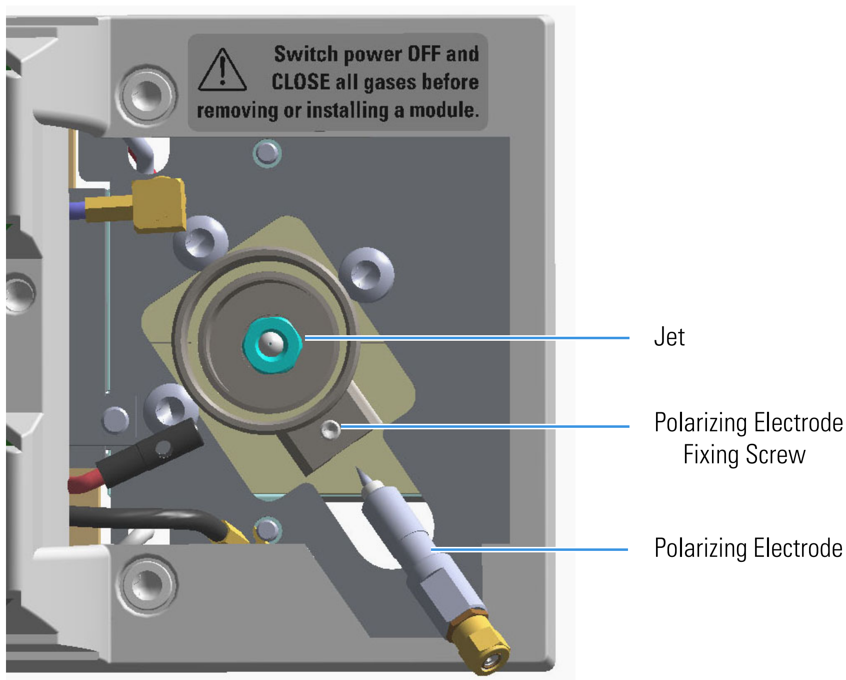
9. Remove the electrode. See Figure 254.

   a. Using forceps or tweezers, carefully extract the collecting electrode, the insulator ring, and the collector insulator through the top of the detector cell. Place all the parts removed on a clean surface.

WARNING The collector insulator must be stored somewhere it can stay clean.

b. Loosen the polarizing electrode fixing screw using a T10 Torxhead screwdriver, and extract the polarizing electrode from its seat. See Figure 255.

Figure 255. FID Jet (2)

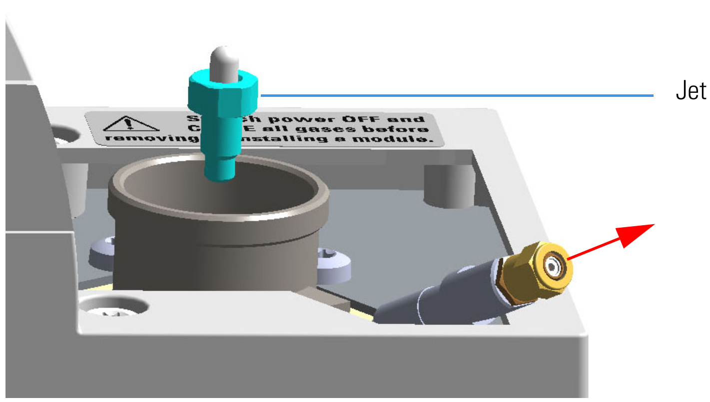


c. Place the polarizing electrode on a clean surface.

10. Remove, clean, and reinstall the jet.

a. Use the elbowed box wrench for unscrewing and extracting the jet through the detector body. See Figure 256.

Figure 256. FID Jet (2)



b. Place the jet in the ultrasonic cleaner, filled with liquid detergent.

c. Sonicate the jet for about five minutes.

d. Handling the jet with forceps or tweezers. Rinse the jet using distilled water, then methanol.

e. Place the jet on a paper towel, and let the jet air dry.

> **Note** If after the cleaning physical condition of the jet does not permit its reuse, replace the jet with a new one.

f. Using the proper tool, reinsert and screw the cleaned (or a new) jet into its seat in the detector body.

11. Reinstall the electrodes.

    a. Reinsert the polarizing electrode into its seat pushing while screwing it, then screw the fixing screw.

    b. Remount the collector insulator, the collecting electrode, and its insulator ring.

12. Remount the top parts of the detector.

    a. Remount the cell top cover.

    b. Screw the detector cap paying attention to not rotate the cell top cover.

    c. Reconnect signal, glow-plug, and polarizing cables.

13. Close the module flap cover.

14. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

15. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

16. Turn the make-up gas on.

17. Set the normal detector working conditions.

18. Ignite the flame. The fuel gases, hydrogen. and air, are automatically opened.

Measuring the NPD Gas Flows

Use this procedure for manually measuring the NPD fuel and make-up gases.

❖ To manually measure the NPD flow rates

Materials needed
Forceps or tweezers
T6 Torxhead key
T10 Torxhead screwdriver
6 mm wrench
Measuring Tool Flowmeter Adapter
Electronic flowmeter (Thermo Scientific GFM Pro Flowmeter, or equivalent)

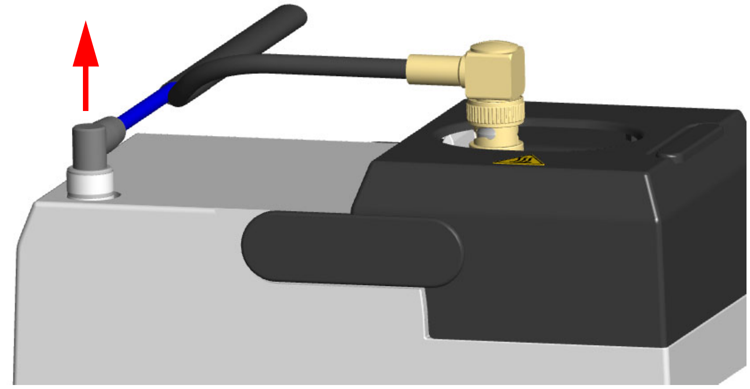
1. Put the GC in standby condition.
2. Switch off the thermionic source. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.
4. Turn the make-up gas off.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
6. Unplug the power cable from the AC input connector of the **NPD Thermionic Source Power Module** and from the wall outlet.

   If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
7. Unplug the signal cable from the detector module. See Figure 257.

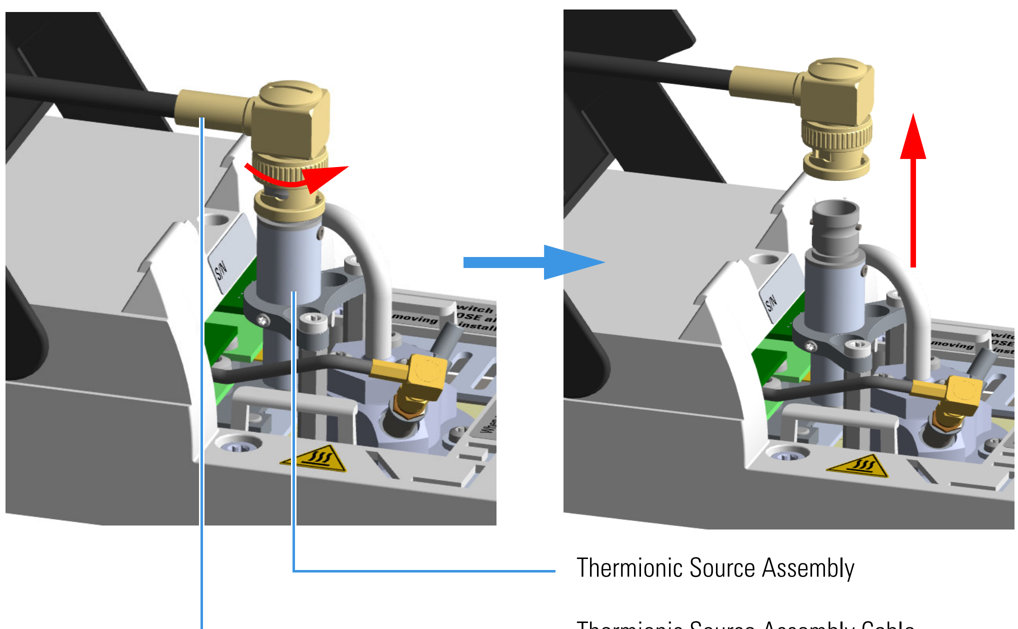
Figure 257. NPD Signal Cable Removal



8. Open the module flap cover.

9. Remove the thermionic source assembly cable. See Figure 258.

Figure 258. NPD Thermionic Source Cable Removal

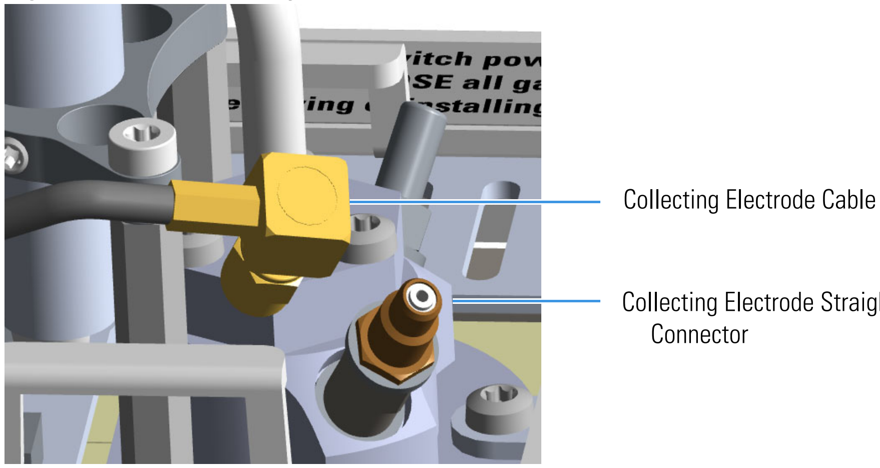


a. Twist the ring to disconnect the thermionic source assembly cable.

b. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart.

10. Unscrew and pull out the straight jack connector of the collecting electrode cable from the collecting electrode bulkhead jack. See Figure 259.

Figure 259. NPD Collecting Electrode Cable Removal



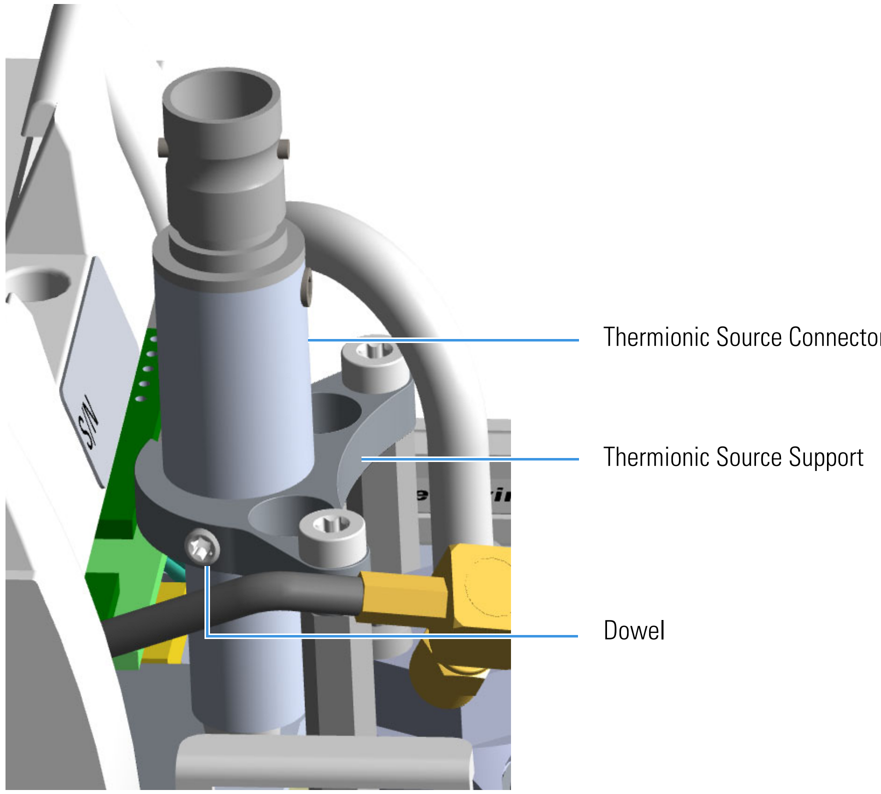
11. Remove the thermionic source

CAUTION The thermionic source is delicate. Be careful not to break or crack the source. When performing maintenance on the NPD, avoid touching the source with your fingers, and prevent it from coming in contact with other surfaces. Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

ATTENTION La source thermo-ionique est fragile. Veillez à ne pas briser ou fissurer la source. Pendant la maintenance du NPD, évitez de toucher la source avec les doigts et empêchez-la d'entrer en contact avec d'autres surfaces. Portez des gants propres et non pelucheux pour éviter de contaminer les pièces avec de la poussière ou de sébum.

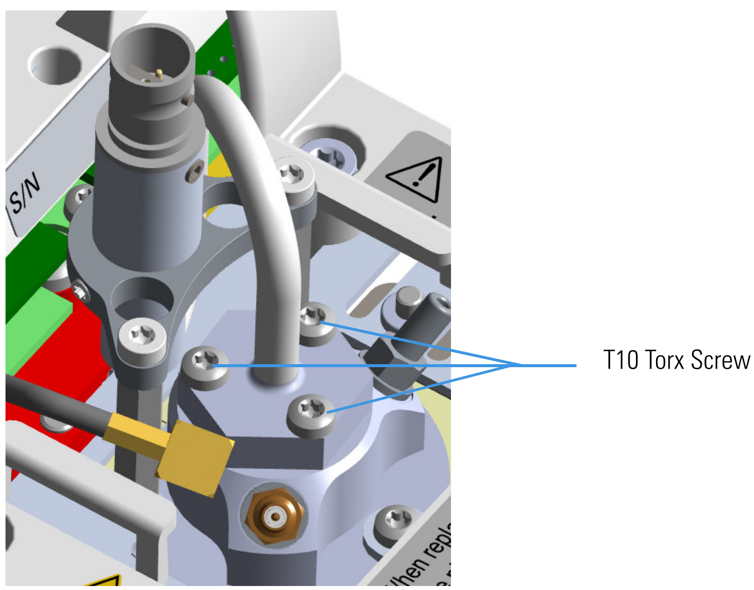
a. Using a T6 Torxhead key, loosen the dowel which fix the thermionic source connector to the thermionic source support. See Figure 260.

Figure 260. NPD Thermionic Source Removal (1)



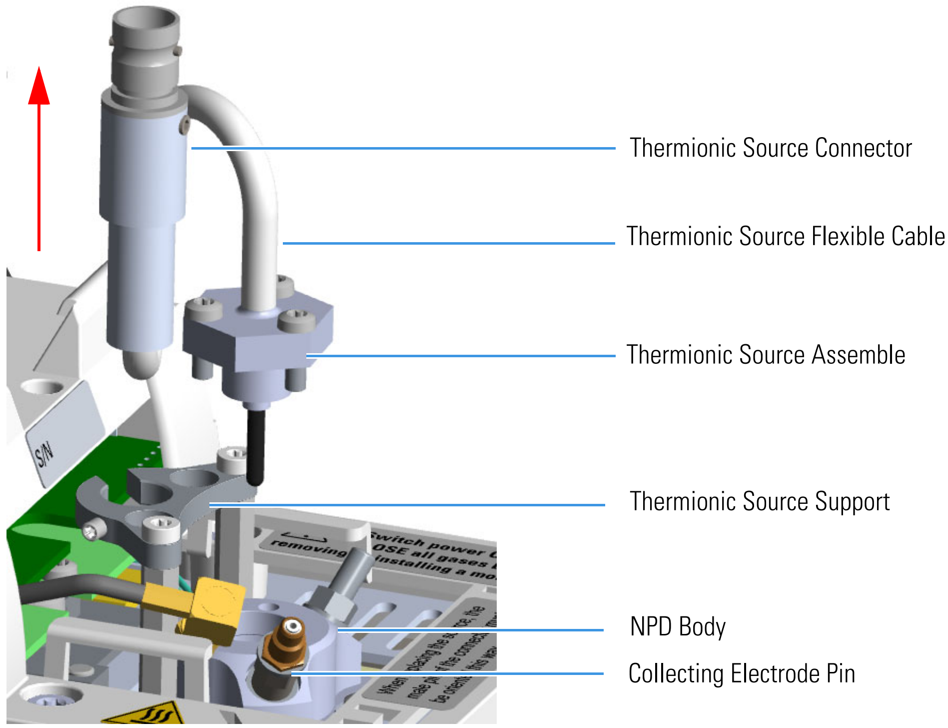
b. Using the T10 Torxhead screwdriver, remove the three T10 Torx screws from the thermionic source assembly. See Figure 261.

Figure 261. NPD Thermionic Source Removal (2)



c. Gently lift up the thermionic source connector guiding the flexible cable from the thermionic source support, then remove the thermionic source assemble from the NPD body. Avoid bumping the bead on the sides of the collector. See Figure 262.

Figure 262. NPD Thermionic Source Removal (3)



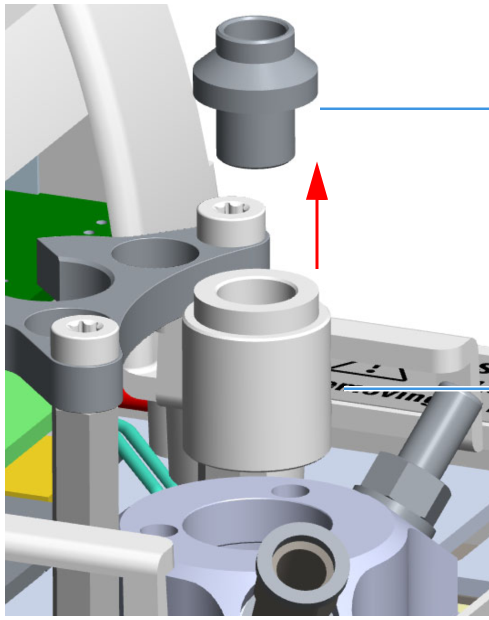
12. Remove the collecting electrode and the insulator. See Figure 263.

   a. Using a 6-mm wrench, unscrew and remove the collecting electrode pin from its seat on the detector body.

   b. Using forceps or tweezers, extract the collecting electrode through the top of the detector body.

   c. Using forceps or tweezers, extract the insulator through the top of the detector body. Place the insulator on a clean surface.

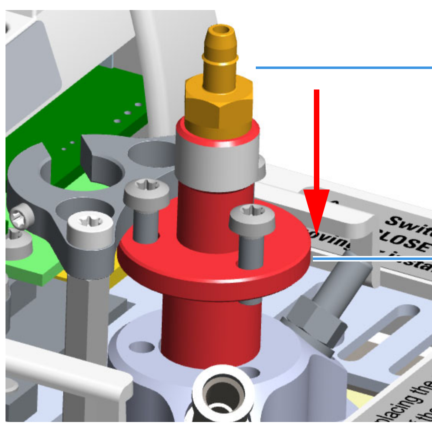
Figure 263. NPD Insulator and Collecting Electrode Removal



WARNING The collector insulator must be stored somewhere it can stay clean.

13. Insert the NPD gases measuring tool. See Figure 264.

Figure 264. NPD Gases Measuring Tool (1)



a. Insert the flowmeter adapter measuring tool into the detector body.

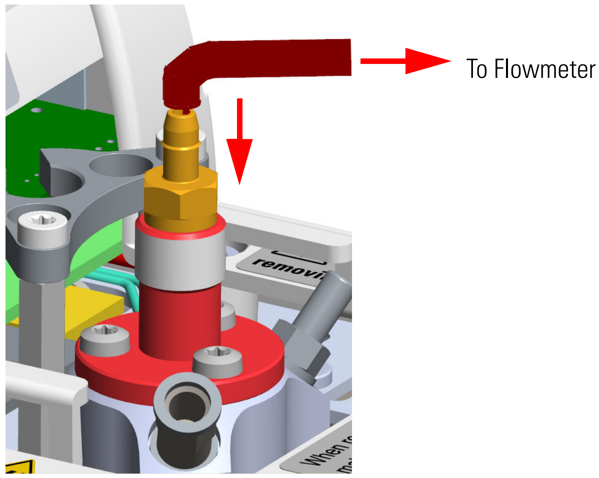
b. Push the flowmeter adapter measuring tool downwards until it stops.

c. Rotate the measuring tool to align the fixing holes, then insert the three screws used to fix the thermionic source.

d. Fix the flowmeter adapter measuring tool to the detector body using a T10 Torxhead screwdriver.

e. Place the flowmeter tubing over the male hose adapter of the measuring tool to begin measuring flows. See Figure 265.

Figure 265. NPD Gases Measuring Tool (2)



14. Measure the gas flow rate.
    a. Open the GC user interface.
    b. Turn the **Hydrogen** flow On.
        i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.
    c. Turn the hydrogen flow Off.
    d. Turn the **Air** supply On.
        i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.
    e. Turn the Air flow Off.
    f. Turn the **Makeup** gas flow On.
        i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.
    g. Turn the Makeup Off.
15. Remove the flowmeter adapter measuring tool from the detector body proceeding in the reverse order in which it was installed.
    a. Using forceps or tweezers, reinstall the insulator into the detector body.
16. Reinstall the insulator and the collecting electrode.
    a. Using forceps or tweezers, reinstall the insulator into the detector body.
    b. Place the collecting electrode in its housing.

c. Using a 6-mm wrench, screw the collecting electrode pin into its seat on the detector body.

d. Screw the straight plug crimp connector of the collecting electrode cable to the collecting electrode bulkhead jack.

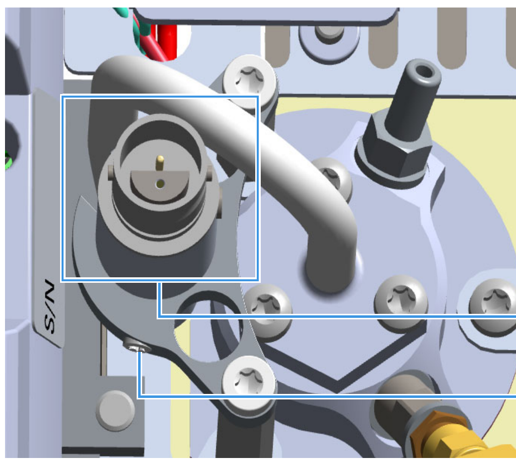
17. Reinstall the thermionic source.

a. Remove the protective cap covering the new thermionic source.

b. Mount and guide the new source assembly on the NPD body proceeding in the reverse order in which it was removed. Be careful not to bump the bead on the sides of the body and collecting electrode.

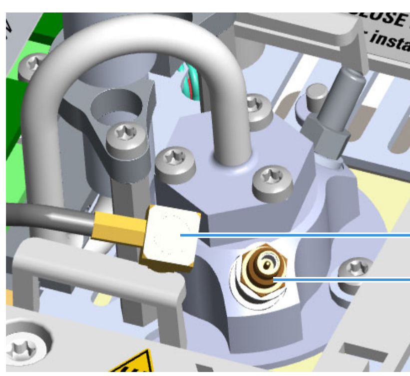
c. Rotate and align the thermionic source connector, then tighten the dowel to fix the connector to the support using the T6 Torxhead key. See Figure 266.

Figure 266. Reinstall Thermionic Source (1)



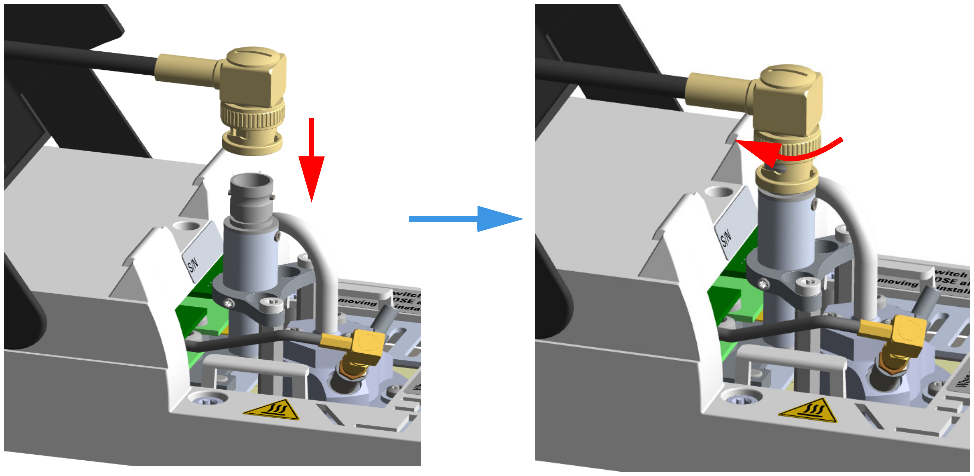
18. Reconnect and screw the straight jack connector of the collecting electrode cable to the collecting electrode bulkhead jack. See Figure 267.

Figure 267. Reinstall Thermionic Source (2)



19. Reconnect the source assembly cable to the NPD cable and twist the ring to lock the connection. See Figure 268.

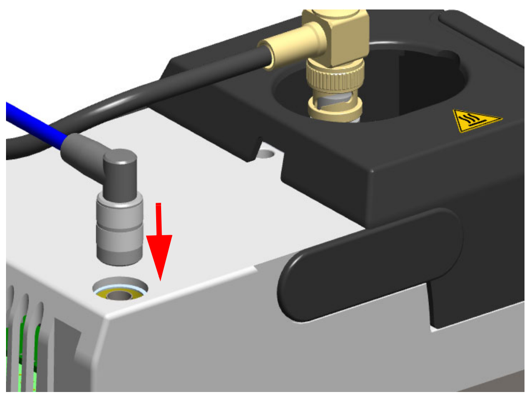
Figure 268. Reinstall Thermionic Source (3)



20. Close the module flap cover.

21. Plug in the signal cable into its contact on the detector module. See Figure 269.

Figure 269. Plug NPD Signal Cable



22. Plug the power cable to the AC input connector of the **NPD Thermionic Source Power Module** and to the wall outlet. The LED marked **On** blinks green.

    If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

23. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

24. Turn the make-up gas on.

25. Heat the detector the working temperature.

26. Switch on the thermionic source. Hydrogen and air are automatically opened.
    The LED marked **On** of the NPD Thermionic Source Power Module becomes solid green.

Cleaning or Replacing the NPD Jet

You should clean the jet semiannually when you analyze particularly dirty compounds that can cause the flame to not burn properly. In case of breakage or cracking, the jet must be replaced.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

❖ To clean or replace the NPD jet

Materials needed
Ultrasonic cleaner
Liquid detergent
GC-grade methanol
Distilled water
Forceps or tweezers
T6 Torxhead key
T10 Torxhead screwdriver
6 mm wrench
Elbowed box wrench, 8-mm
Jet (if necessary)

1. Put the GC in standby condition.
2. Switch off the thermionic source. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.
4. Turn the make-up gas off.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

5. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

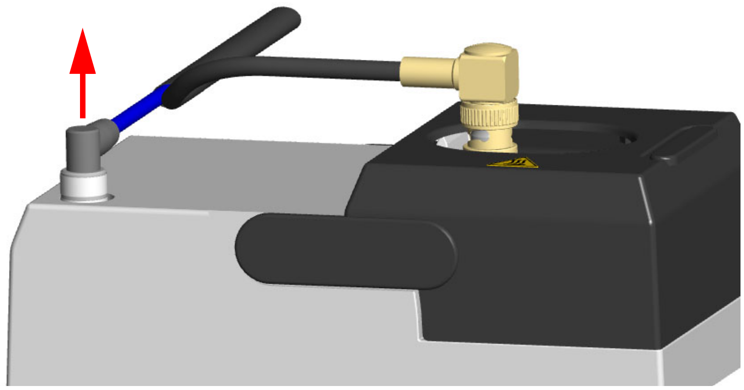
6. Unplug the power cable from the AC input connector of the **NPD Thermionic Source Power Module** and from the wall outlet.

   If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

7. If present, move the autosampler away from the module.

8. Unplug the signal cable from the detector module. See Figure 270.

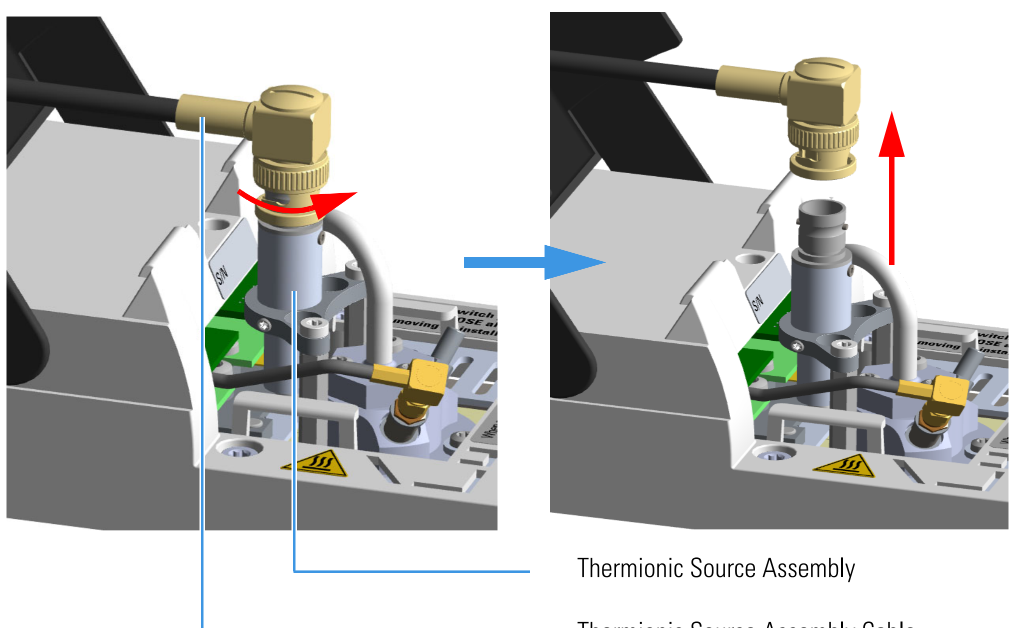
   Figure 270. NPD Signal Cable Removal



9. Open the module flap cover.

10. Remove the thermionic source assembly cable. See Figure 271.

   Figure 271. NPD Thermionic Source Cable Removal

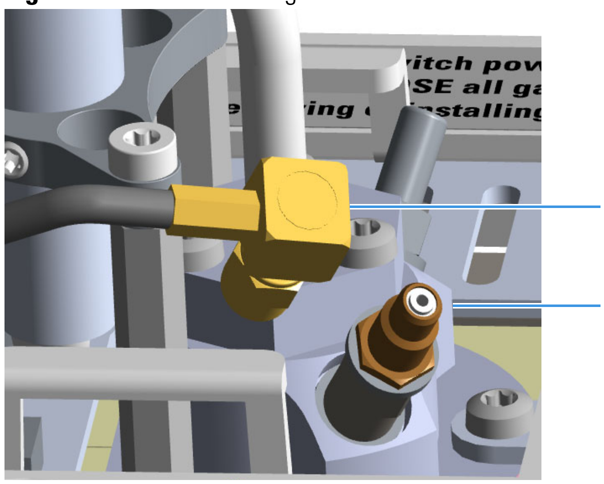


a. Twist the ring to disconnect the thermionic source assembly cable.

b. Push and twist the lock so that the button slides up in the groove, then pull the cable ends apart.

11. Unscrew and pull out the straight jack connector of the collecting electrode cable from the collecting electrode bulkhead jack. See Figure 272.

Figure 272. NPD Collecting Electrode Cable Removal



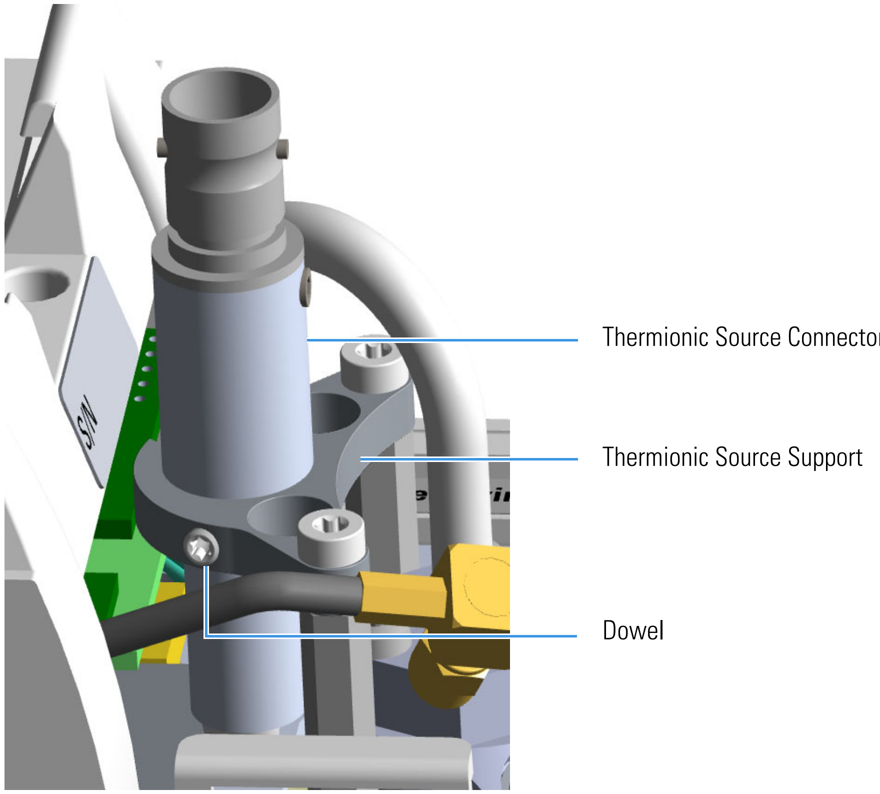
12. Remove the thermionic source

CAUTION The thermionic source is delicate. Be careful not to break or crack the source. When performing maintenance on the NPD, avoid touching the source with your fingers, and prevent it from coming in contact with other surfaces. Wear clean, lint-free gloves to prevent contamination of parts with dirt and skin oils.

ATTENTION La source thermo-ionique est fragile. Veillez à ne pas briser ou fissurer la source. Pendant la maintenance du NPD, évitez de toucher la source avec les doigts et empêchez-la d’entrer en contact avec d’autres surfaces. Portez des gants propres et non pelucheux pour éviter de contaminer les pièces avec de la poussière ou de sébum.

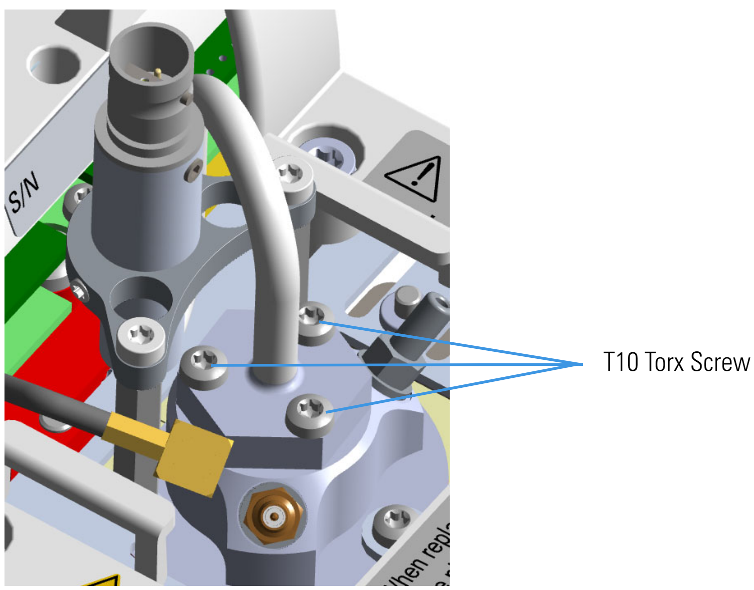
a. Using a T6 Torxhead key, loosen the dowel which fixes the thermionic source connector to the thermionic source support. See Figure 273.

Figure 273. NPD Thermionic Source Removal (1)



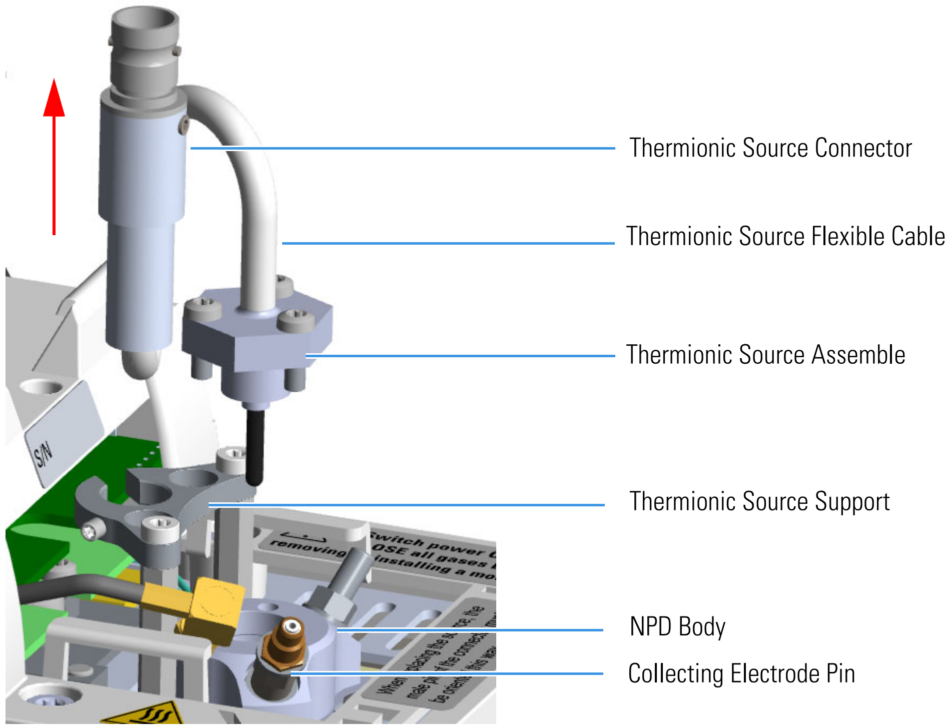
b. Using the T10 Torxhead screwdriver, remove the three T10 Torx screws from the thermionic source assembly. See Figure 274.

Figure 274. NPD Thermionic Source Removal (2)



c. Gently lift up the thermionic source connector guiding the flexible cable from the thermionic source support, then remove the thermionic source assembly from the NPD body. Avoid bumping the bead on the sides of the collector. See Figure 275.

Figure 275. NPD Thermionic Source Removal (3)

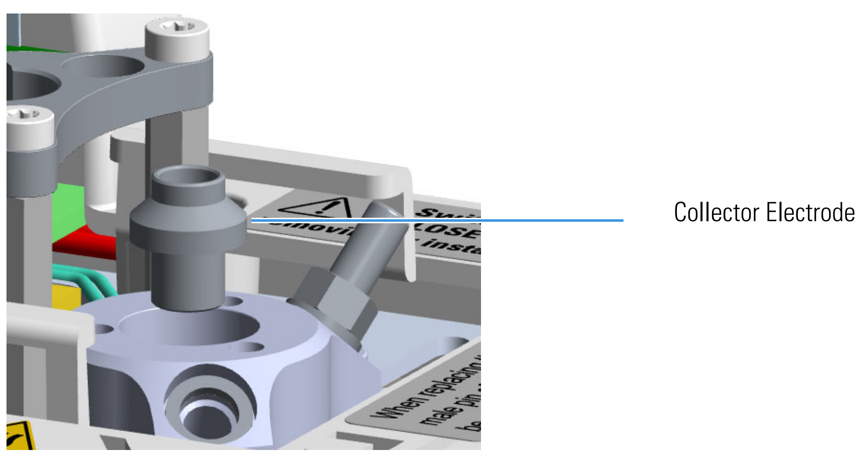


13. Remove the collecting electrode. See Figure 276.

a. Using a 6-mm wrench, unscrew and remove the collecting electrode pin from its seat on the detector body.

b. Using forceps or tweezers, extract the collecting electrode through the top of the detector body.

Figure 276. NPD Collecting Electrode Removal



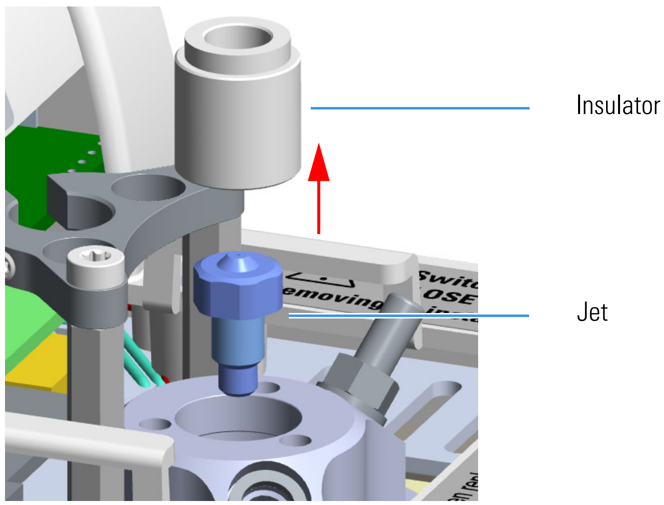
14. Remove and clean the jet. See Figure 277.

    a. Using forceps or tweezers, extract the insulator through the top of the detector body. Place the insulator on a clean surface.

WARNING The collector insulator must be stored somewhere it can stay clean.

    b. Use the elbowed box wrench for unscrewing and extracting the jet through the detector body.

Figure 277. Jet Removal



    c. Place the jet in the ultrasonic cleaner, filled with liquid detergent.

    d. Sonicate the jet for about five minutes.

Note If after cleaning the physical condition of the jet does not permit its reuse, replace the jet with a new one.

15. Reinsert the jet

    a. Using the proper tool, reinsert the cleaned (or a new) jet, into the detector body and screw it in its seat.

    b. Using forceps or tweezers, reinstall the insulator into the detector body.

16. Reinstall the collecting electrode.

    a. Place the cleaned (or a new) collecting electrode in its housing.

    b. Using a 6-mm wrench, screw the collecting electrode pin into its seat on the detector body.

    c. Screw the straight plug crimp connector of the collecting electrode cable to the collecting electrode bulkhead jack.

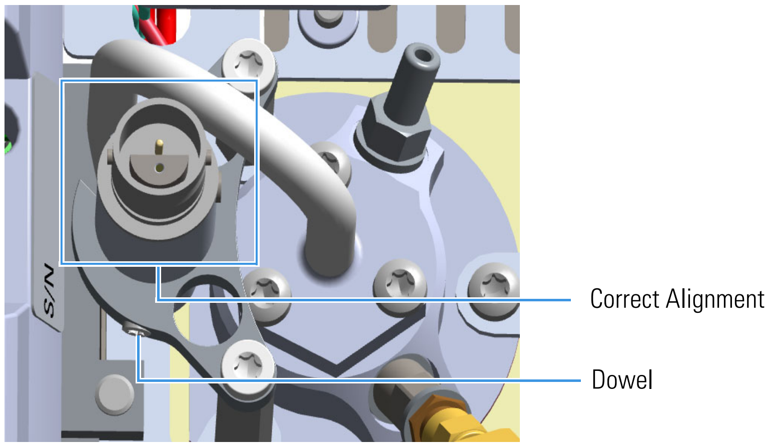
17. Reinstall the thermionic source.

a. Remove the protective cap covering the new thermionic source.

b. Mount and guide the new source assembly on the NPD body proceeding in the reverse order in which it was removed. Be careful not to bump the bead on the sides of the body and collecting electrode.

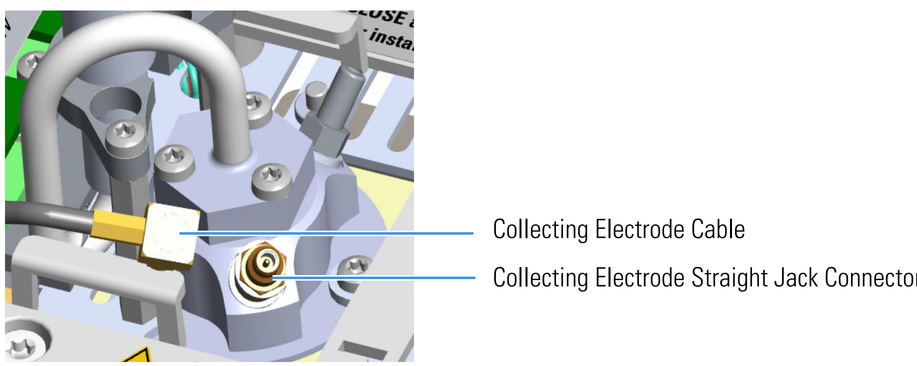
c. Rotate and align the thermionic source connector, then tighten the dowel to fix the connector to the support using the T6 Torxhead key. See Figure 278.

Figure 278. Reinstall Thermionic Source (1)



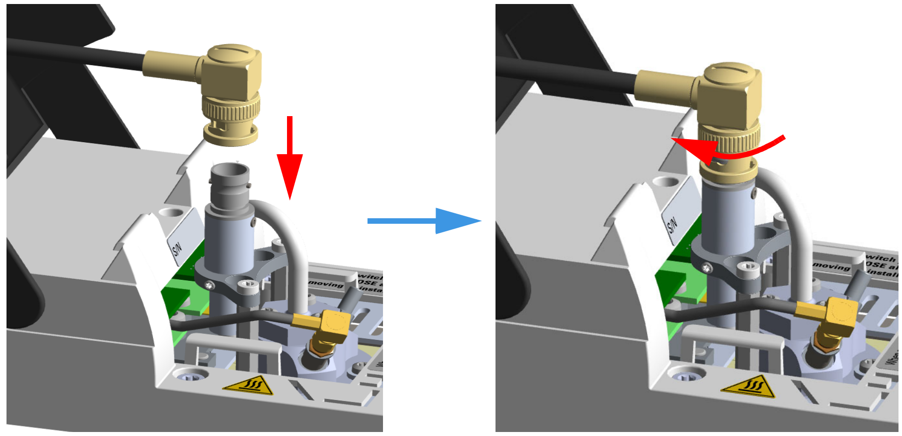
18. Reconnect and screw the straight jack connector of the collecting electrode cable to the collecting electrode bulkhead jack. See Figure 279.

Figure 279. Reinstall Thermionic Source (2)



19. Reconnect the source assemble cable to the NPD cable and twist the ring to lock the connection. See Figure 280.

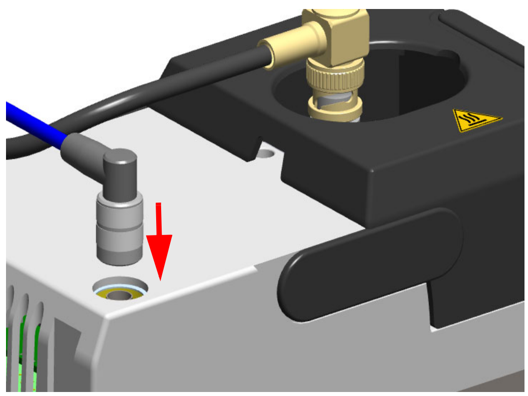
Figure 280. Reinstall Thermionic Source (3)



20. Close the module flap cover.

21. Plug in the signal cable into its contact on the detector module. See Figure 281.

Figure 281. Plug NPD Signal Cable



22. If present, move the autosampler towards the module to restore the original alignment.

23. Plug the power cable to the AC input connector of the **NPD Thermionic Source Power Module** and to the wall outlet. The LED marked **On** blinks green.

    If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

24. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

25. Turn the make-up gas on.

26. Heat the detector the working temperature.

27. Switch on the thermionic source. Hydrogen and air are automatically opened. The LED marked **On** becomes solid green.

Measuring the FPD Gas Flows

Use this procedure for manually measuring the FPD fuel gases.

❖ To manually measure the FPD flow rates

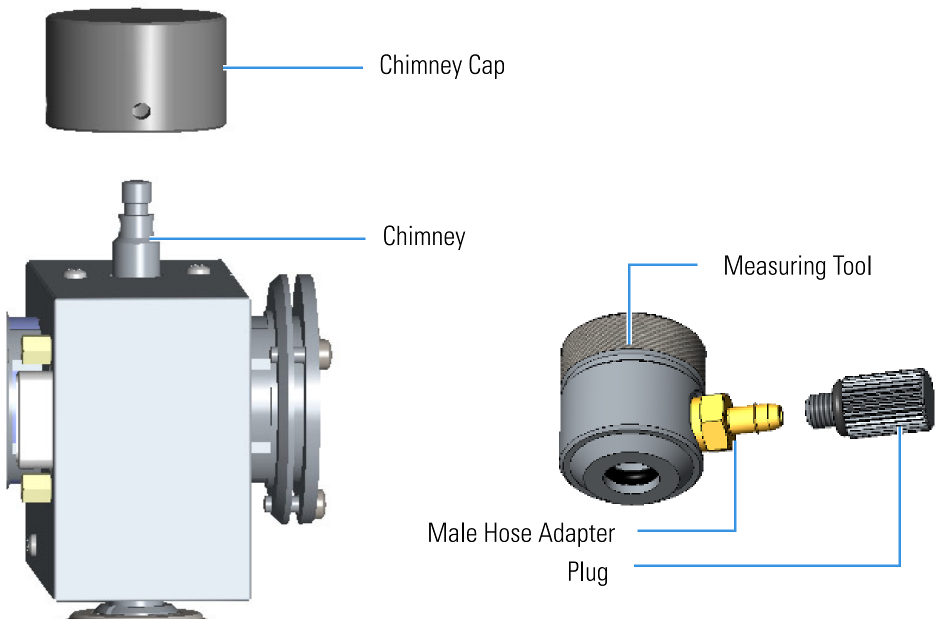
Materials needed
Forceps or tweezers
T10 Torxhead screwdriver
Measuring Tool Flowmeter Adapter
Electronic flowmeter (Thermo Scientific GFM Pro Flowmeter, or equivalent)

1. Put the GC in standby condition.
2. Turn the flame off. The fuel gases, hydrogen, and air are automatically closed.
3. Cool the detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Remove the column end from the bottom of the detector, then plug the bottom of the detector using the blind cap.
5. Insert the FPD gases measuring tool. See Figure 282.
   a. Remove the chimney cap.
   b. Place the measuring tool on the chimney.

Figure 282. FPD Gases Measuring Tool



> **Note** For measuring the flows use the male hose adapter. The plug must be used instead the male hole adapter when a leak test is required.

6. Place the flowmeter tubing over the male hose adapter of the measuring tool to begin measuring flows.
7. Measure the gas flow rate.
   a. Open the GC user interface.
   b. Turn the **Hydrogen** flow On.
      i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.
   c. Turn the hydrogen flow Off.
   d. Turn the **Air** supply On.
      i. Measure the gas flow and verify that the actual flow rate corresponds to the setpoint value.
   e. Turn the Air flow Off.
8. Remove the flowmeter tubing from the male hose adapter of the measuring tool.
9. Remove the measuring tool from the chimney.
10. Replace the chimney cap over the chimney.
11. Remove the blind cap from the bottom of the detector.
12. Reconnect the column end into the bottom of the detector.

13. Ignite the flame. The fuel gases, hydrogen and air, are automatically opened.

Cleaning or Replacing the FPD Mirror Metal Plug

Before cleaning or replacing the FPD mirror metal plug, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Materials needed
FPD fixing tools
Paper towels
Methylene chloride or GC-grade methanol
1-mm Allen wrench

❖ To clean or replace the FPD mirror metal plug

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

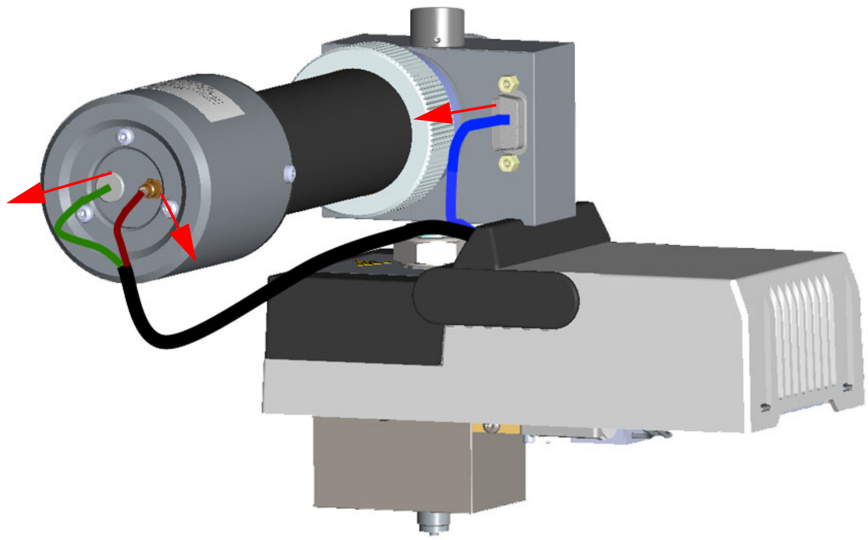
b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

6. Remove the FPD detector from the base.

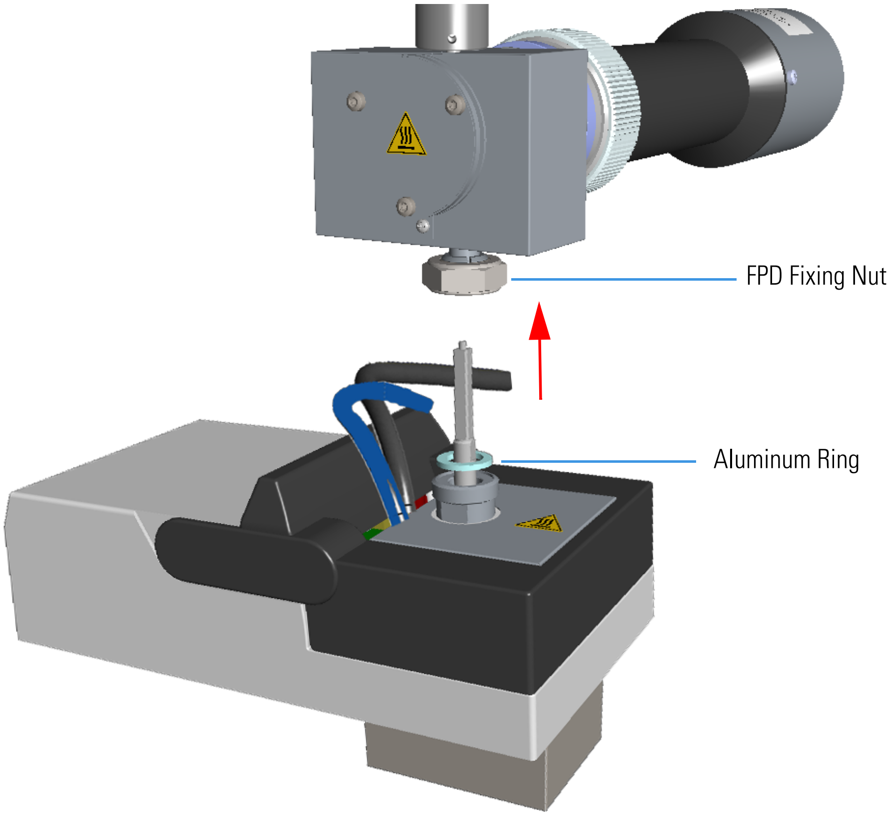
a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 283.

Figure 283. FPD Cables Disconnection



b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 284.

Figure 284. FPD Detector Removal

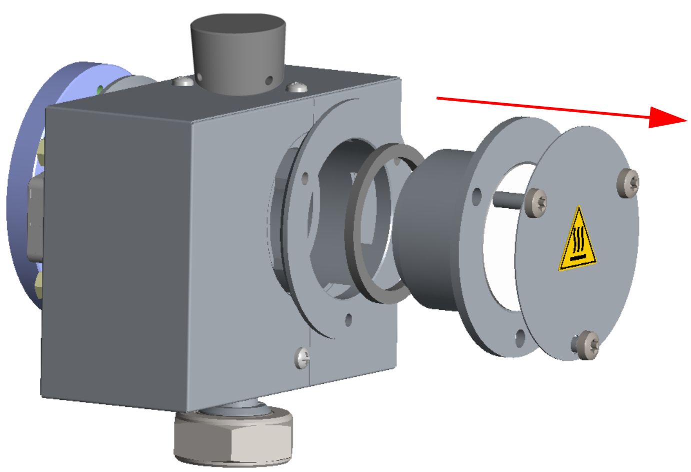


Note Do not lose the aluminum ring inserted between the detector head and the base body.

7. Remove the mirror plug.

   a. Loosen the Allen screws on the mirror plug and remove it. See Figure 285.

Figure 285. FPD Mirror Plug Removal



8. Clean the mirror surface of the plug.

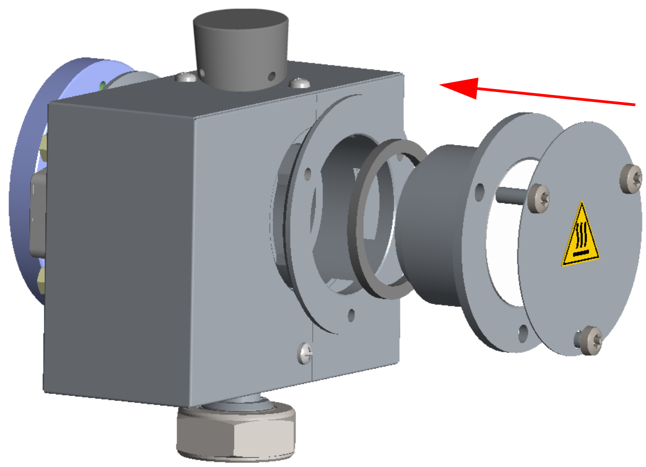
a. Using a clean paper towel, clean the mirror surface of the plug. If necessary, use a solvent as methylene chloride or methanol to remove deposits, and a metal polishing paste to restore it to the previous reflectivity.

9. Remount the mirror plug.

> **Note** Before reinserting the mirror plug, inspect the graphite seal inside the plug's housing. If the seal is damaged and could not ensure tightness, replace it with a new one.

a. Insert the cleaned or a new mirror plug in the detector body and fix it with the relevant Allen screws. See Figure 286.

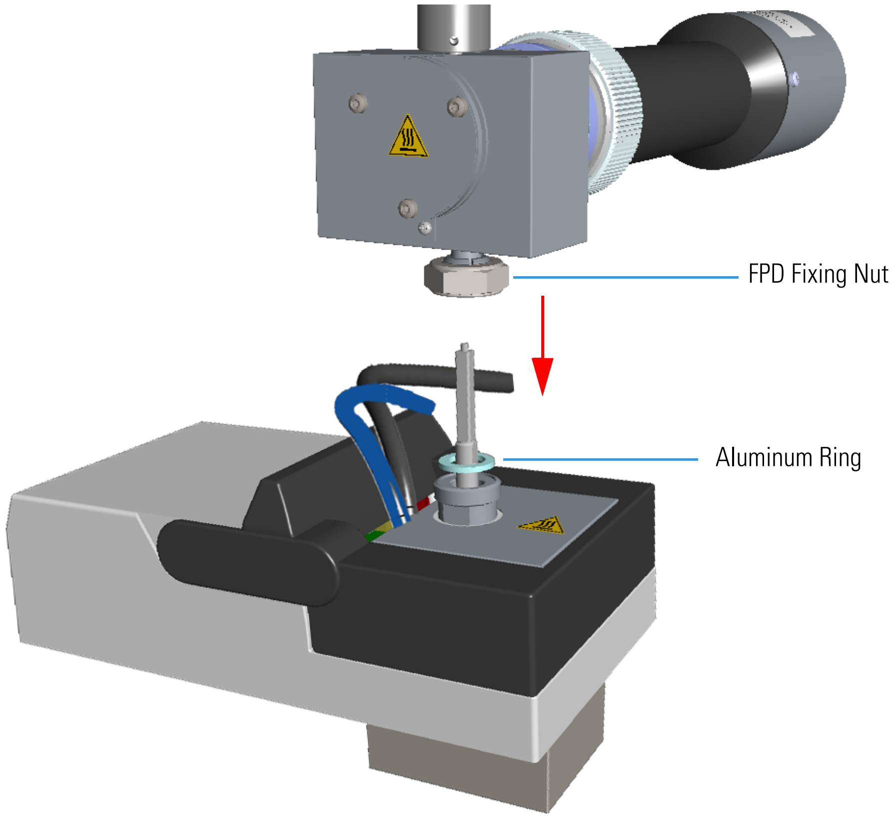
Figure 286. FPD Mirror Plug Remounting



10. Reinstall the FPD detector on the base.

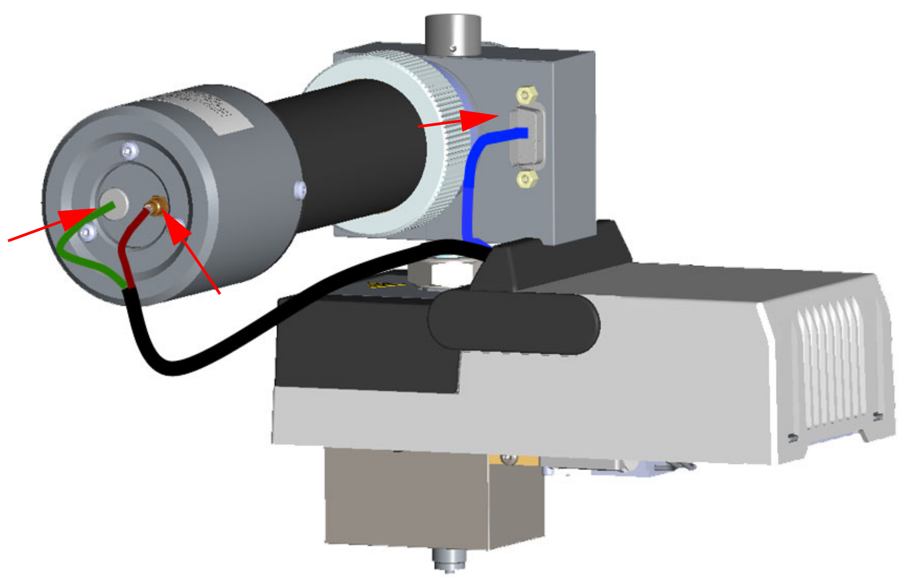
a. Place the detector on its base body, ensuring that the aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 287.

Figure 287. FPD Detector Reinstallation



b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 288.

Figure 288. FPD Cables Connection



11. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

12. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
13. Set the normal working conditions.

Cleaning or Replacing the FPD Filter-side Heat Shields

Before cleaning or replacing the FPD filter-side heat shield, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Materials needed
FPD fixing tools
Paper towels
FPD maintenance kit
Methylene chloride or GC-grade methanol
1 mm Allen wrench
Screwdriver

❖ To clean or replace the FPD filter-side heat shield

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.

   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

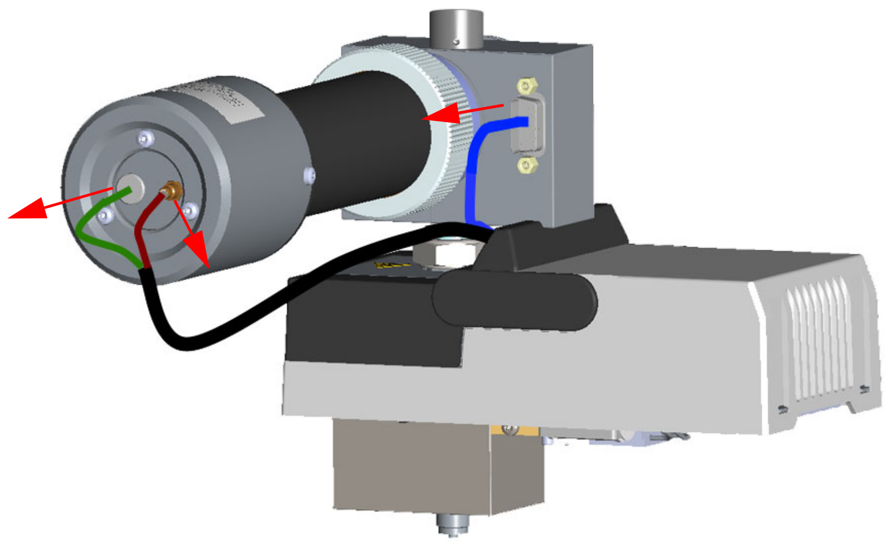
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet

5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

6. Remove the FPD detector from the base.

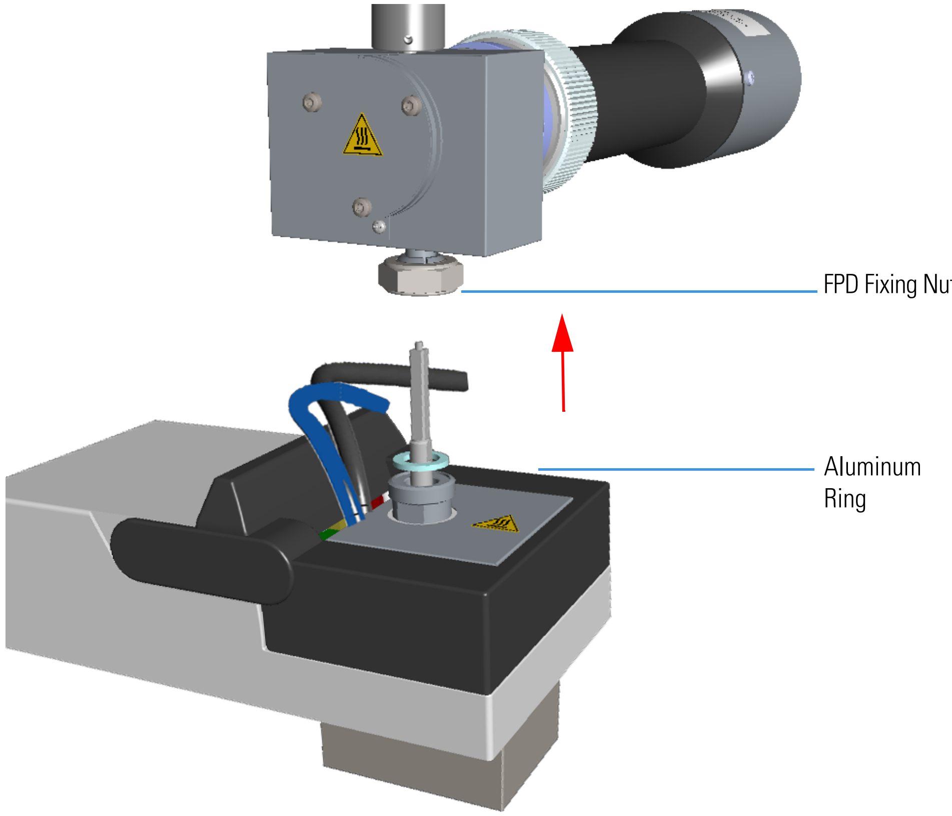
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 289.

   Figure 289. FPD Cables Disconnection

   b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 290.

Figure 290. FPD Detector Removal

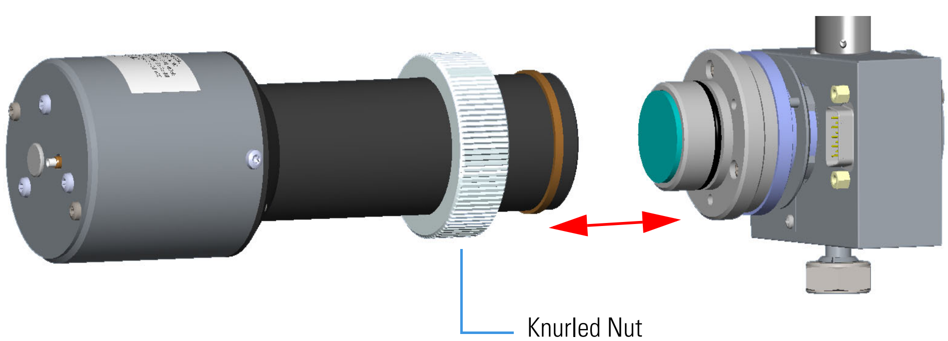


> **Note** Do not lose the Aluminum ring inserted between the detector head and the base body.

7. Remove the photomultiplier assembly and the filter.

   a. Loosen the knurled nut that fixes the photomultiplier assembly and remove it from the detector body. See Figure 291.

   Figure 291. Photomultiplier Assembly Removal

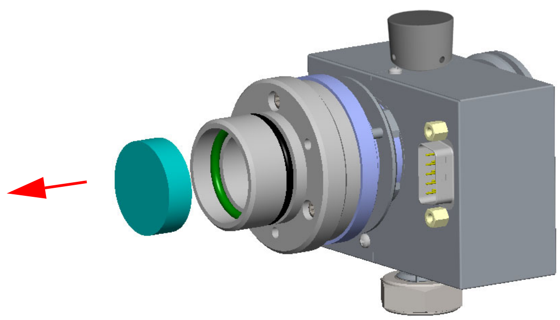
   

CAUTION The photomultiplier tube could damage if exposed to ambient light with the excitation voltage On. Make sure the power supply has been switched off before disconnecting the tube from the detector body.

ATTENTION Le tube photomultiplicateur pourrait être endommagé en cas d’exposition à la lumière ambiante alors que la tension d’excitation est activée. Assurez-vous que l’alimentation a été coupée avant de débrancher le tube du corps du détecteur.

b. Remove the interferential filter from its housing, handling it very gently. Keep it using a clean paper towel. See Figure 292.

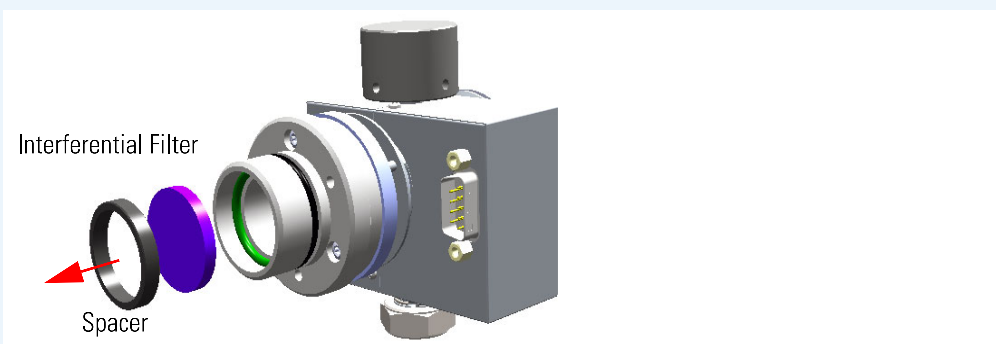
Figure 292. Filter Removal



CAUTION Filters are fragile. Pay attention not to let the filter fall down and damage.

ATTENTION Les filtres sont fragiles. Assurez-vous de ne pas faire tomber et endommager le filtre.

CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first remove the spacer, and then the filter.

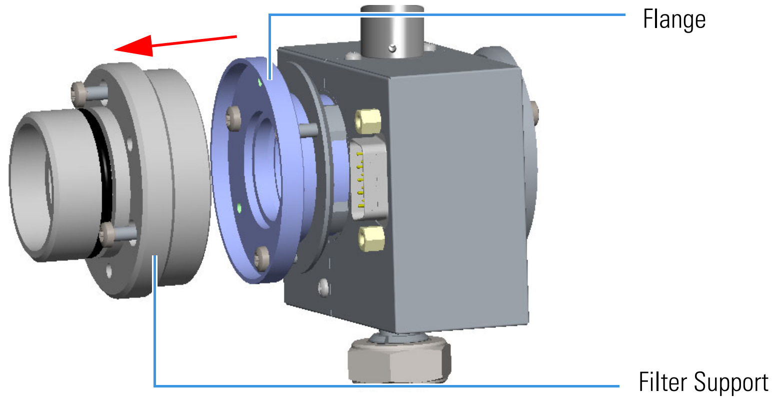


ATTENTION Si le filtre installé est équipé d’un espaceur (voir les kits réf. 19050785 et réf. 19050786), retirez d'abord le filtre, puis l'entretoise.

8. Remove the filter-side heat shield.

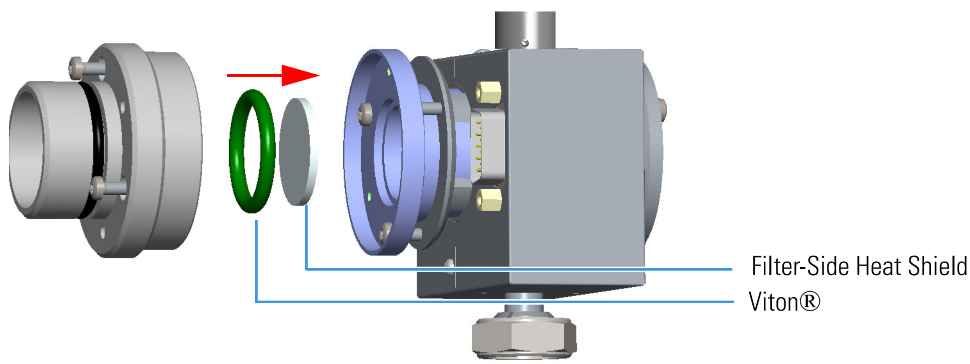
   a. Loosen the three Allen screws that fix the filter support to the flange of the detector body and remove it. See Figure 293.

   Figure 293. Filter-side Heat Shield Removal (1)

   b. Turn down slowly the detector body and let the filter-side heat shield come out from the flange. Pay attention not to lose the O-ring inserted in the filter support.

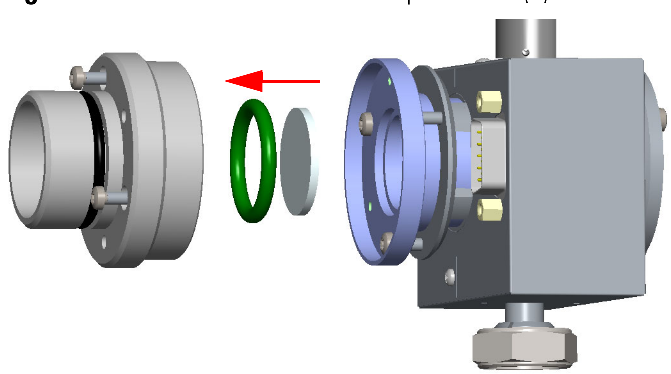
   Figure 294. Filter-side Heat Shield Removal (2)

9. Insert a new filter-side heat shield.

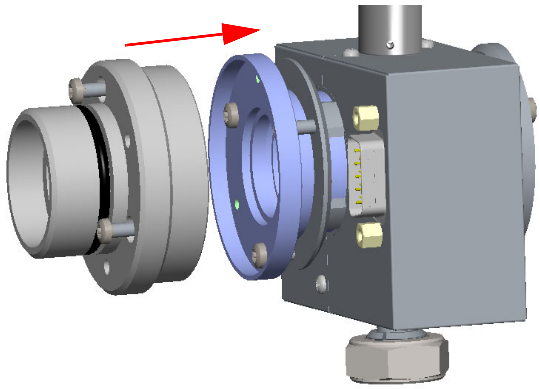
   a. Insert a new filter-side heat shield into its housing inside the filter support. See Figure 295.

   Figure 295. Filter-side Heat Shield Replacement (1)

b. Insert the filter support into the flange and fix it tightening the three Allen screws. Check the O-ring that fixes the heat shield is in place before tightening the screws. See Figure 296.

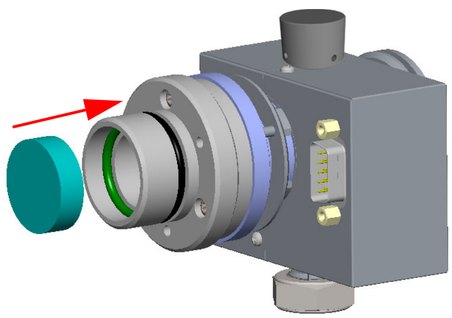
Figure 296. Filter-side Heat Shield Replacement (2)



10. Remount the filter and the photomultiplier assembly.

a. Reinsert the filter into the support. The mirror face must be oriented towards the flame. See Figure 297.

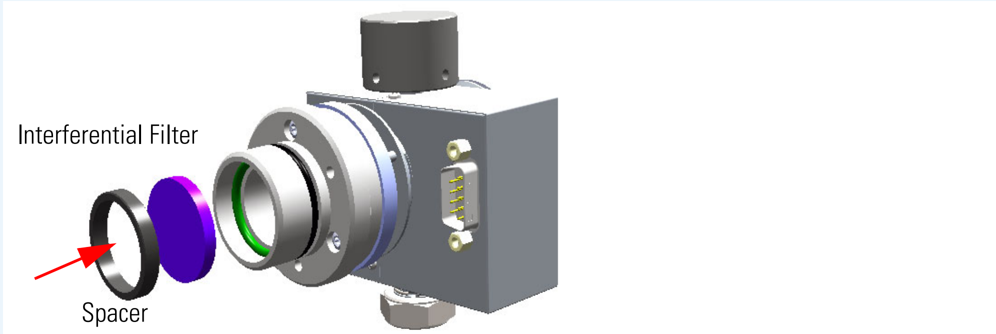
Figure 297. Filter Remounting



CAUTION Avoid touching the filter with your fingers. If you see fingerprints on the filter, clean it using GC-grade methanol and air dry before remounting.

ATTENTION Évitez de toucher le filtre avec vos doigts. Si vous voyez des traces de doigts sur le filtre, nettoyez-le avec du méthanol de qualité GC et séchez-le à l'air avant de le remonter.

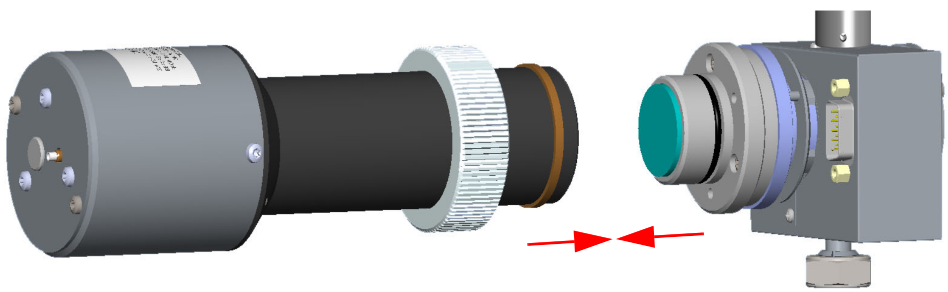
CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first insert the filter, and then the spacer.



ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), insérez d'abord le filtre, puis l'espaceur.

b. Reassembly the photomultiplier assembly and the detector body, then fix them together tightening the knurled nut. See Figure 298.

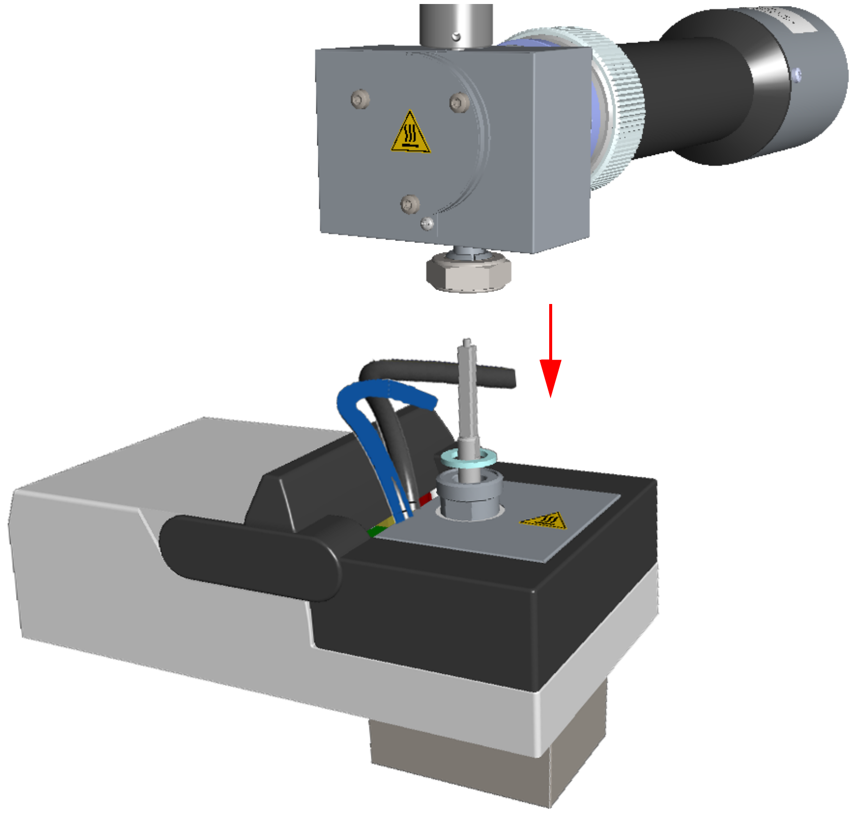
Figure 298. Photomultiplier Assembly Remounting



11. Reinstall the FPD detector on the base.

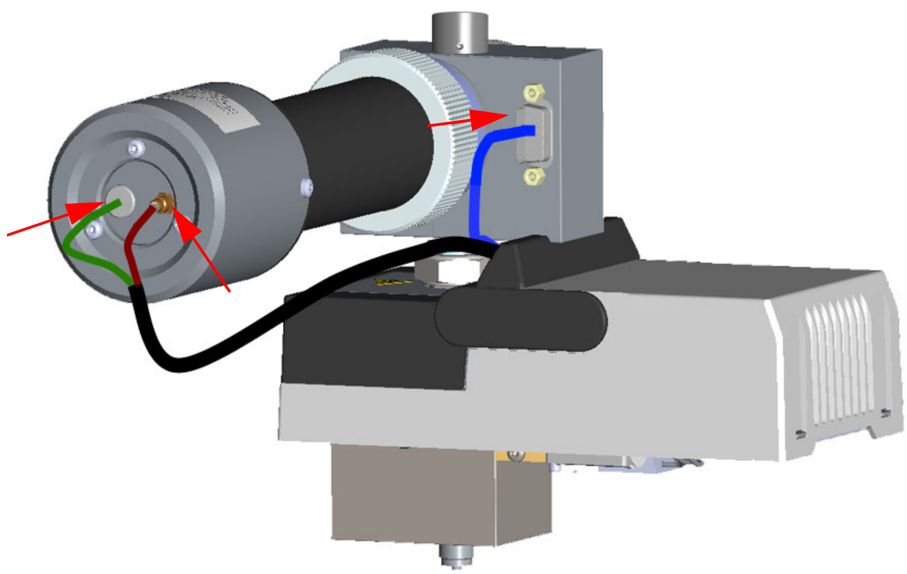
a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 299.

Figure 299. FPD Detector Reinstallation



b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 300.

Figure 300. FPD Cables Connection



12. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

13. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
14. Set the normal working conditions.

Cleaning or Replacing the FPD Flame-side Heat Shields

Before cleaning or replacing the FPD flame-side heat shield, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

CAUTION When handling organic solvents you must take precautions to avoid health hazards.

ATTENTION Pendant la manipulation de solvants organiques, prenez les mesures nécessaires pour éviter tout risque sanitaire.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Materials needed
FPD fixing tools
Paper towels
FPD maintenance kit
Methylene chloride or GC-grade methanol
1-mm Allen wrench
Screwdriver

❖ To clean or replace the FPD flame-side heat shield

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Power off the GC.

   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

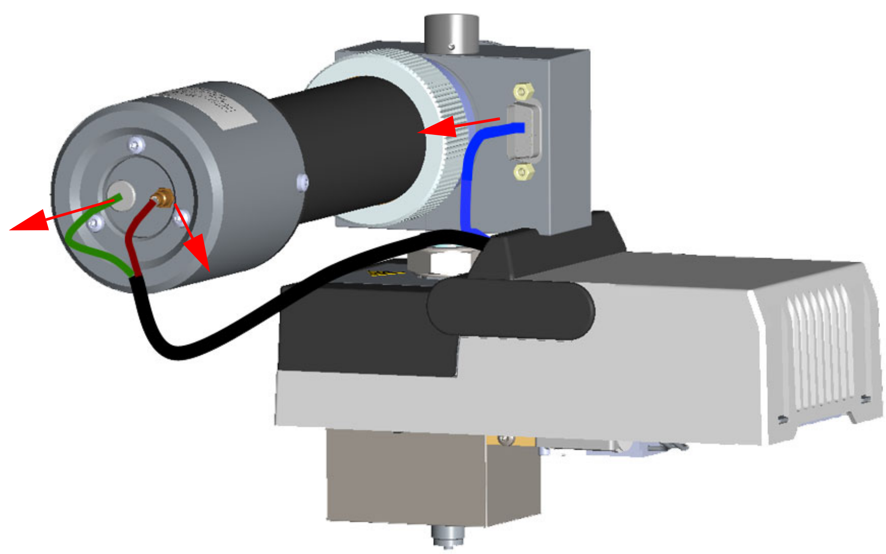
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

6. Remove the FPD detector from the base.

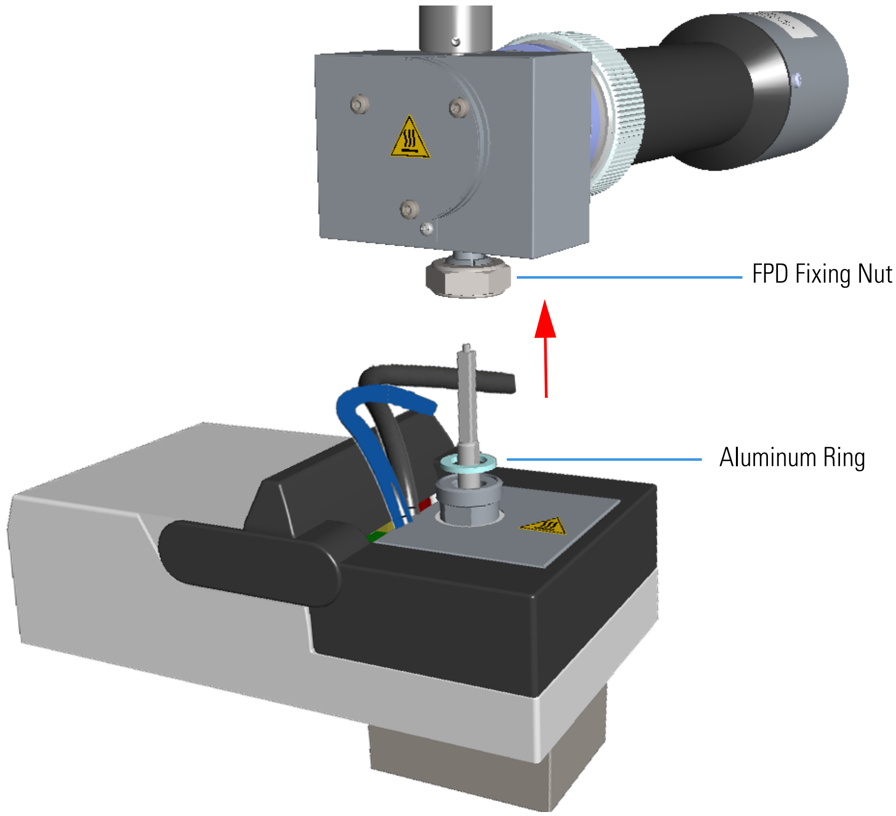
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 301.

   Figure 301. FPD Cable Disconnection

   b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 302.

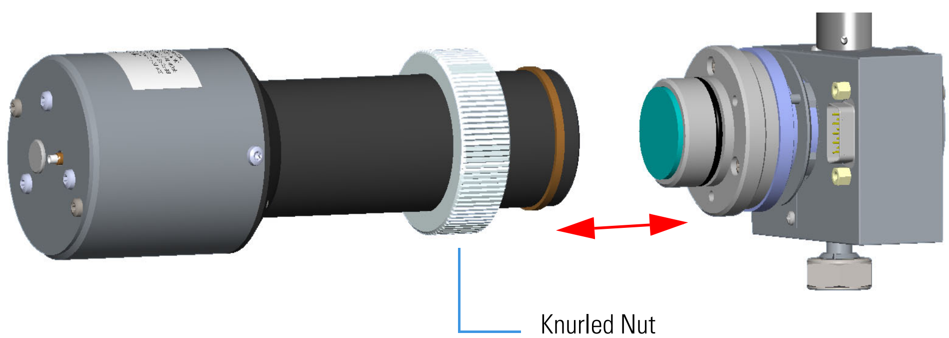
Figure 302. FPD Detector Removal



Note Do not lose the Aluminum ring inserted between the detector head and the base body.

7. Remove the photomultiplier assembly and the filter. See Figure 303.

Figure 303. Photomultiplier Assembly Removal



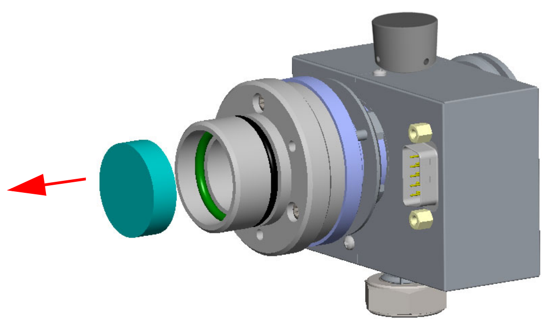
a. Loosen the knurled nut that fixes the photomultiplier assembly and remove it from the detector body.

CAUTION The photomultiplier tube could damage if exposed to ambient light with the excitation voltage On. Make sure the power supply has been switched off before disconnecting the tube from the detector body.

ATTENTION Le tube photomultiplicateur pourrait être endommagé en cas d'exposition à la lumière ambiante alors que la tension d'excitation est activée. Assurez-vous que l'alimentation a été coupée avant de débrancher le tube du corps du détecteur.

b. Remove the interferential filter from its housing, handling it very gently. Keep it using a clean paper towel. See Figure 304.

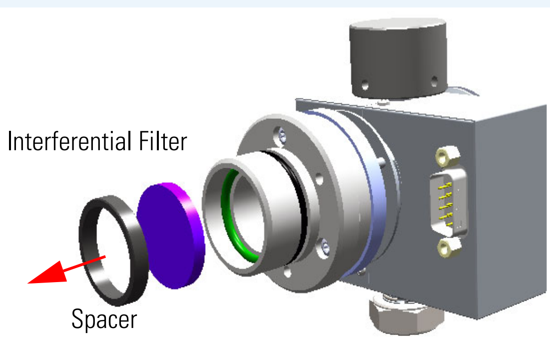
Figure 304. Filter Removal



CAUTION Filters are fragile. Pay attention not to let the filter fall down and damage.

ATTENTION Les filtres sont fragiles. Assurez-vous de ne pas faire tomber et endommager le filtre.

CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first remove the spacer, and then the filter.

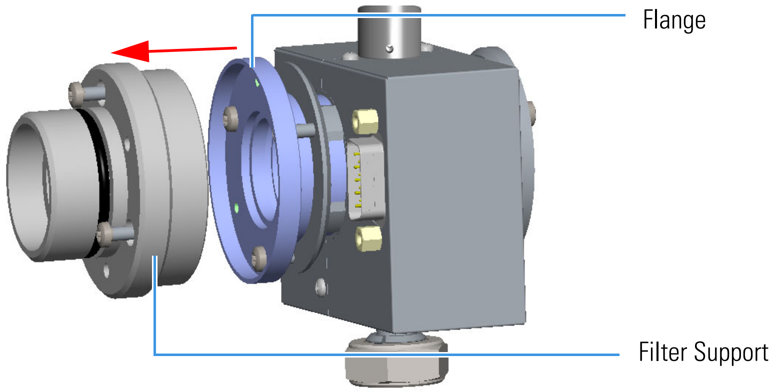


ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), retirez d'abord le filtre, puis l'entretoise.

8. Remove the filter support.

   a. Loosen the three Allen screws that fix the filter support to the flange of the detector body and remove it. See Figure 305.

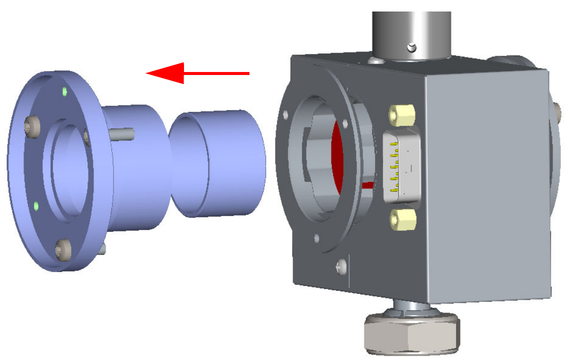
Figure 305. Filter Support Removal



9. Remove the filter-side heat shield.

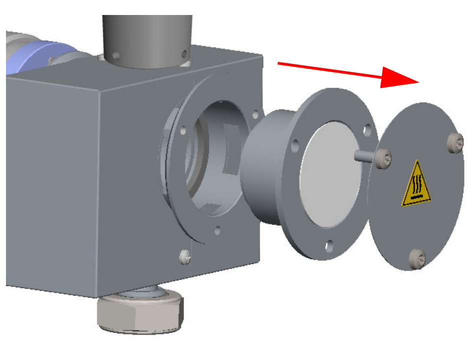
   a. Loosen the three Allen screws that fix the flange to the detector body and remove it with the spacer that should remain inserted in the flange. Now you could access the flame-side heat shield, and the relevant graphite seal. See Figure 306.

Figure 306. Filter-side Heat Shield Removal (1)



   b. Loosen the Allen screws that fix the mirror plug and remove it. See Figure 307.

Figure 307. Mirror Plug Removal

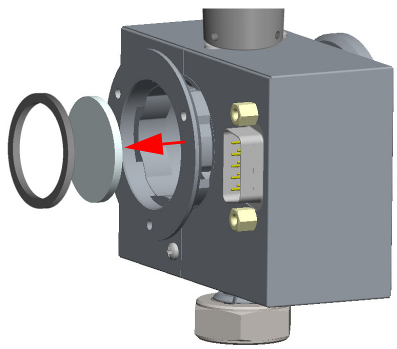


c. Insert the handle of a screwdriver or other un-sharpened tool in the combustion chamber and push the flame-side heat shield and its graphite seal out from its housing. Act gently to avoid breaking of the heat shield. See Figure 308.

CAUTION While pushing out the heat shield, pay attention not to damage the ignition coil.

ATTENTION Pendant l'extraction de l'écran thermique, veillez à ne pas endommager la bobine d'allumage.

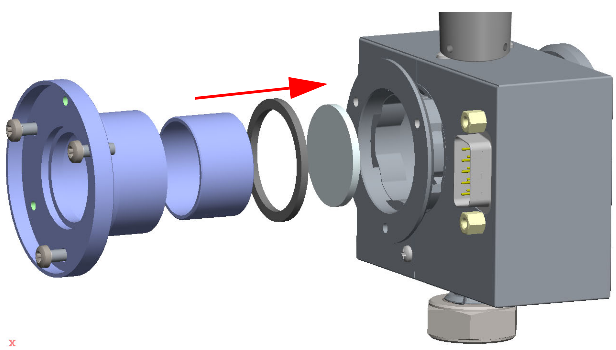
Figure 308. Filter-side Heat Shield Removal (2)



d. Remove with care traces of graphite due to the breaking of the seal.

10. Insert a new filter-side heat shield. See Figure 309.

Figure 309. Filter-side Heat Shield Replacement (1)



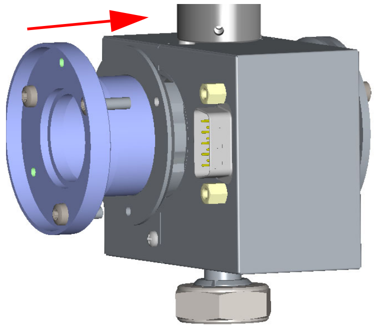
a. Insert a new heat shield into its housing inside the detector body.

b. Insert the spacer into the flange, letting it stand out for about 5 mm.

c. Insert a new graphite seal on the spacer, pushing it slowly until it touches the flange.

d. Insert the flange into the detector body and fix it tightening the three Allen screws. See Figure 310.

Figure 310. Filter-side Heat Shield Replacement (2)

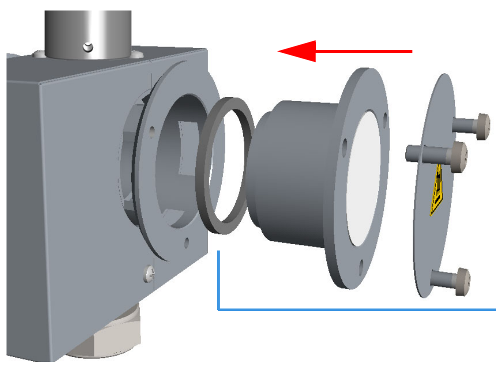


e. Using a clean paper towel, clean the mirror surface of the plug. If necessary, use a solvent as methylene chloride or methanol to remove deposits and a metal polishing paste to restore it to the previous reflectivity.

f. Insert the mirror plug in the detector body and fix it with the relevant Allen screws. See Figure 311.

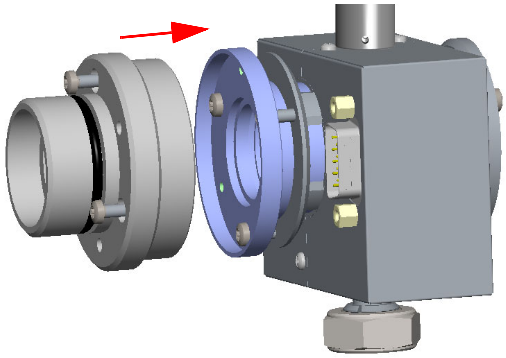
> **Note** Before reinserting the plug, inspect the graphite seal inside the plug's housing. If the seal is damaged and could not ensure tightness, remove it and replace with a new one.

Figure 311. Mirror Plug Reinstallation



g. Insert the filter support into the flange and fix it tightening the three Allen screws. Check the O-ring that fixes the heat shield is in place before tightening the screws. See Figure 312.

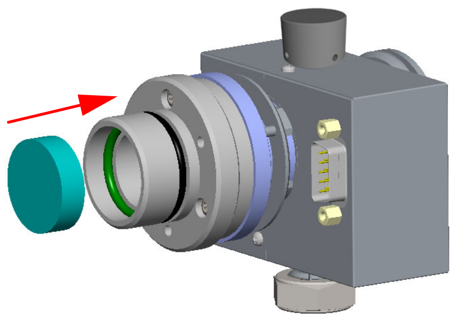
Figure 312. Filter Support Reinstallation



11. Reassembly the filter and the photomultiplier assembly.

    a. Reinsert the filter into the support. The mirror face must be oriented towards the flame. See Figure 313.

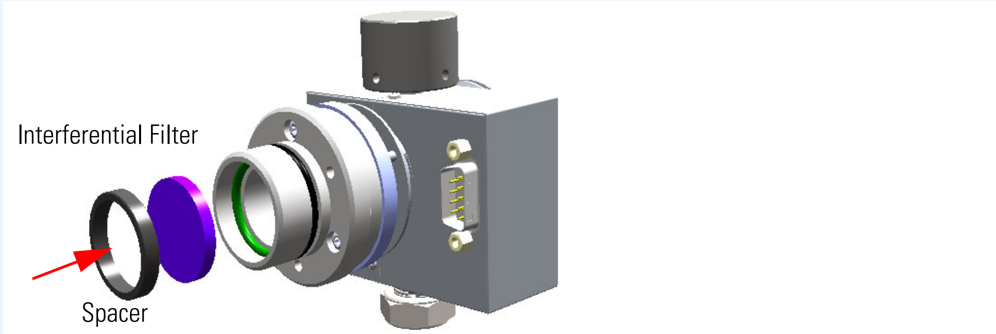
Figure 313. Filter Remounting



CAUTION Avoid touching the filter with your fingers. If you see fingerprints on the filter, clean it using GC-grade methanol and air dry before remounting.

ATTENTION Évitez de toucher le filtre avec vos doigts. Si vous voyez des traces de doigts sur le filtre, nettoyez-le avec du méthanol de qualité GC et séchez-le à l'air avant de le remonter.

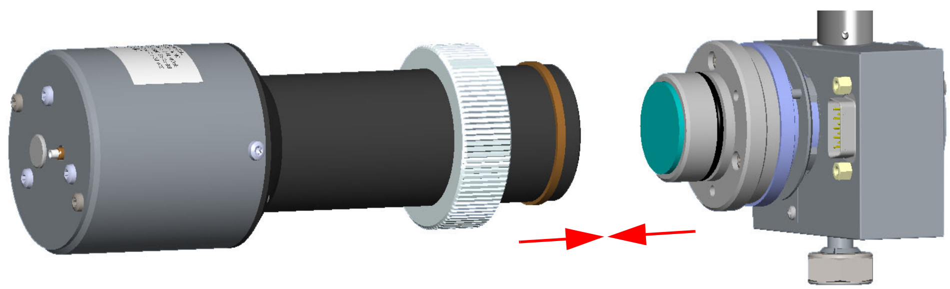
CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first insert the filter, and then the spacer.



ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), insérez d'abord le filtre, puis l'espaceur.

b. Reassembly the photomultiplier assembly and the detector body, then fix them together tightening the knurled nut. See Figure 314.

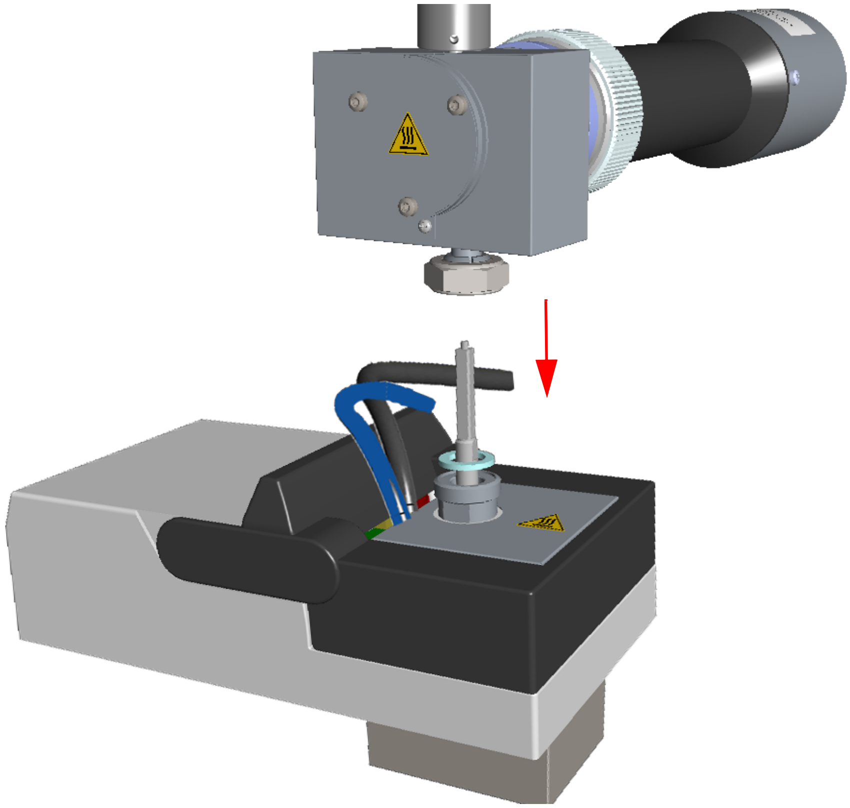
Figure 314. Photomultiplier Assembly Remounting



12. Reinstall the FPD detector on the base.

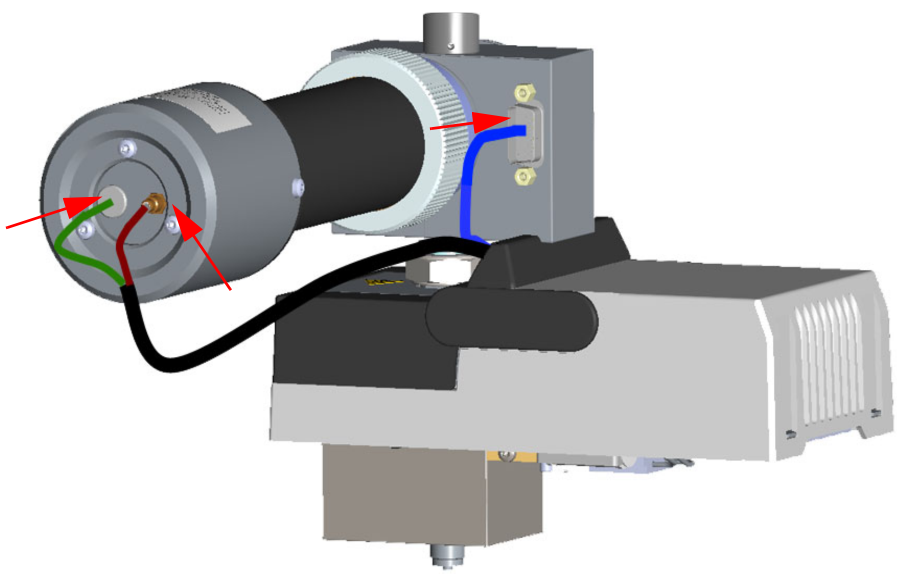
  a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 315.

Figure 315. FPD Detector Reinstallation



b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 316.

Figure 316. FPD Cables Connection



13. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

14. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
15. Set the normal working conditions.

Replacing the FPD Photomultiplier Tube

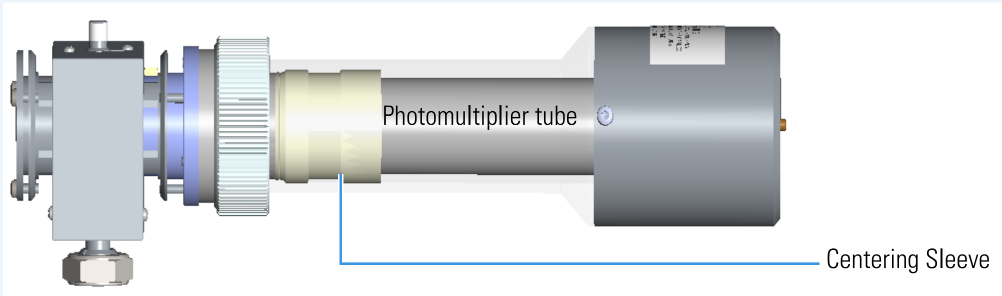
Before replacing the FPD photomultiplier tube, read the following precautions:

WARNING Carry out all the operations at low temperature to avoid burns. Therefore, before beginning maintenance, cool the detector to room temperature.

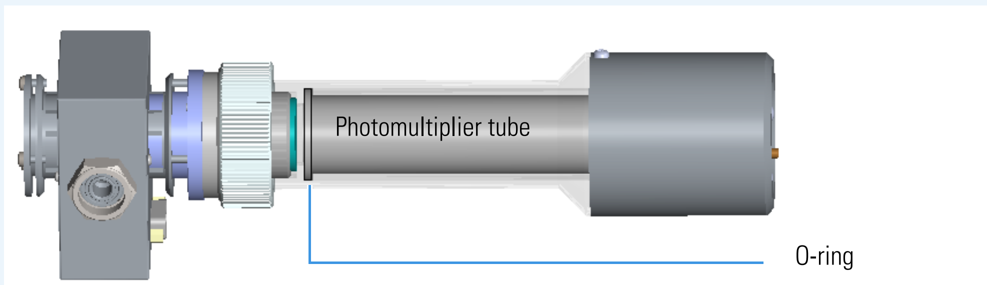
CAUTION The photomultiplier tube must be replaced only when defective.
Wear clean, lint- and powder-free gloves when you handle the photomultiplier tube.

ATTENTION Le tube photomultiplicateur ne doit être remplacé que s’il est défectueux.
Portez des gants propres, non pelucheux et non poudreux pendant la manipulation du tube photomultiplicateur.

IMPORTANT The photomultiplier tube is kept aligned to the interferential filter through the **PMT telescopic centering sleeve assemble**.

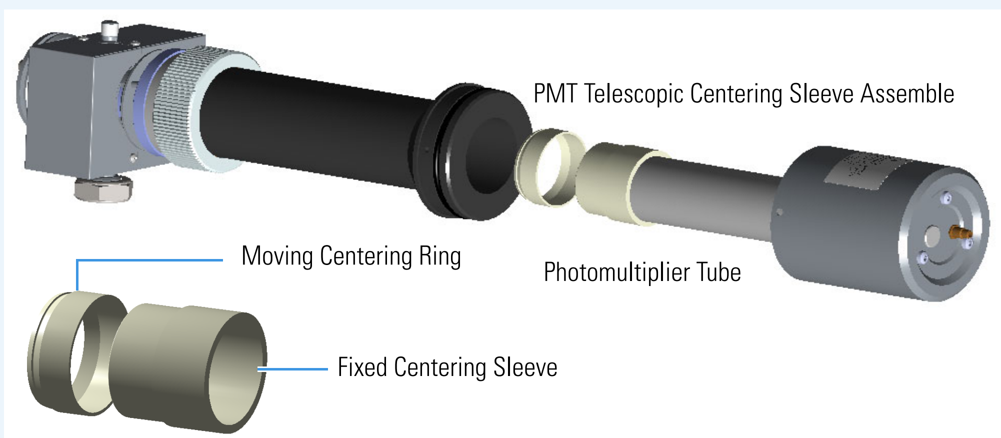


In the previous FPD detector the photomultiplier tube is kept aligned to the interferential filter through an O-ring, now replaced by the PMT telescopic centering sleeve assemble.



The procedure for replacing the photomultiplier tube is valid for both the FPD detector versions.

Note The centering sleeve assembly consists of two pieces as shown in the following figure.



❖ To replace the photomultiplier tube

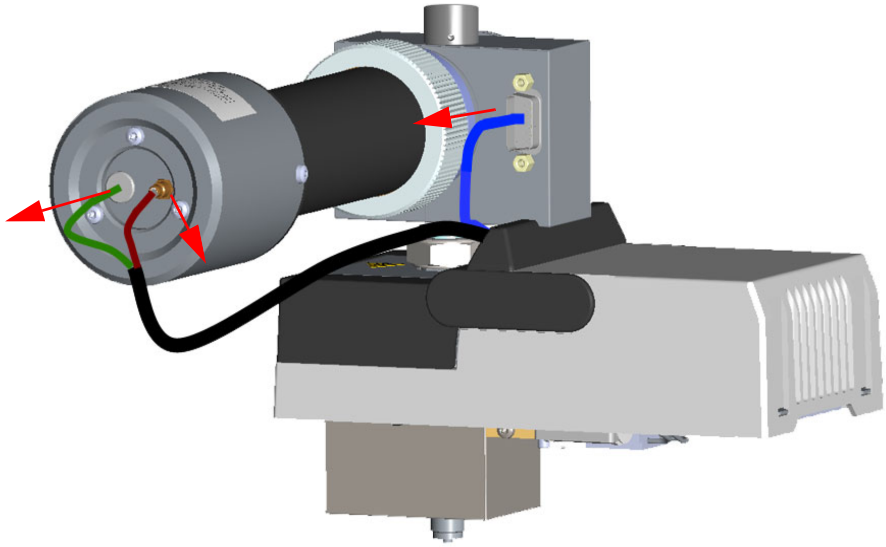
Materials needed
FPD fixing tools
FPD Photomultiplier Tube
1-mm Allen wrench
Cross head screwdriver
Gloves

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

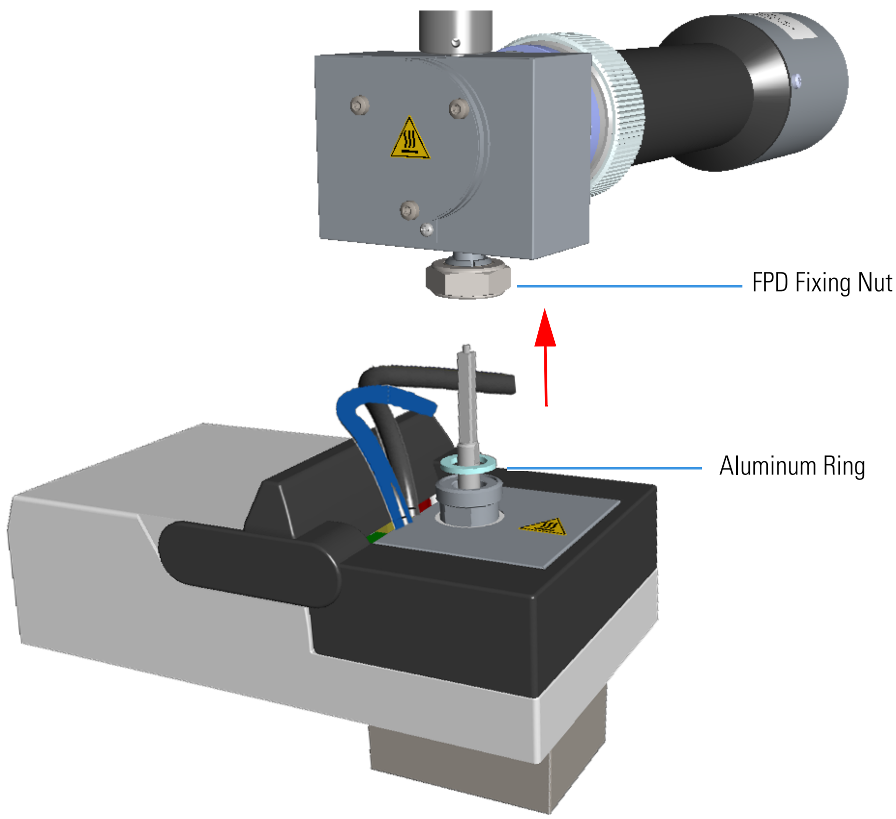
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.
6. Remove the FPD detector from the base.
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 317.

Figure 317. FPD Cable Disconnection



b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 318.

Figure 318. FPD Detector Removal

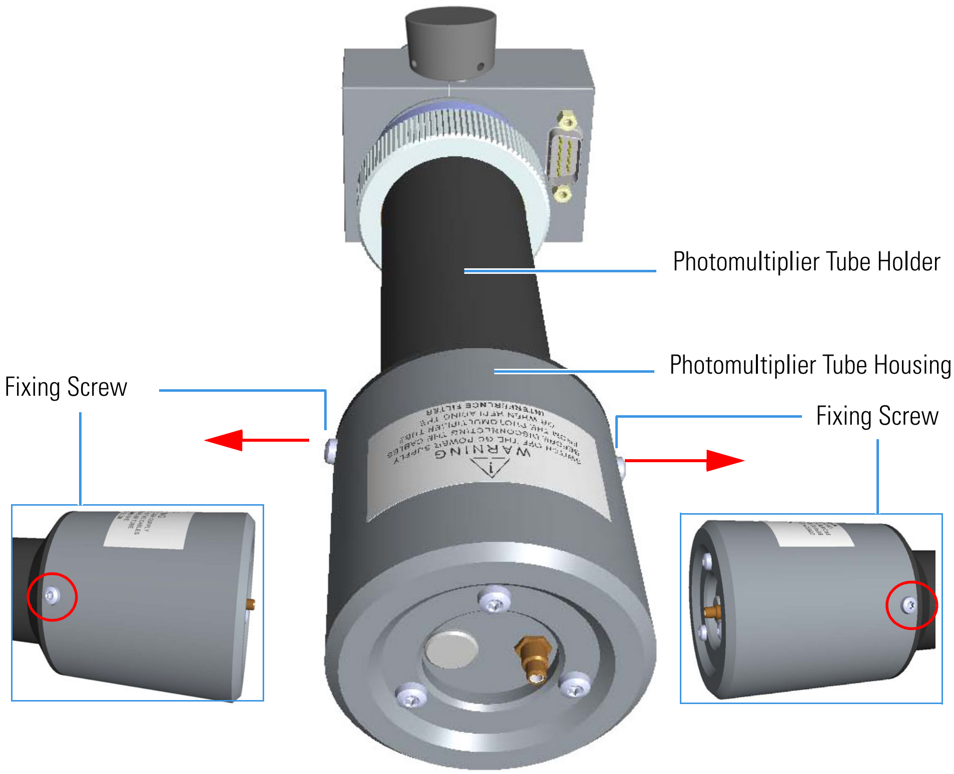


> **Note** Do not lose the Aluminum ring inserted between the detector head and the base body.

7. Dismount the photomultiplier tube assembly.

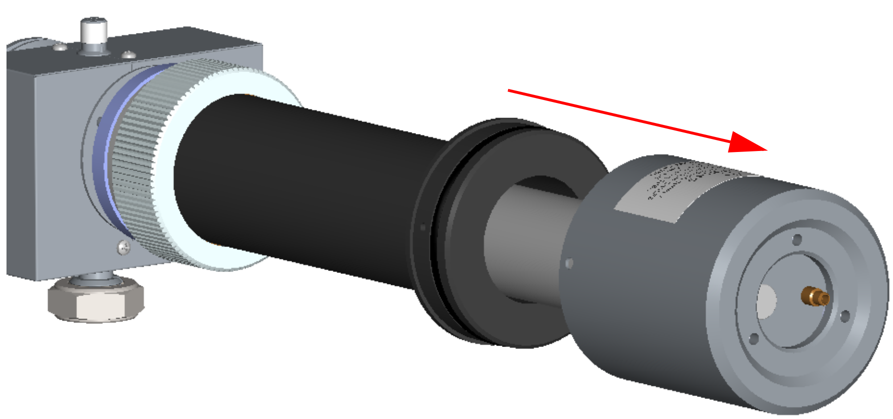
   a. Using a crosshead screwdriver unscrew the two fixing screws that fix the photomultiplier tube housing to the photomultiplier tube holder. See Figure 319.

   Figure 319. Photomultiplier Tube Housing Removal (1)



   b. Remove the photomultiplier tube housing from the photomultiplier tube holder. Holding the photomultiplier tube holder with one hand, use the other hand to pull out the photomultiplier tube housing from the holder. During the extraction inside the holder. See Figure 320.

   Figure 320. Photomultiplier Tube Housing Removal (2)



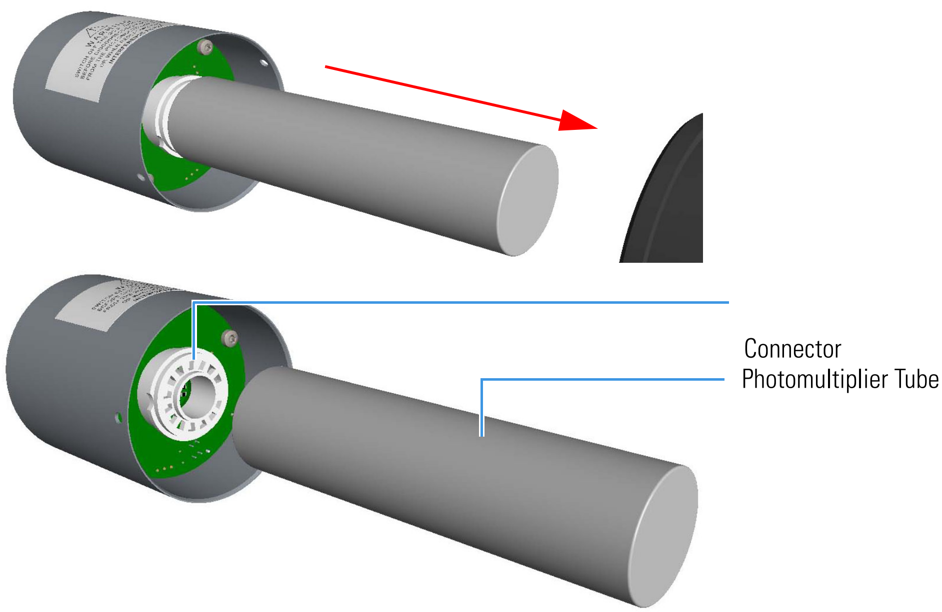
Note During the extraction of the photomultiplier tube from its holder, the PMT telescopic centering sleeve assemble could remain inside the holder or get out of it. In this case, before reinserting the photomultiplier tube into its holder, the PMT telescopic centering sleeve assemble must be correctly repositioned as described at the step 9.

8. Replace the defective photomultiplier tube.

Note Wear clean, lint- and powder-free gloves when you handle the photomultiplier tube and void exposing it to light.

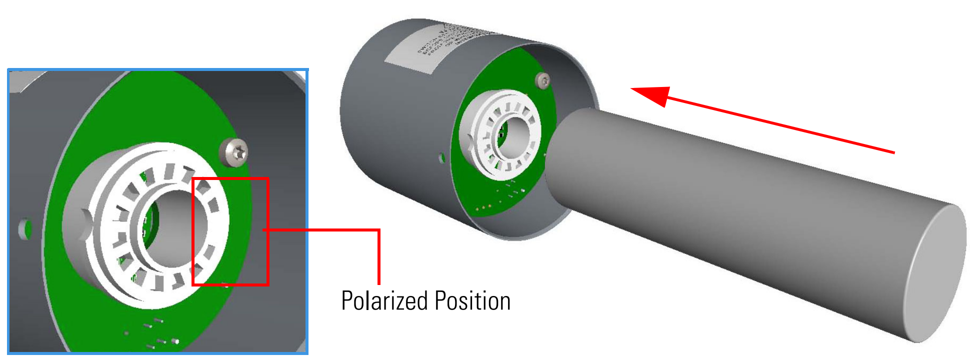
a. Carefully extract the photomultiplier tube from its connector. See Figure 321.

Figure 321. Photomultiplier Tube Replacement (1)



b. Replace the photomultiplier tube with a new one. Make sure to correctly insert the pins of the photomultiplier tube into the connector referring to the polarized position. See Figure 322.

Figure 322. Connector Polarized Position



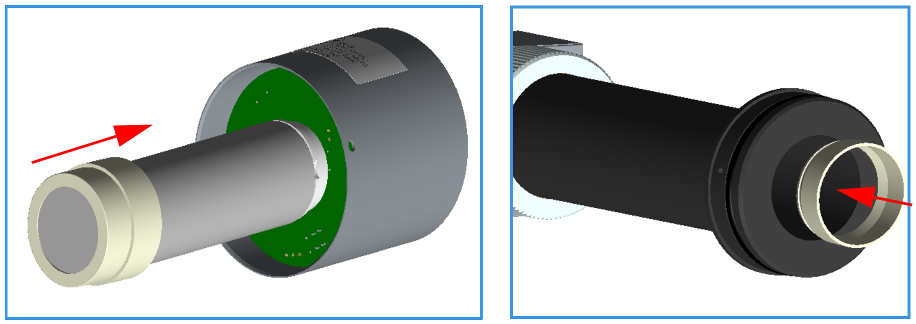
9. Remount the photomultiplier tube assemble.

   a. Check where the PMT telescopic centering sleeve assemble is:

      – if into the photomultiplier tube holder go directly to step b

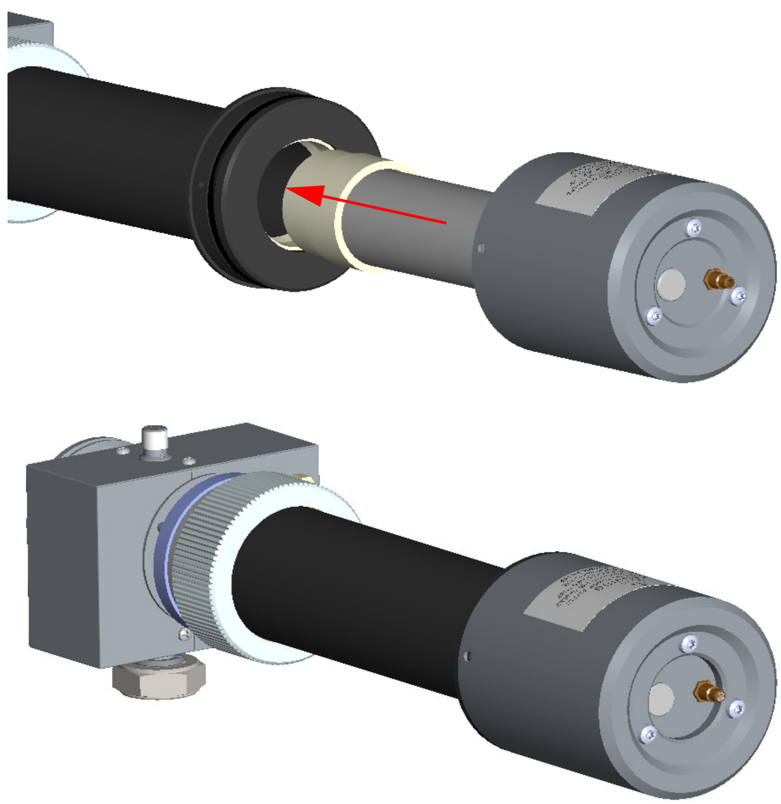
      – if out the photomultiplier tube holder proceed as follow:

      Slide the fixed centering sleeve on the photomultiplier tube, then insert the moving centering ring into the photomultiplier tube holder.



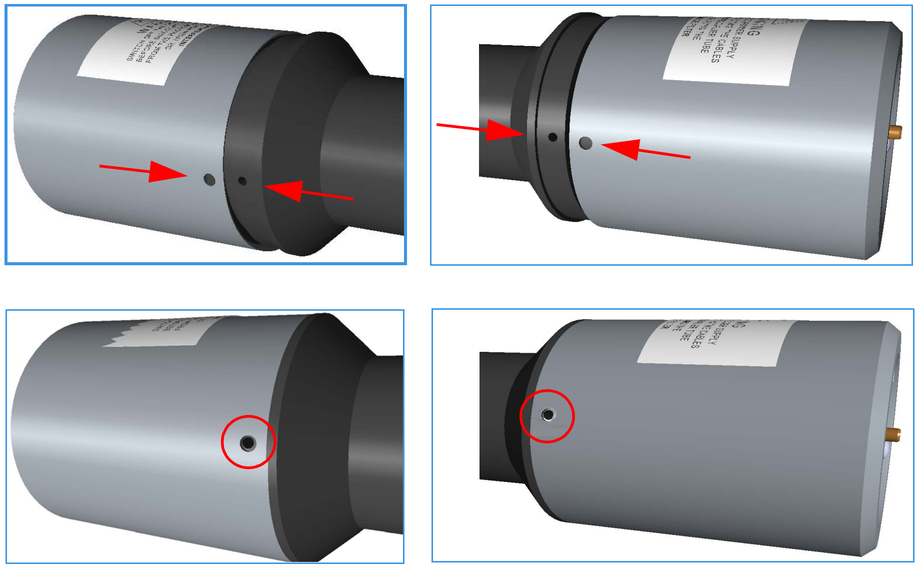
   b. Reinsert the photomultiplier tube housing into the photomultiplier tube holder. Holding the photomultiplier tube holder with one hand, use the other hand to reinsert the photomultiplier tube housing into the holder. See Figure 323.

Figure 323. Photomultiplier Tube Housing Reinstallation (1)



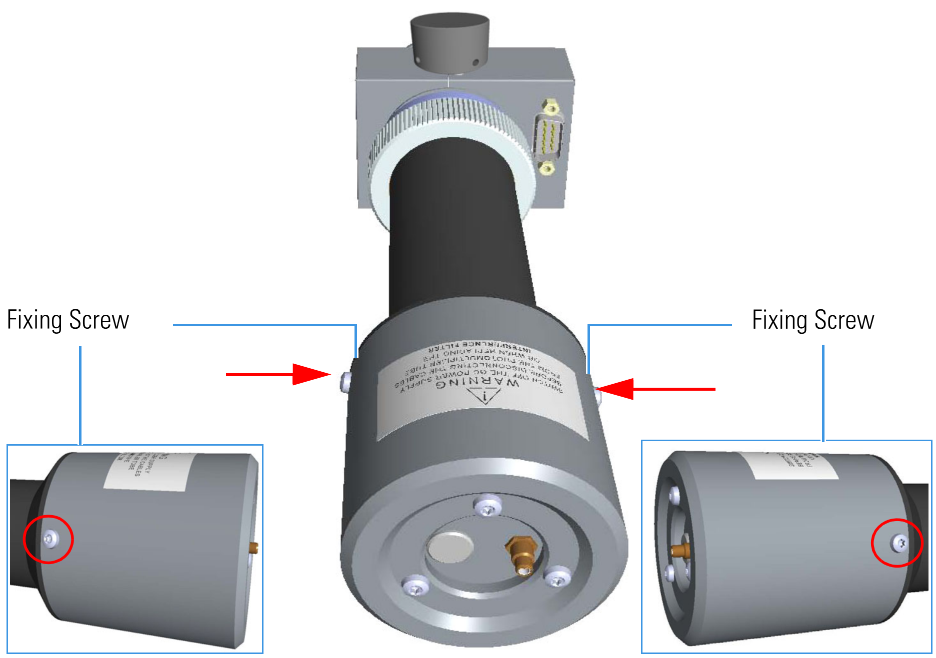
c. Fix the photomultiplier tube housing to the photomultiplier tube holder. Carefully rotate the photomultiplier tube housing up to matching its fixing holes to the fixing holes on the photomultiplier tube holder. See Figure 324.

Figure 324. Photomultiplier Tube Housing Reinstallation (2)



d. Insert the two fixing screws into the corresponding fixing holes, then tighten the screws using a crosshead screwdriver.

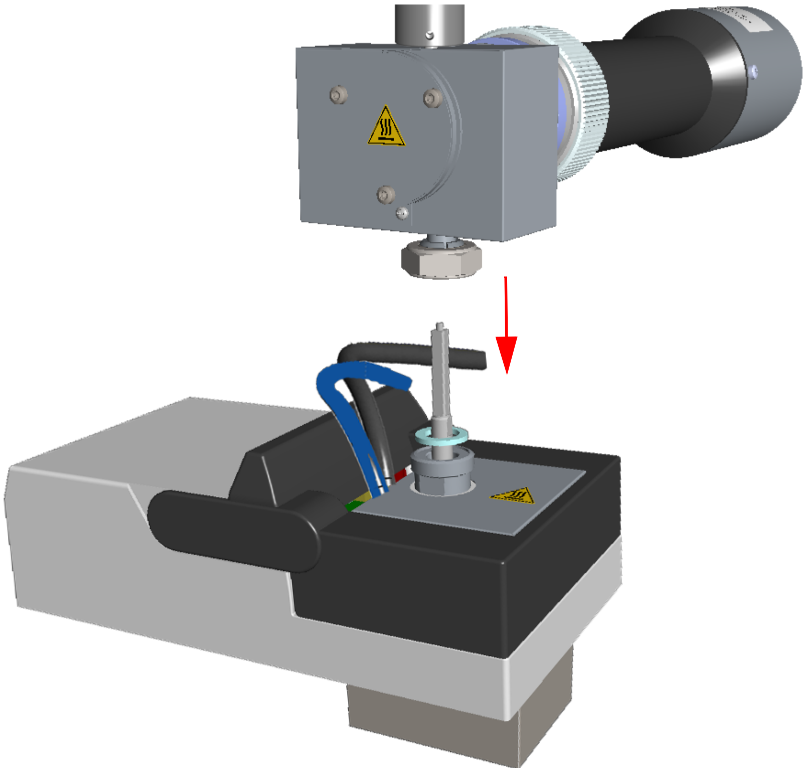
Figure 325. Photomultiplier Tube Housing Reinstallation (3)



10. Reinstall the FPD detector on the base.

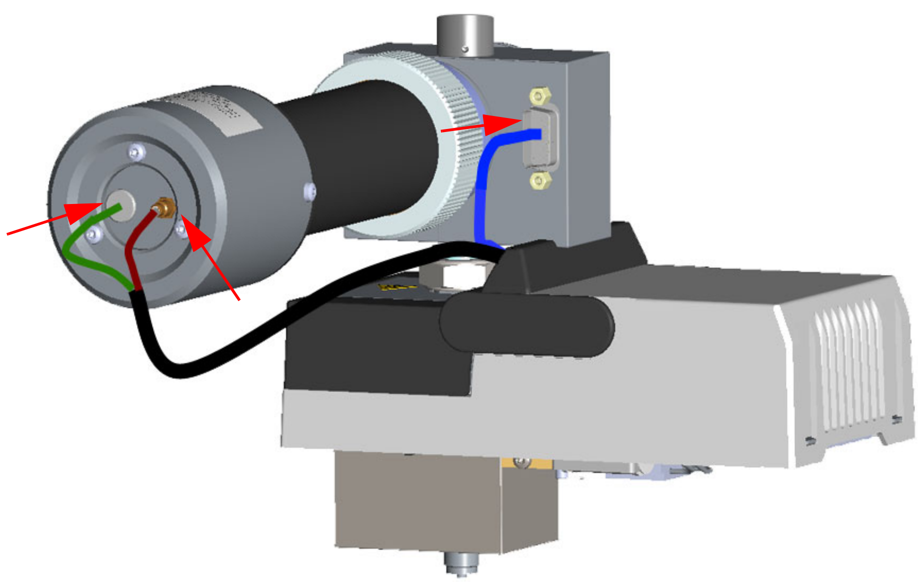
a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut. See Figure 326.

Figure 326. FPD Detector Reinstallation



b. Reconnect the signal, excitation voltage and ignition/heating cables to the detector. See Figure 327.

Figure 327. FPD Cables Connection



11. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

12. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

13. Set the normal working conditions.

8

Installing Optional Kits

This chapter describes how to install the optional kits available for the TRACE 1600/1610. See the *TRACE 1600/1610 Spare Parts Guide* for information about ordering the upgrade kits in this chapter.

Contents

Installing the Helium Saver-H2 Safer Option

The Helium Saver-H_2 Safer option modifies a standard SSL module installed in the front or back injector position and a valve box installed on the back of the GC.

It is necessary to plumb the carrier gas to the valve box on the back of the GC. The valve box is connected to the related tube of the gas net on the back of the GC. Although nitrogen will not be the actual carrier gas for the analytical separation, it will be the carrier gas during the injection, and it is necessary to plumb nitrogen as the carrier gas input.

❖ To install the Instant Connect Helium Saver-H_2 Safer option

1. Cool the heated zones and then shut off all carrier and detector gases on the local GC user interface as well as at the source cylinder.
2. Remove the injector or "dummy module" from the location where the option will be used by loosening the three captive T20 Torx screws.
3. Use a 7/16 in. wrench to plumb the carrier gas line with nitrogen.

   Figure 328. Plumbing the Carrier Gas

4. Using a T20 Torx screwdriver, remove the cover for the B-F Helium Saver-H_2 Safer valve box on the back of the GC. Select the front or back gas line you want to connect and replace the cover using the T20 Torx screwdriver. See Figure 329.

Figure 329. B-F Gas Connection Cover

5. Unscrew and remove the red cap on the gas line to be used. A sticker with **F** (front) and **B** (back) indicates the injector position that will be supplied. See Figure 330.

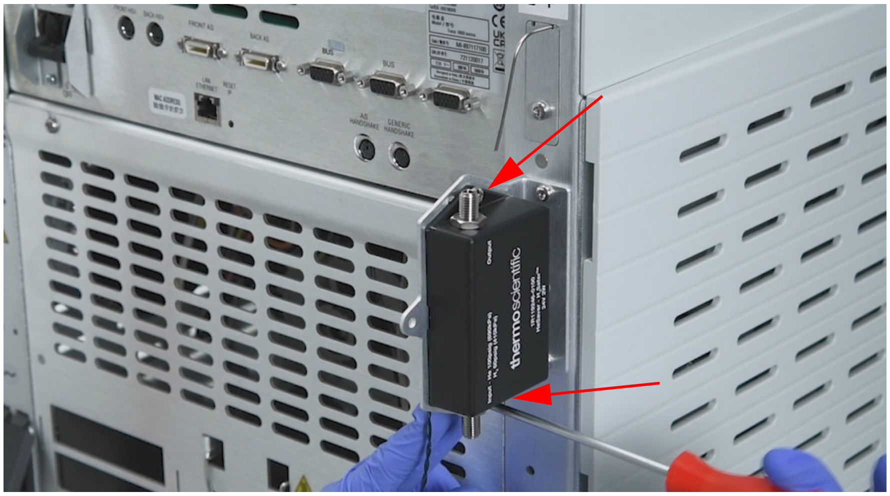
Figure 330. B-F Gas Connections

6. Mount the bracket to the GC using a T20 Torx screwdriver in the two mounting holes. See Figure 331.

Figure 331. Bracket Installation

7. Mount the valve box to the bracket using the available mounting holes. Figure 332.

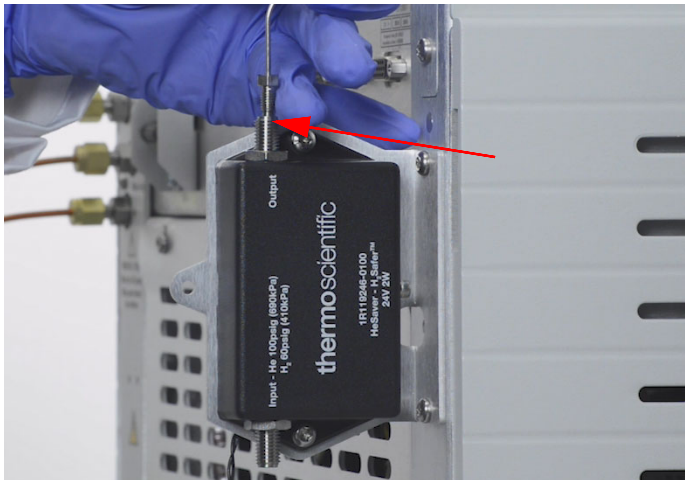
Figure 332. Valve Box Installation (1)



8. Attach the B/F gas line to the **Output** connector located on the top of the valve box.

   Put a nut and ferrule on the gas line and use a 1/4 in. wrench to tighten. Do not overtighten. See Figure 333.

Figure 333. Valve Box Connection (2)



9. Attach the gas input to the **Input** connector located on the bottom of the valve box. Put a nut and ferrule on the gas line and use a 1/4 in. wrench to tighten. Do not overtighten.

10. Plumb with helium or hydrogen using a 1/4 in. wrench. See Figure 334.

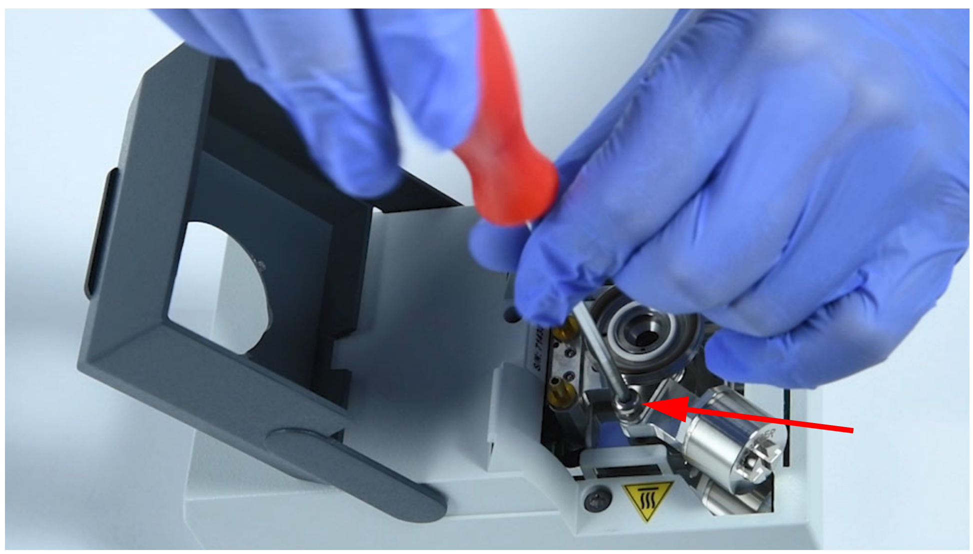
Figure 334. Valve Box Connection (3)

11. Remove the bottom fitting from the injector. See Figure 335.

Figure 335. Removing the Injector Bottom Fitting

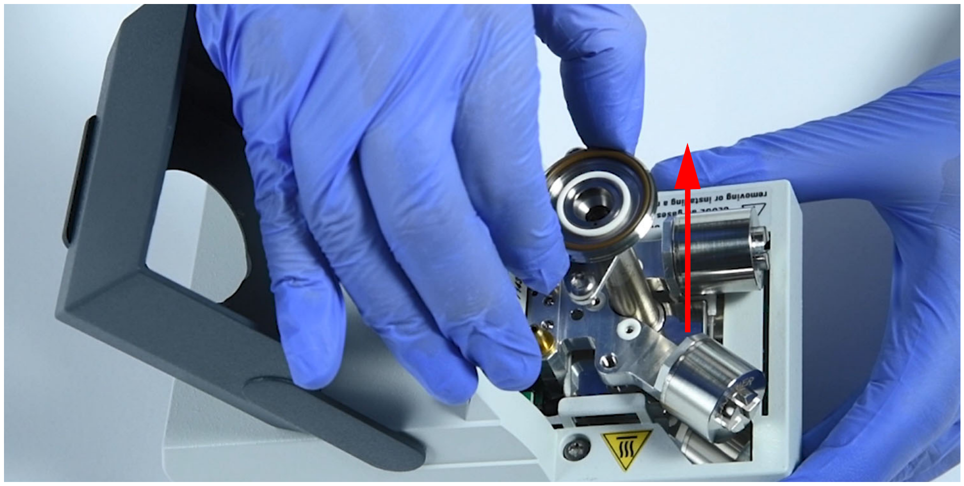
12. Using a T20 Torx screwdriver, remove the two T20 Torx screws on the injector body. See Figure 336.

Figure 336. Removing the T20 Torx Screws on the Injector Body



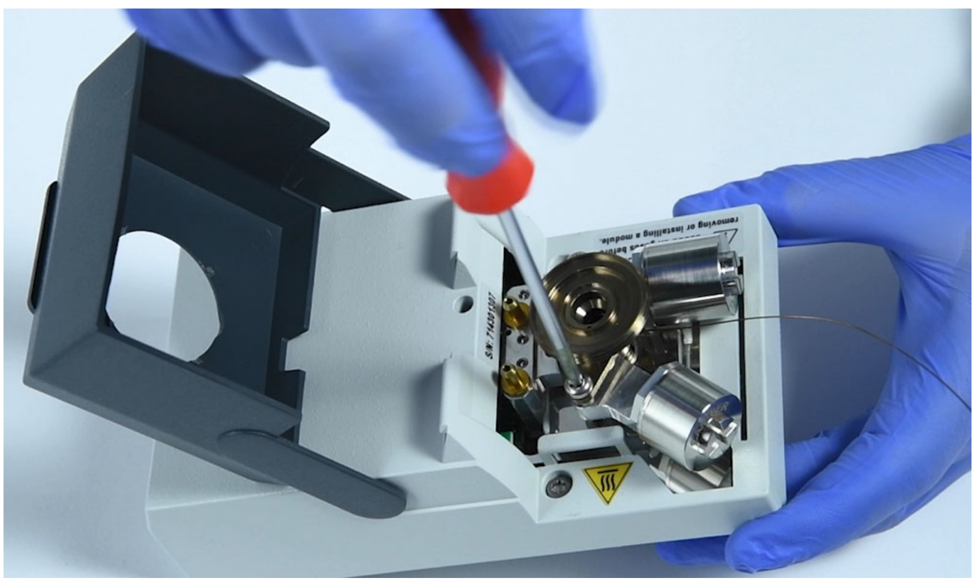
13. Remove the SSL injector body. See Figure 337.

Figure 337. Removing the SSL Injector Body



14. Insert the Helium Saver-H_2 Safer injector body. Secure the two screws using a T20 Torx screwdriver. See Figure 338.

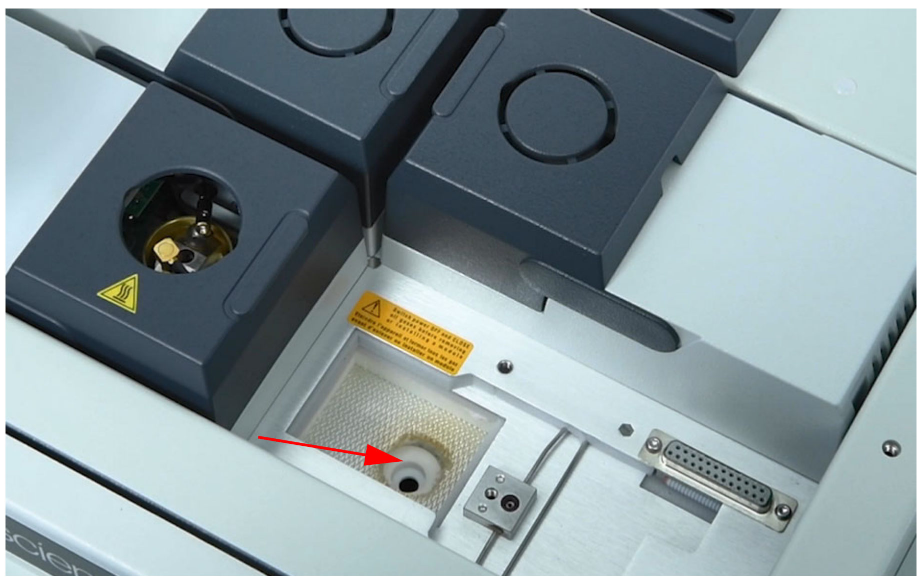
Figure 338. Installing Helium Saver-H_2 Safer Injector Body



15. Install the ceramic washer and seat the module. See Figure 339 and Figure 340.

Figure 339. Installing Ceramic Washer

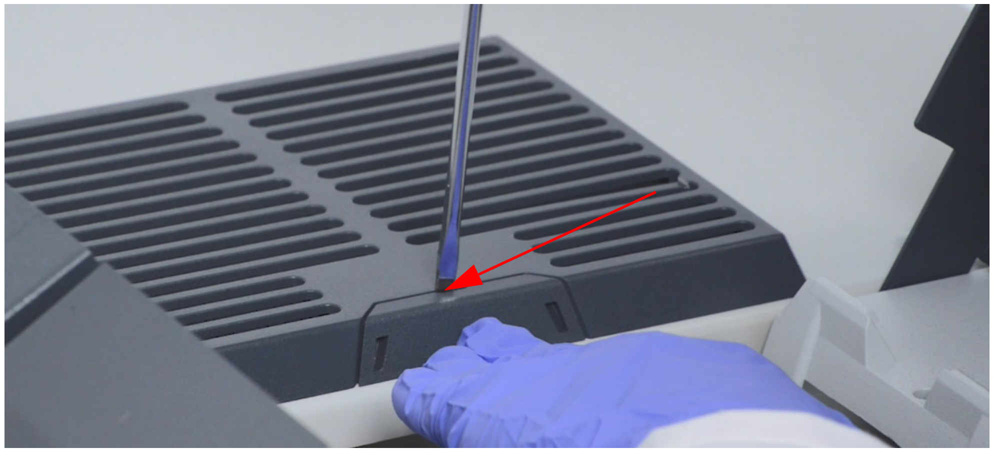
Figure 340. Ceramic Washer Seated



❖ **To connect the Helium Saver-H_2 Safer injector to the gas net fitting.**

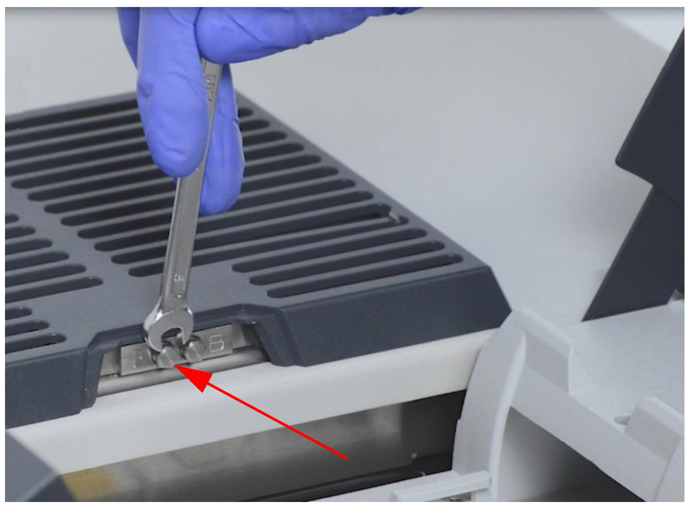
1. Use a flathead screwdriver to remove the gas net cover. See Figure 341.

Figure 341. Gas Net Cover



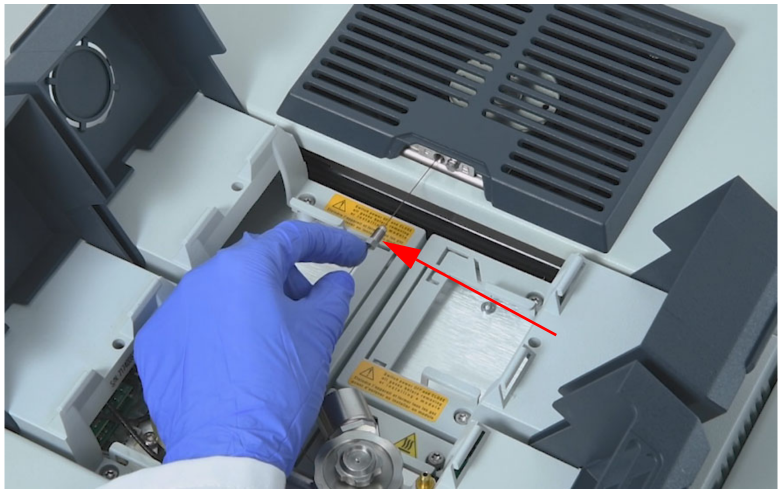
2. Use the 5 mm wrench to remove the blind nut from the gas net manifold.

Figure 342. Gas Net Connection



3. Put the provided gas net nut and O-ring on the Helium Saver-H_2 Safer gas transfer tubing. See Figure 343.

Figure 343. Gas Net Connection



4. Tighten the gas net nut using a 5 mm wrench.

5. Close the module flap covers and ensure the tubing is not obstructed.

6. Plug valve box connector to the **Front HSV** or **Back HSV** connector on the rear of the GC. See Figure 344.

Figure 344. HSV Connection

7. Open the gas supplies, and power on GC.

Column Installation

The Instant Connect Helium Saver-H_2 Safer option is designed to be used with Silflow™ metallic ferrules. This allows for very accurate trimming of the column following compression of the ferrule onto the column. It is important that only 5 mm of column protrudes past the tip of the ferrule for proper operation.

The inlet has been designed to work optimally with 0.25 mm (ID) columns, although larger (up to 0.32 mm (ID)) or narrower inside diameters can be used successfully. Insert the column through the SilFlow™ nut and ferrule.

The standard outfit option is equipped with SilFlow ferrules with 0.50 mm, 0.40 mm, and 0.35 mm internal diameters.

Column ID (mm)	Ferrule (mm)
0.25	0.35 or 0.40
0.32	0.50

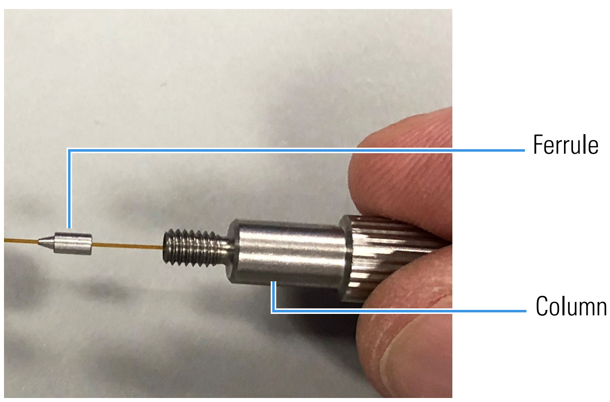
The following are replacement Thermo Scientific part numbers:

- 0.50 mm ferrule **10/pk** 29063467 (For 0.32 columns)
- 0.40 mm ferrule **10/pk** 29063466
  (For 0.25 columns and smaller on the high end of the o.d. tolerance)
- 0.35 mm ferrule **10/pk** 29063465
  (For 0.25 columns and smaller on the low end of the o.d. tolerance)

❖ To prepare the tubing and install the column

1. Position the column nut and ferrule onto the tubing, as shown in Figure 345.

   Figure 345. Installing the Column Nut and Ferrule

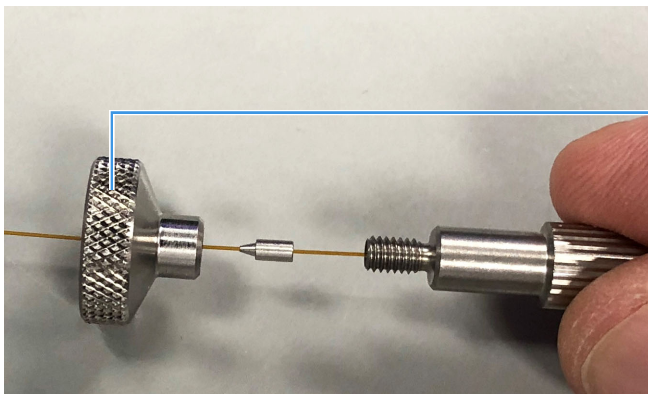
2. Use a scoring wafer to cut the tubing after inserting it through the ferrule. See Figure 346. Then use the pre-swage tool to secure the ferrule into position.

   When done correctly, the tubing will extend slightly past the tip of the ferrule. It is important to use the pre-swage tool to prevent crushing the tip of the fused silica.

Figure 346. Cutting the Tubing with the Scoring Wafer

3. Place the fused silica and ferrule into the pre-swage tool and rotate the column nut until you feel it start to bottom against the ferrule.

Figure 347. Installing the Column Nut and Ferrule

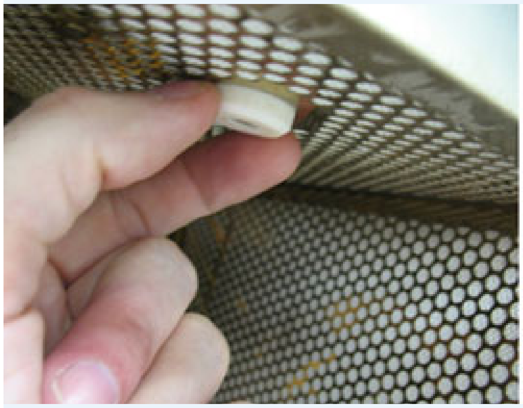


4. Use the tool to swage the ferrule to the tubing. Be sure to keep the tip of the fused silica bottomed out in the pre-swage tool.

5. Pull the fused silica back until it is even with the bottom of the pre-swage tool then hand tighten the nut. Remove the pre-swaged ferrule and column. If necessary, a thumb tack may be used to displace the ferrule to one side. Shifting the ferrule slightly will allow easy removal. The column should extend 5 mm, ±1 mm from the tip of the ferrule, in order to sit in the proper place of the back diffusion barrier.

6. The column should be fully captured by the ferrule without being able to slide it up or down. At this point, remove the nut and ferrule assembly and confirm the column will not slide in the ferrule. Trim the column such that only 5 mm extends past the tip of the ferrule. Carefully reinstall the column and again tighten the ferrule. The column is now installed in the injector.

Tip When installing the column, nut and ferrule, lift up slightly on the ceramic insulator surrounding the base of the injector insert as shown in figure. This will expose the end of the insert and make it easier to locate the column in the central hole. After the final trimming and installation of the column, make sure to pull the insulator back to its lowest position.



Tip An indispensable tool for removal of the column from the inlet is a scaler, tack, or push pin. When the SilFlow ferrule engages the inlet on tightening, it is slightly deformed at the tip in order for the sealing to occur. This causes the ferrule to become "stuck," which is a normal occurrence.

The ferrule can be removed by inserting the pointed tip of the scaler or tack gently along the side of the ferrule and pressing vertically to cause the ferrule to be displaced to the side. Gently pulling on the column at the same time will dislodge the ferrule.

Using the Helium Saver-H2 Safer with a Standalone TCD Detector

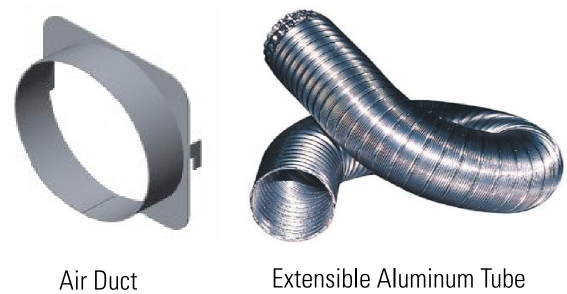
A TCD detector gets its reference gas from the gas net carrier line, and the pressurization gas now uses the Helium Saver-H_2 Safer carrier line. Install the TCD detector opposite where the Helium Saver-H_2 Safer is located. For example, install the TCD in the back detector position if the Helium Saver-H_2 Safer occupies the front injector of the GC. Doing this allows the other gas net carrier line to supply the proper gas to the TCD.

Installing the Oven Exhaust Kit

The oven vents at the back of the GC discharge hot air up to 450 °C (842 °F) during cooling. Installing the optional Oven Exhaust Kit (PN 19050760), the hot air from the oven vents can be carried away to a fume hood or other exhausting devices.

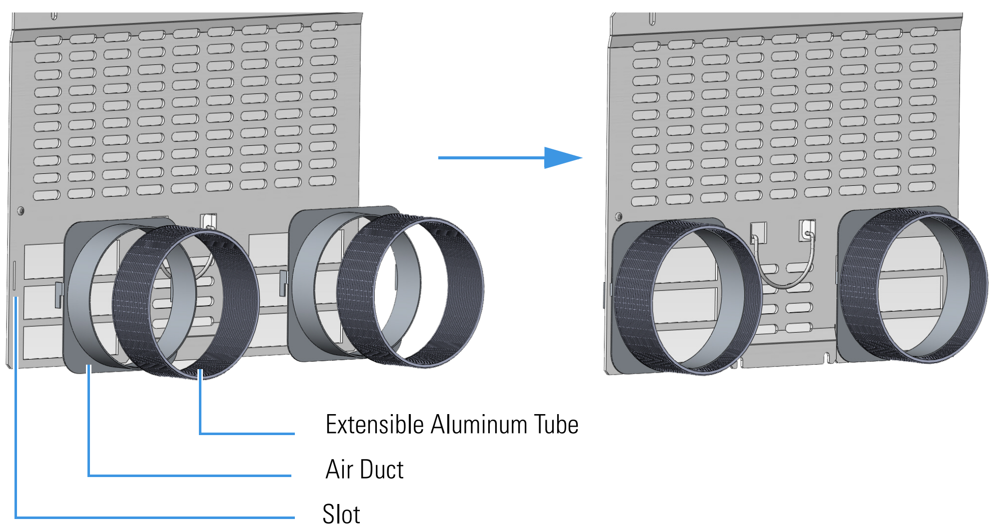
The kit includes two air ducts and two 3-m length extensible Aluminum tubes. See Figure 348.

Figure 348. Air Duct and Extensible Aluminum Tube



❖ **To install the oven exhaust kit**

1. Put the GC in standby condition.
2. Cool the oven to room temperature.
3. Place each air duct on the oven vent inserting the hooks of the air duct into the relevant vertical slots provided on the GC back panel.
4. Place an end of each extensible Aluminum tube on each air duct.
5. Connect the other end of the extensible Aluminum tube to an exhausting device.



6. Set the normal GC working conditions.

Installing the Merlin Microseal High Pressure Valve Kit

This section provides instructions for installing the Merlin Microseal™ High Pressure Valve kit (PN 19050735) on the SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF injectors.

Note Merlin Microseal™ is a trademark of the Merlin Instrument Company.

Introduction

The Merlin Microseal™ High Pressure Valve is a long-life replacement for the standard septum on the SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF injectors of the TRACE 1600/1610. High pressure capability allows operation from 15 to 700 kPa (2 - 100 psi). A top wiper rib improves resistance to particulate contamination. The valve can be taken apart for cleaning. High resistance to wear greatly reduces the shedding of valve particles into the injection port liner. This eliminates a major source of septum bleed and ghost peaks in the chromatogram. Longer life reduces the chances of valve leaks occurring during extended automated runs. The low syringe insertion force makes manual injections easier.
The Microseal High Pressure valve requires a 0.63-mm diameter (0.025-in.) blunt tip syringe.

Syringe Compatibility — The Microseal valve should be used only with a blunt-tipped 0.63-mm diameter (0.025-in.; 23 gauge) syringe needle.

- A needle with too small a diameter, such as a 0.43-mm diameter (0.017-in.; 23 gauge) needle, will not seal properly.
- A needle with too large a diameter will overstretch and damage the O-ring and duckbill seals.
- A sharp-pointed or sharp-edged syringe needle will slice or pierce the seals.

Temperature and Pressure Limits — The operating temperature of the valve is lower than the injection port temperature set point. For long term operation (> 6 months) use the following limits for operating conditions:

- Injection port temperature < 350 °C; Pressure range: 15 - 700 kPa (2 - 100 psi)

Higher temperatures and pressures result in shorter lifetime. High temperature deterioration can be recognized by leaks caused by stiffening and cracking of the Microseal valve, particularly around the sealing flange.

Getting Started

Install the Microseal High Pressure Valve on the SSL, SSLBKF, HeS-S/SL, PTV, and PTVBKF injector following the instructions in the next operating procedures.

- "To install the Merlin Microseal Valve kit on the SSL/SSLBKF and HeS-S/SL injector" on page 364
- "To install the Merlin Microseal Valve kit on the PTV/PTVBKF injector" on page 365

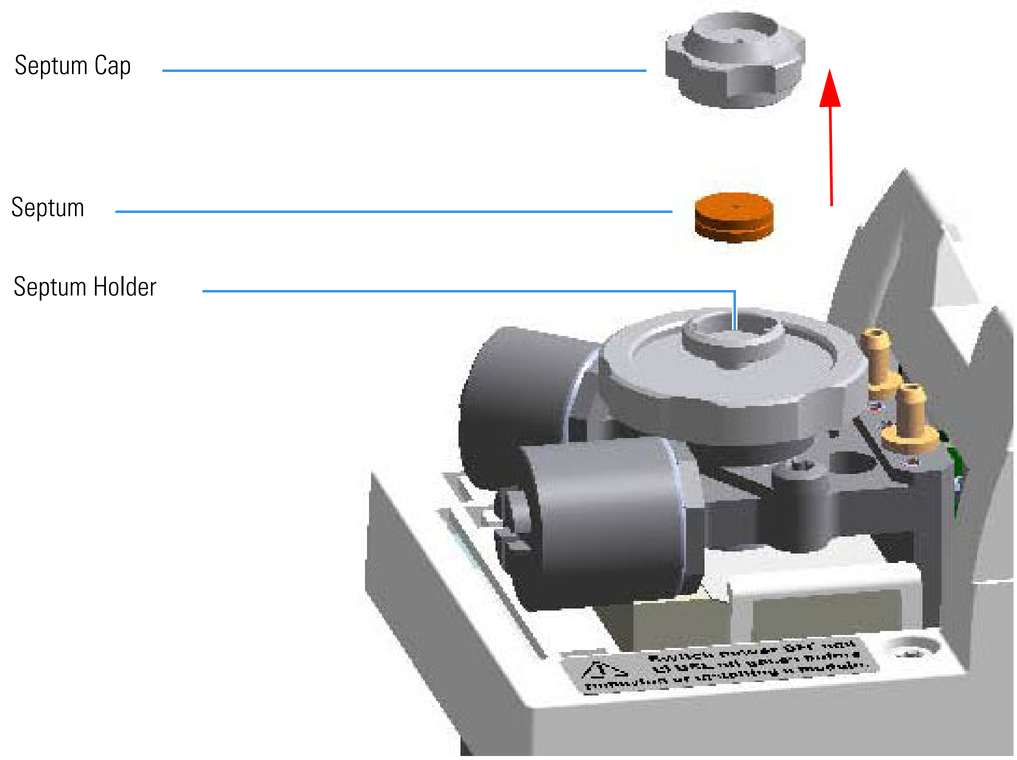
❖ To install the Merlin Microseal Valve kit on the SSL/SSLBKF and HeS-S/SL injector

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.
5. Open the module flap cover.
6. Remove the septum.

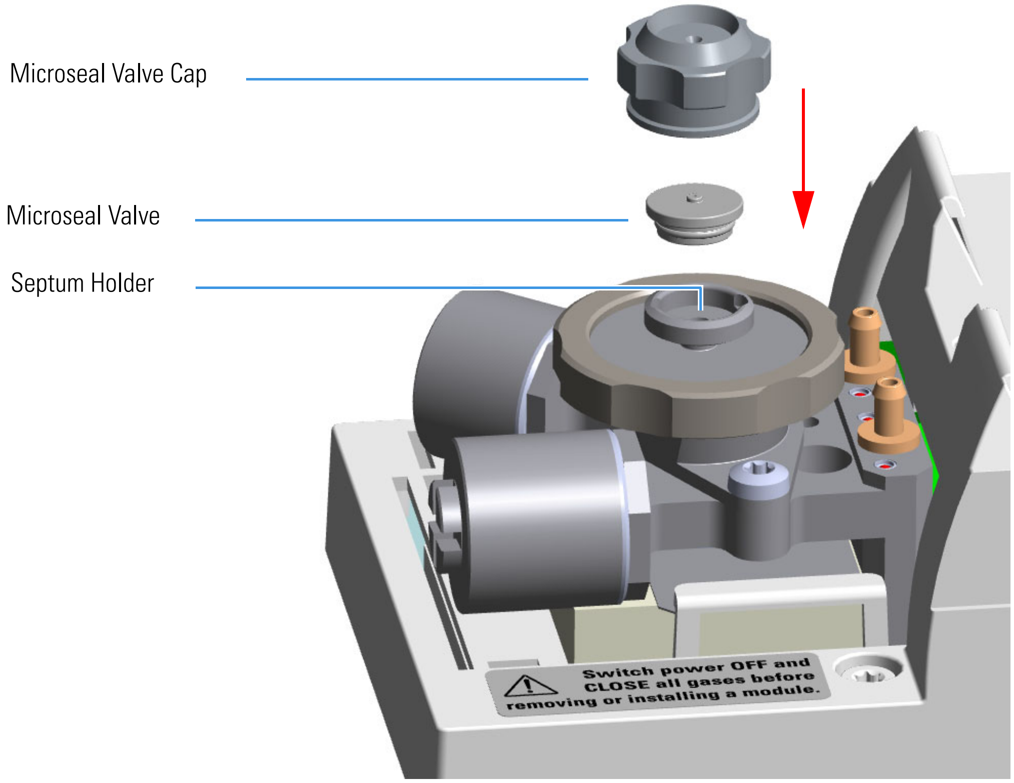
Figure 349. SSL/SSLBKF and HeS-S/SL Injector: Septum Replacement



   a. Unscrew and remove the septum cap.
   b. Using tweezers, remove the septum from the septum holder.

7. Install the Microseal valve on the injector.

Figure 350. SSL/SSLBKF and HeS-S/SL Injector: Microseal Valve Installation



a. Place the Microseal valve in the septum holder.

b. Push down gently to seat the Microseal valve onto the rim of the septum holder.

c. Screw the Microseal valve cap completely. Microseal valve overtightening and sealing flange stressing is not mechanically allowed.

8. Close the module flap cover.

9. If present, move the autosampler towards the module to restore the original alignment.

10. Turn the carrier gas on.

11. Set the normal injector, detector, and GC working conditions.

❖ To install the Merlin Microseal Valve kit on the PTV/PTVBKF injector

1. Put the GC in standby condition.

2. Cool the oven and injector to room temperature.

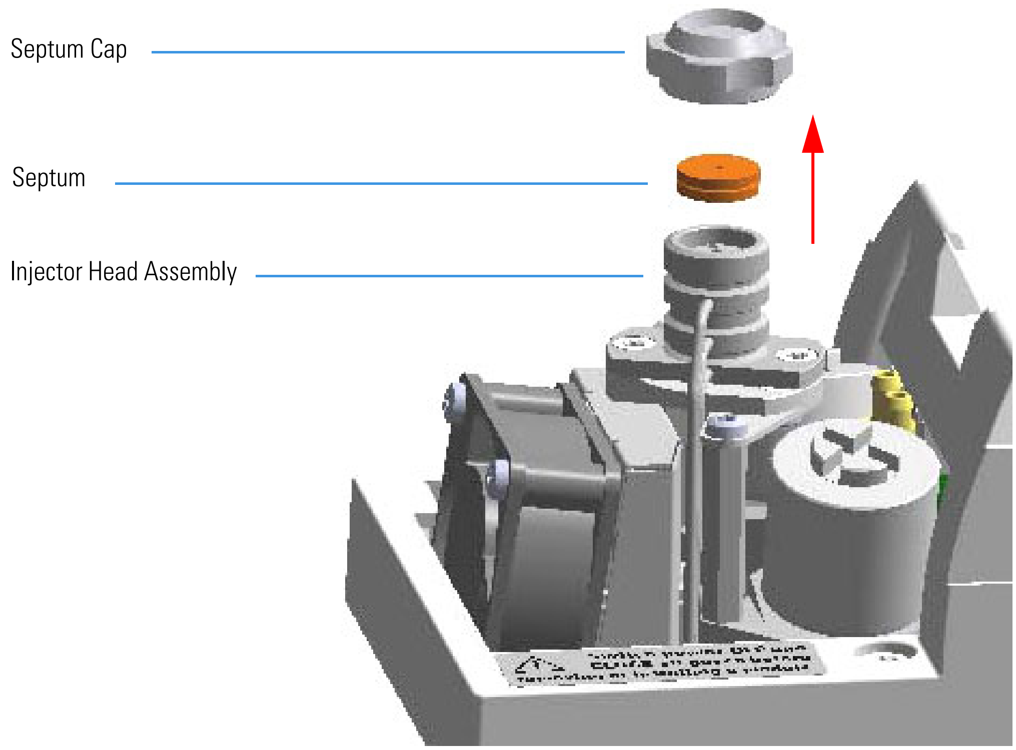
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Put the autosampler away if present.

5. Open the module flap cover.
6. Remove the septum.

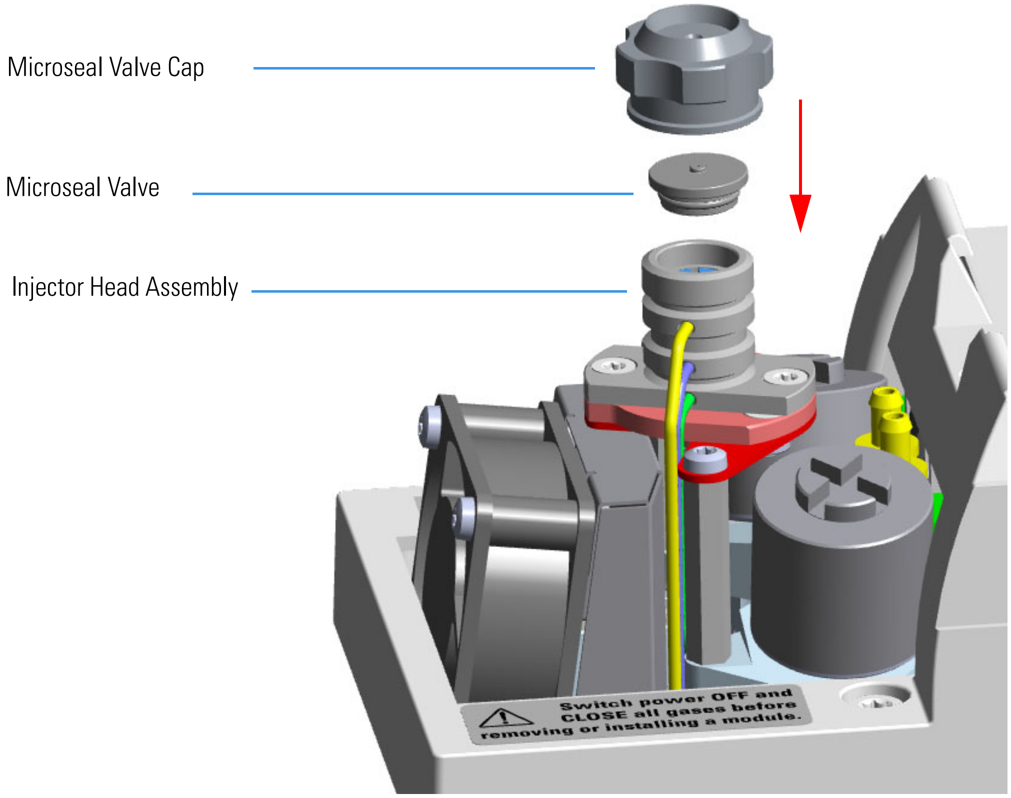
Figure 351. PTV/PTVBKF Injector: Septum Replacement



   a. Unscrew the septum cap of the injector.
   b. Using tweezers, remove the septum from the injector head assembly.

7. Install the Microseal valve on the injector.

Figure 352. PTV/PTVBKF Injector: Microseal Valve Installation



a. Place the Microseal valve in the injector head assembly.

b. Push down gently to seat the Microseal valve onto the rim of the septum holder.

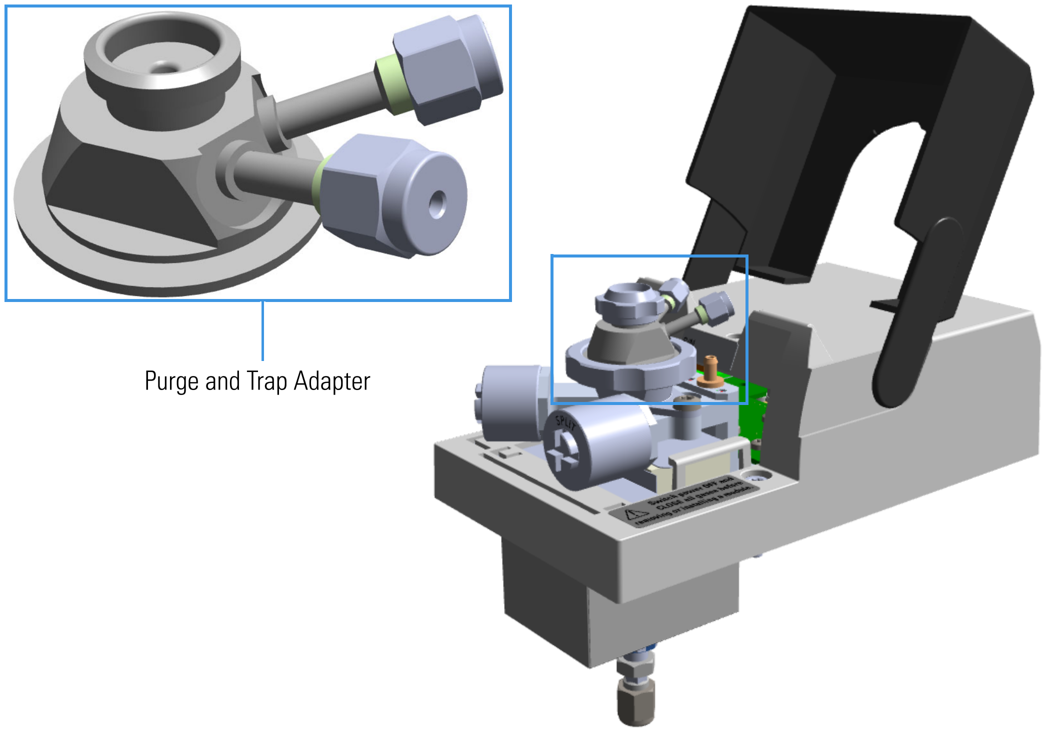
c. Screw the Microseal valve cap completely. Microseal valve overtightening and sealing flange stressing is not mechanically allowed.

8. Close the module flap cover.
9. If present, move the autosampler towards the module to restore the original alignment.
10. Turn the carrier gas on.
11. Set the normal injector, detector, and GC working conditions.

Installing the Purge & Trap Adapter Kit on the SSL/SSLBKF Injector

This section provides the instruction for installing the Purge & Trap Adapter kit (PN 19050730) on the SSL/SSLBKF injector for the use with a Purge & Trap system. See Figure 353.

Figure 353. Purge & Trap Adapter



❖ To install the Purge & Trap Adapter

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. Remove the column end from the injector.
   a. Open the front door of the GC.

b. Loosen the retaining nut from the injector fitting on the upper interior wall of the GC oven.

c. Remove the analytical column with its nut and ferrule from the bottom of the injector.

6. Put the autosampler away if present.

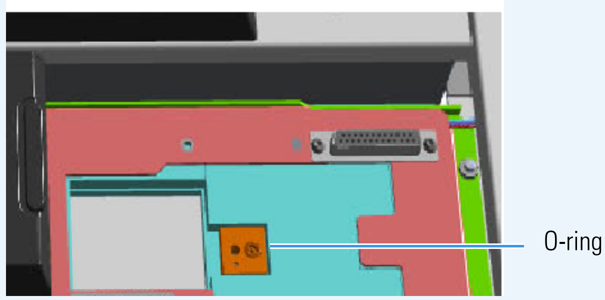
7. Remove the SSL/SSLBKF injector module from its seat.

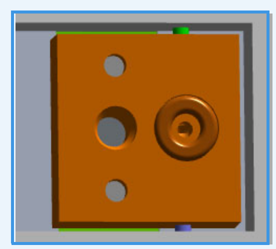
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.

   c. Throw upward the module from its seat of the injector housing. Place the SSL/SSLBKF module on a clean surface.

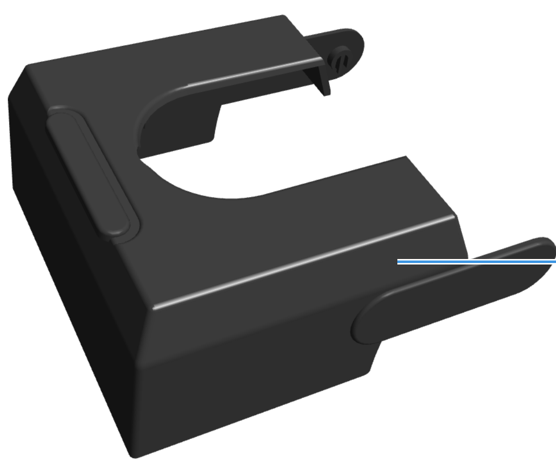
WARNING Make sure the O-ring remains into its seat on the gas connection. **Do not install the module if the O-ring is missing.**





8. Replace the module flap cover with the one's provided. See Figure 354.

Figure 354. Module Flap Cover for Purge & Trap



9. Reinstall the injector module into the main frame.

   a. Open the module flap cover.

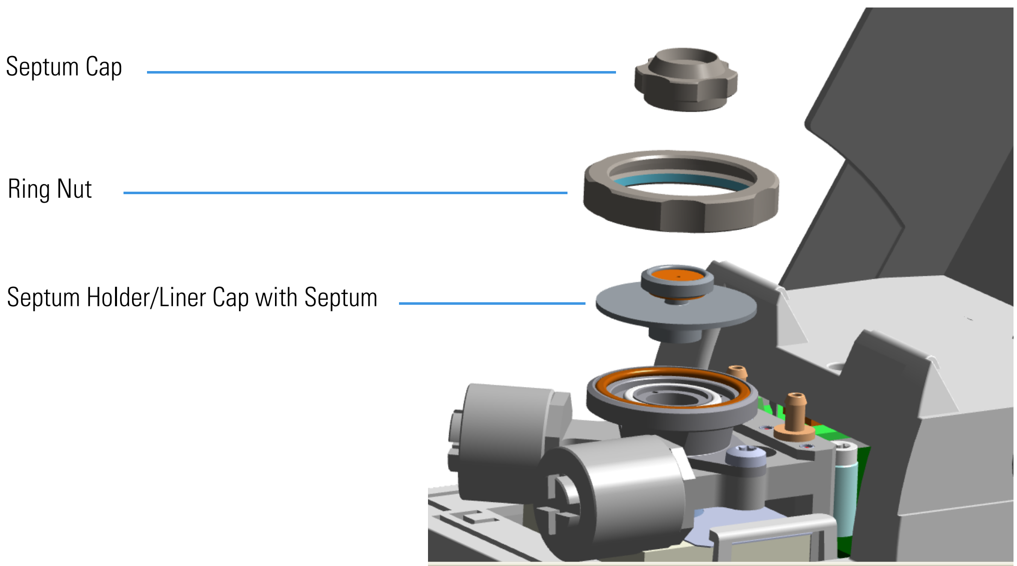
b. Place the injector module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtighten.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

10. Remove the top parts of the injector. See Figure 355.

Figure 355. Injector Top Parts Removal



a. Unscrew the septum cap of the injector.

b. Unscrew the ring nut.

c. Remove the septum holder/liner cap with septum from the injector body head.

11. Replace the liner and the O-ring.

IMPORTANT We suggest replacing the liner currently installed in the injector with the HS/SPME liner (PN 453A1335). The O-ring currently installed on the liner must be replaced with the SSL O-ring for the Purge & Trap Adapter (PN MI-290AA1-0001).

a. Use tweezers to remove the current liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it. Glass splinters could fall into the lower part of the vaporization chamber.

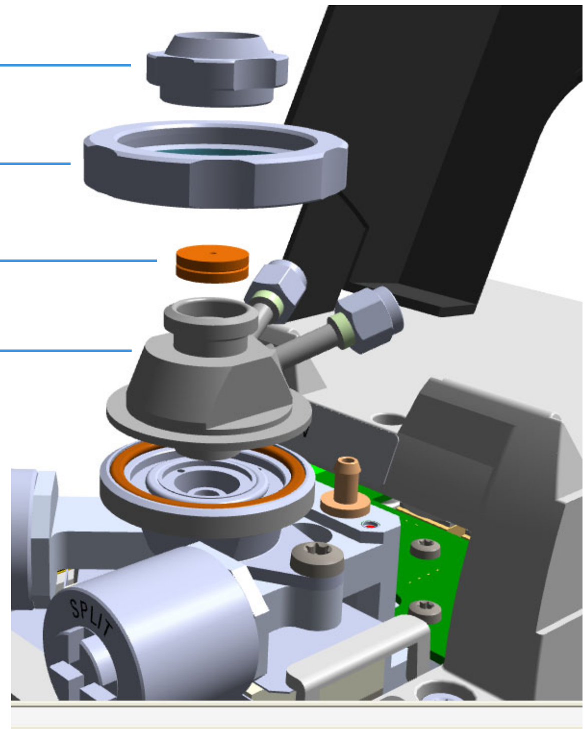
> **ATTENTION** Attention à ne pas casser le liner en verre lors de son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation.

b. Holding the HS/SPME liner with tweezers place the new liner seal over the liner.

c. Insert the liner into the injector and push it gently towards the bottom of the injector.

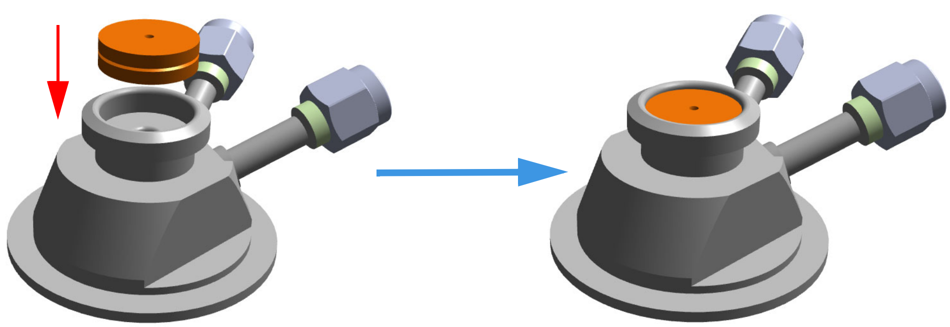
12. Install the purge & trap adapter on the top of the injector. See Figure 356.

Figure 356. Purge & Trap Adapter (1)



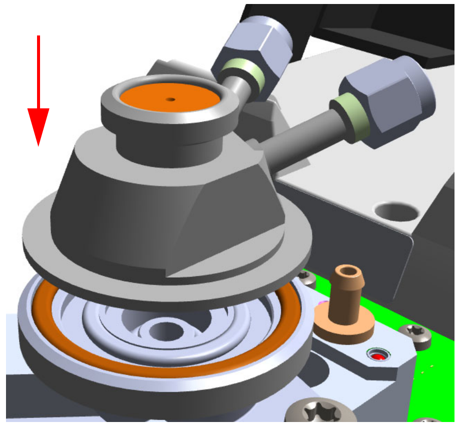
a. Avoid touching the septum with your fingers. Insert a new septum into the septum holder cavity of the purge & trap adapter using tweezers. See Figure 357.

Figure 357. Purge & Trap Adapter (2)



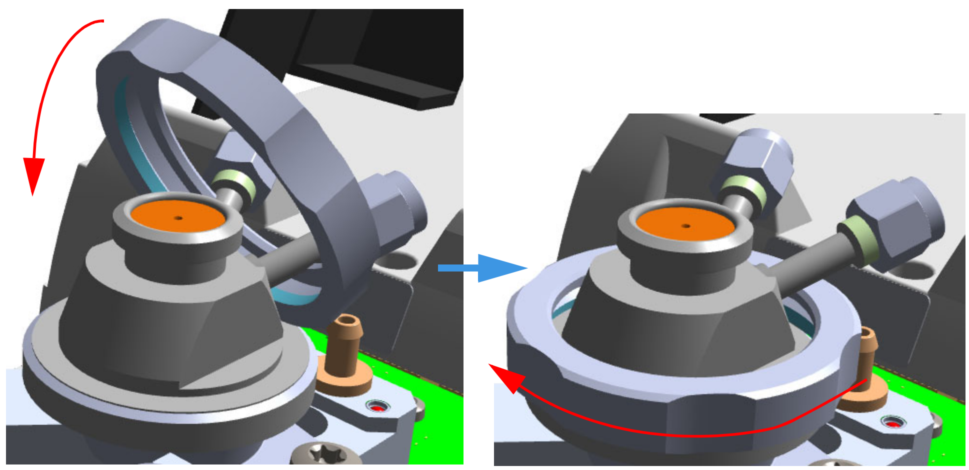
b. Place purge & trap adapter with the septum on the body head of the injector. See Figure 358.

Figure 358. Purge & Trap Adapter (3)



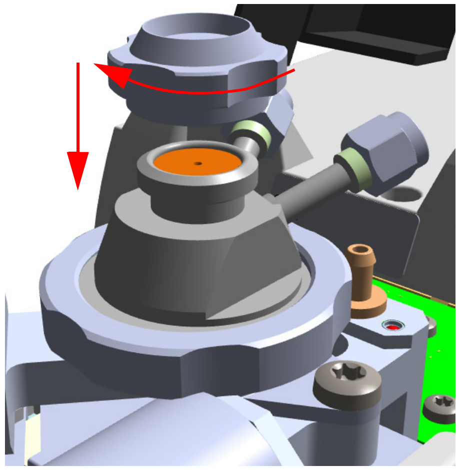
c. Guide the ring nut on the purge & trap adapter with the septum, then fix it screwing the ring nut. See Figure 359.

Figure 359. Purge & Trap Adapter (4)



d. Screw and tighten the septum cap to finger-tight. See Figure 360.

Figure 360. Purge & Trap Adapter (5)



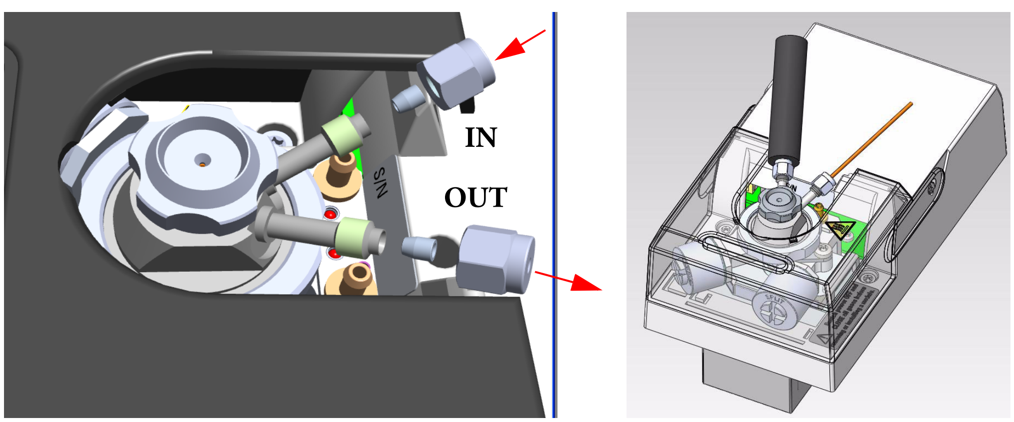
CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l'instrument.

13. Close the module flap cover.

14. Connect the purge & trap adapter to the Purge & Trap system. See Figure 361.

Figure 361. Purge & Trap Adapter (6)



a. Using the nut and ferrule provided, connect the heated transfer line from the Purge & Trap on the connector IN of the purge & trap adapter.

b. Using the nut and ferrule provided, connect the gas line from the injector module to the Purge & Trap on the connector OUT of the purge & trap adapter.

15. Reconnect the column end to the injector and verify the connection point.

16. Open the gas supplies.
17. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip out the power switch (breaker) to the position I.
18. Pressurize the module with the carrier gas.
19. Check for leaks.
    a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check the two fitting for leaks.
    b. If you detect a leak, tighten the connection and retest it.
    c. Repeat this process until all connections are leak free.
20. Close the front door of the GC.
21. If present, update the autosampler for the new injection position.

Installing the Packed Column Adapters

This section provides instructions for installing the adapters for connecting 1/8 or 1/16-in. OD metal packed columns to the bottom of the SSL injector, FID, NPD, ECD, TCD, and FPD. Refer to the following Caution text before connecting to a PDD detector.

WARNING Do not try to connect packed columns if the length of the column ends above the end of the ferrule are not compatible with the adapters. In this case we suggest you connect a new packed column by using the nuts and ferrules provided with the kit.

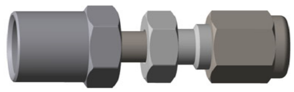
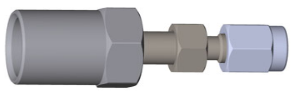
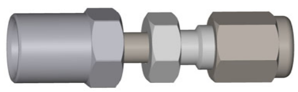
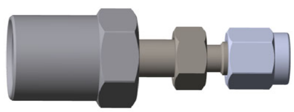
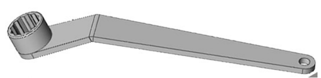
CAUTION **Connecting a packed column to a PDD detector**: An adapter to connect the PDD packed column adapter can be assembled using a piece of tube, the 1/16-in. nut and gold plated ferrule, and a 1/8-in. to 1/16-in. reducing union in the standard outfit.

ATTENTION **Branchement d’une colonne à garnissage à un détecteur PDD** : Un adaptateur pour brancher la colonne à garnissage PDD peut être assemblé avec une longueur de tube, l’écrou 1,58 mm (1/16 po) et la ferrule plaquée or et un raccord union de réduction 3,17 mm (1/8 po) à 1,58 mm -1/16 po) en configuration standard.

Introduction

The adapters are provided with the kit PN 19050758. The kit includes the following parts:

Table 15. Packed Column Adapters and 1/2-in. Wrench

Part	Description
	Adapter for the connection of the 1/8-in. OD packed column to the SSL injector
	Adapter for the connection of the 1/16-in. OD packed column to the SSL injector
	Adapter for the connection of the 1/8-in. OD packed column to the FID, NPD, ECD, TCD, or FPD detector
	Adapter for the connection of the 1/16-in. OD packed column to the FID, NPD, ECD, or FPD detector
	1/2-in. wrench

Getting Started

Install the column adapters following the instructions in the next operating procedures.

- “To install the packed column adapters” on page 375
- “To connect a new packed column to the injector and detector adapters” on page 378

❖ To install the packed column adapters

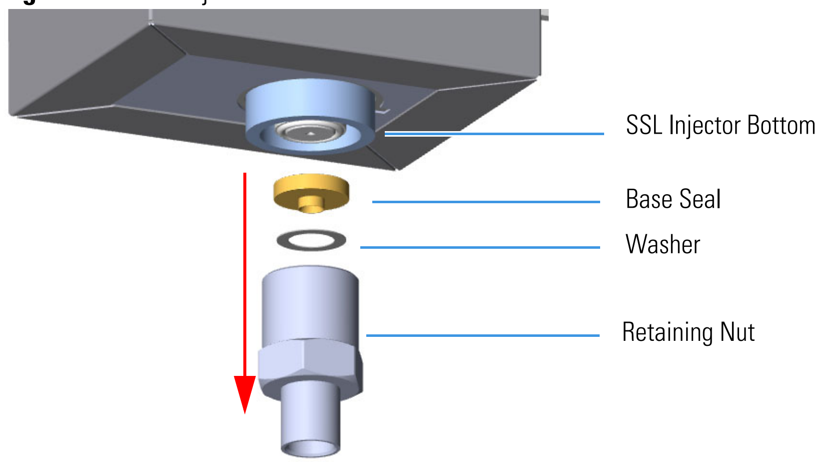
1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Remove the analytical column.
   a. Open the front door of the GC.
   b. Loosen the retaining nut from the injector and detector fitting on the upper interior wall of the GC oven.
   c. Remove the analytical column with its nut and ferrule from the bottom of the injector and the detector.

5. Remove the bottom parts of the SSL injector. See Figure 362.

Figure 362. SSL Injector Bottom Parts Removal



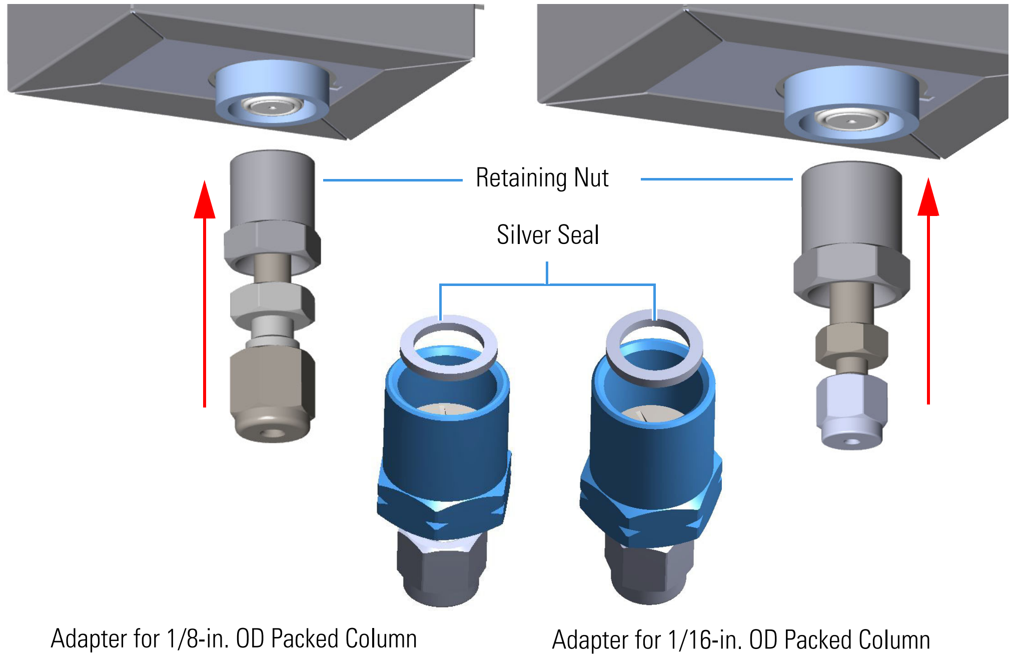
   a. Using the 1/2 wrench provided, unscrew the retaining nut with the base seal and the washer from the bottom of the injector.

CAUTION Make sure that the liner does not come out from the bottom of the injector. Save the bottom parts of the SSL injector in a safe place because they will be reused when you restore the original configuration for capillary columns.

ATTENTION Assurez-vous que le liner ne sorte pas par le bas de l’injecteur. Conservez les pièces inférieures de l’injecteur SSL en lieu sûr, car elles seront réutilisées pendant la restauration de la configuration d’origine pour les colonnes capillaires.

6. Install the adapter on the bottom the injector interposing the silver seal. See Figure 363.

Figure 363. Adapter Installation on SSL Injector Bottom

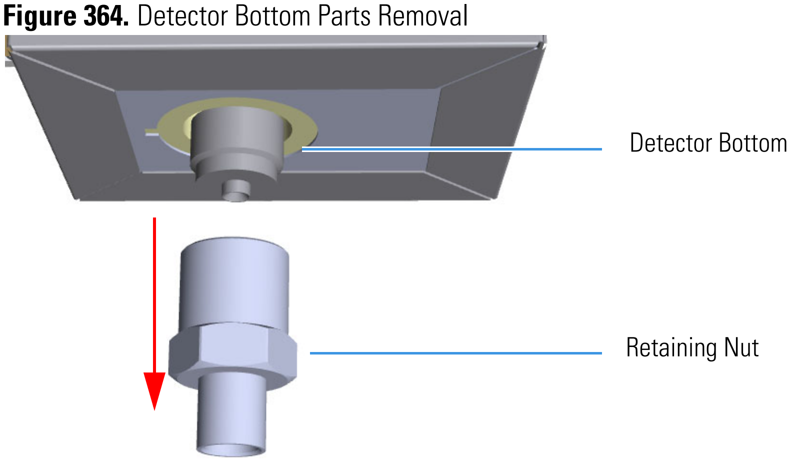


a. Finger-tighten the retaining nut of the adapter until it starts to grip the bottom of the injector.

b. Use the 1/2 wrench to firmly tighten the retaining nut of the adapter with the base seal from the bottom of the injector.

7. Remove the bottom parts of the FID, NPD, ECD, TCD, or FPD detector. See Figure 364.

Figure 364. Detector Bottom Parts Removal

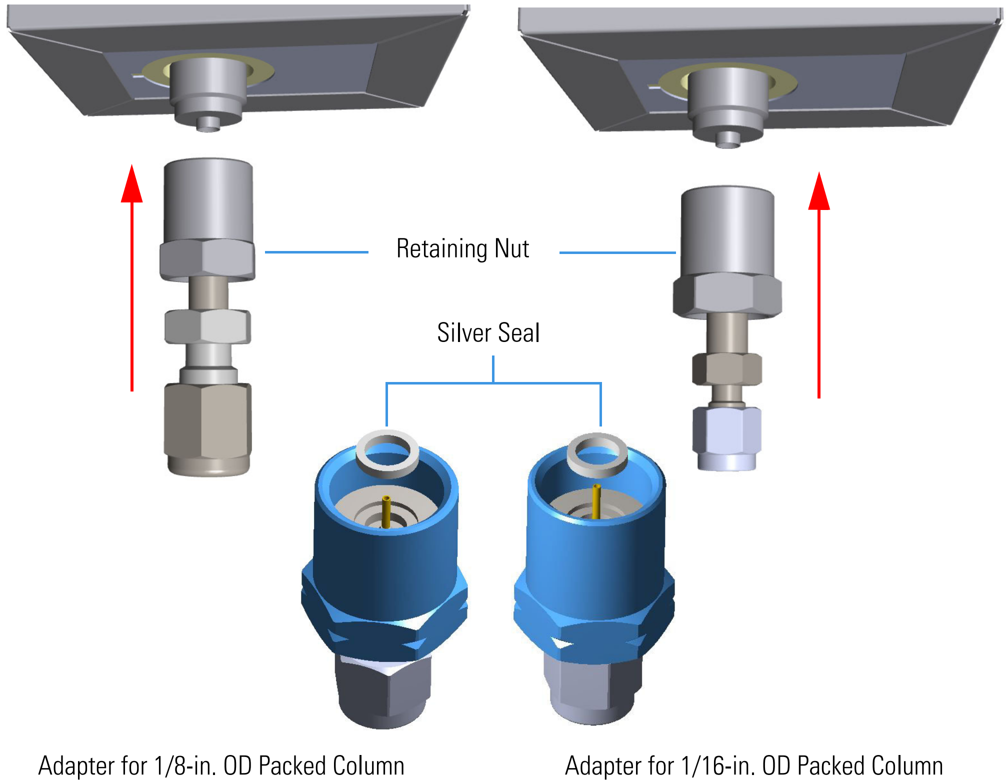


> **Note** Save the bottom parts of the detector in a safe place because will be reused when you restore the original configuration for capillary columns.

a. Using the 1/2 wrench provided, unscrew the retaining nut from the bottom of the detector.

8. Install the adapter on the bottom the detector interposing the silver seal. See Figure 365.

Figure 365. Adapter Installation on the Bottom of the Detector



   a. Finger-tighten the retaining nut of the adapter until it starts to grip the bottom of the detector.

   b. Use the 1/2 wrench to firmly tighten the retaining nut of the adapter with the base seal from the bottom of the injector.

❖ To connect a new packed column to the injector and detector adapters

Before you begin, verify that the proper adapters are installed on the injector and detector side.

1. Preparing the metal packed column.

   a. Using a 1/4-5/16-in. wrench, remove the column nut and ferrules from the base of the injector adapter.

   b. Using a 1/4-5/16-in. wrench, remove the column nut and ferrules from the base of the detector adapter.

   c. Slide the column nut and the ferrules onto the packed column injector and detector ends in the order and direction as shown in the Figure 366 and Figure 367.

Figure 366. Column Nut and Ferrules (1)

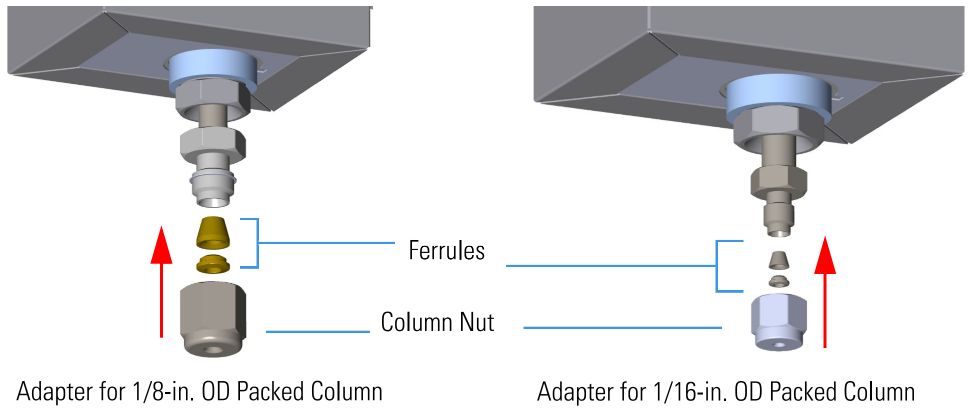
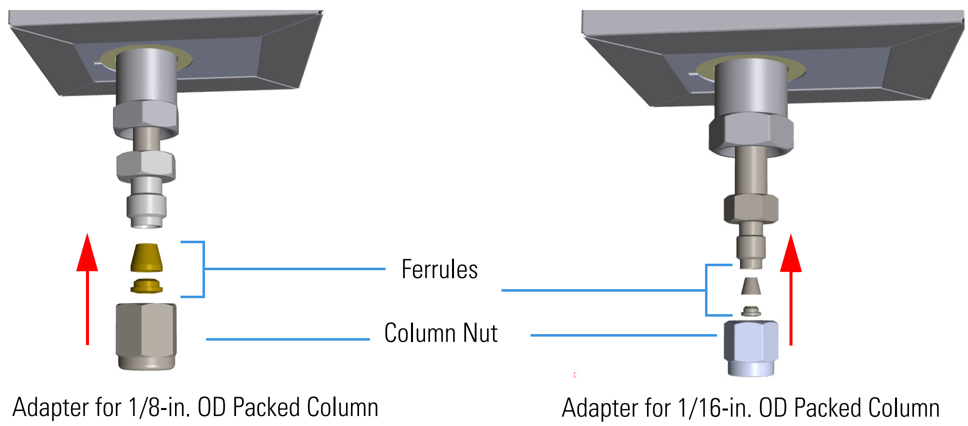


Figure 367. Column Nut and Ferrules (2)



2. Connect the packed column to the injector.
   a. Insert the inlet end of the column as far as possible into bottom of the adapter.
   b. Slide the ferrule up to adapter base then finger-tighten the column retaining nut until it starts to grip the column.
   c. Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.
3. Close the front door of the GC.
4. Turn on the gas supplies and the injector temperature.
5. Setup the GC.
   a. Set the oven and injector temperature to 50 °C.
   b. Allow the column to purge for few minutes.
6. Condition the column.

   The column must be conditioned before inserting it into the detector.

Column conditioning consists of passing a carrier gas flow through the column heated at a programmed temperatures as described in the *column manufacturer's instructions*.

In case the column does not have any column conditioning instructions, perform the column conditioning by setting a final temperature up to 10 °C - 20 °C below its recommended maximum temperature.

CAUTION When performing column conditioning, the column should be connected only to the injector leaving the column outlet disconnected to avoid the possibility of contamination of the detector.

Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

ATTENTION Pendant le conditionnement de la colonne, branchez uniquement cette dernière à l'injecteur. La sortie de colonne ne doit pas être branchée, afin d'éviter toute contamination du détecteur.

N'utilisez pas l'hydrogène comme gaz vecteur pour le conditionnement ! Il risquerait de s'échapper dans le four et de présenter un risque d'explosion.

a. Run the temperature program that is recommended by the manufacturer.

INSTRUMENT DAMAGE: Never exceed the column manufacturer's maximum operating temperature.

7. Connect the column to the detector inside the GC.

   a. Lower the oven temperature to 30 °C and allow it to cool.

WARNING-BURN HAZARD: The injector, detector, and oven, may be hot. Allow them to cool to room temperature before touching them.

8. Connect the packed column to the detector.

   a. Insert the inlet end of the column as far as possible into bottom of the adapter.

   b. Slide the ferrule up to adapter base then finger-tighten the column retaining nut until it starts to grip the column.

   c. Use the wrench to tighten the retaining nut. Use no more pressure than is necessary to obtain a good seal (1/4 to 1/2 turn).

9. End of the column installation.

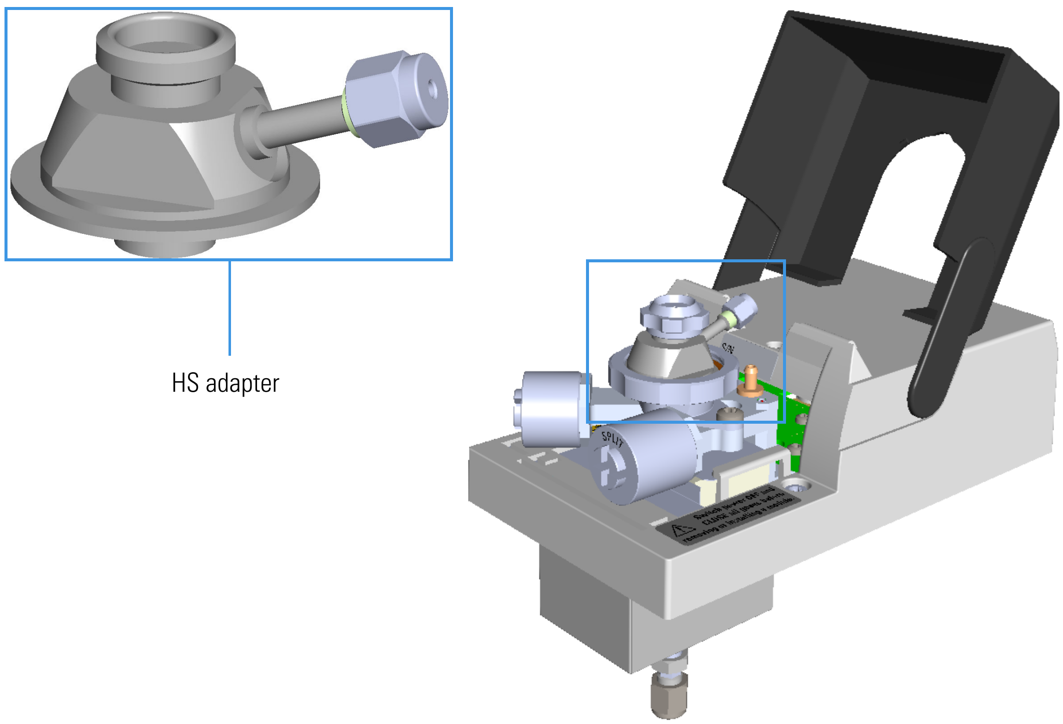
   a. Close the front door of the GC.

Installing the HS Adapter Kit on the SSL/SSLBKF Injector

This section provides the instructions for installing the HS Adapter kit PN 19050732, on the SSL/SSLBKF injector for the use with a TriPlus 300 Headspace sampling system. See Figure 368.

> **Note** Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Figure 368. HS Adapter



❖ To install the HS adapter

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

   > **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. Remove the column end from the injector and the detector.

   a. Open the front door of the GC.

   b. Loosen the retaining nut from the injector fitting on the upper interior wall of the GC oven.

   c. Remove the analytical column with its nut and ferrule from the bottom of the injector.

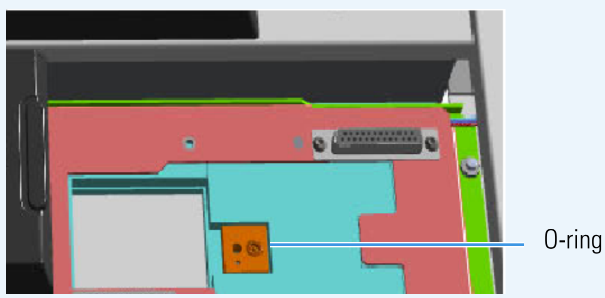
6. Remove the SSL/SSLBKF injector module from its seat.

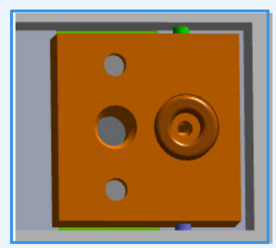
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.

   c. Lift the module from its seat in the injector housing. Place the SSL/SSLBKF module on a clean surface.

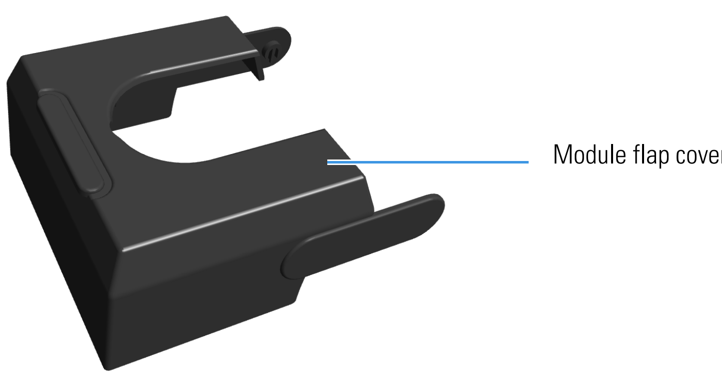
WARNING Make sure the O-ring remains into its seat on the gas connection. **Do not install the module if the O-ring is missing.**





7. Replace the module flap cover with the one's provided. See Figure 369.

Figure 369. Module Flap Cover for the HS Adapter



8. Reinstall the injector module into the main frame.

   a. Open the module flap cover.

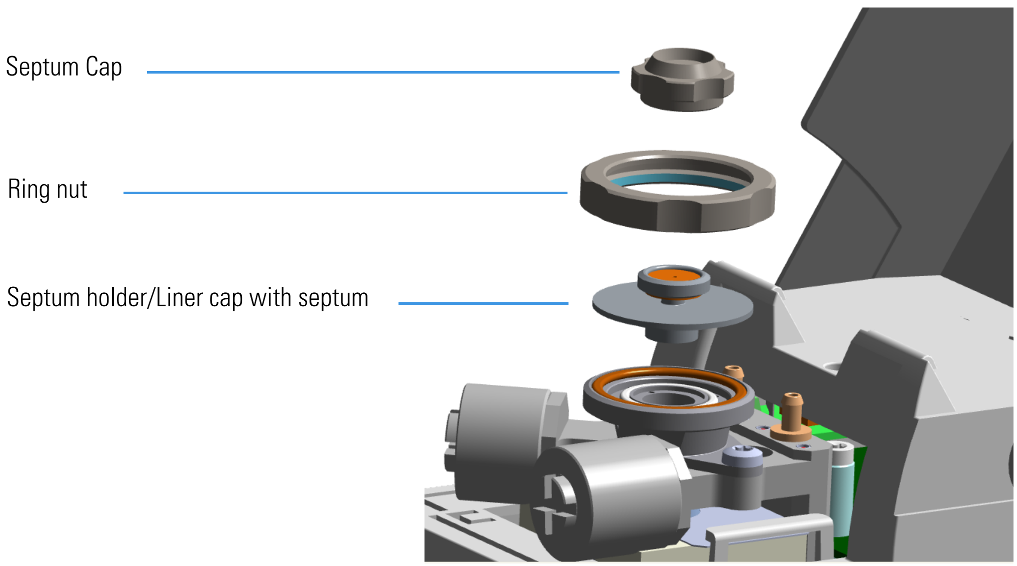
b. Place the injector module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

9. Remove the top parts of the injector. See Figure 370.

Figure 370. Injector Top Parts Removal

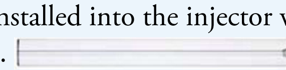


a. Unscrew the septum cap of the injector.

b. Unscrew the ring nut.

c. Remove the septum holder/liner cap with septum from the injector body head.

10. Replace the liner.

IMPORTANT We suggest replacing the liner currently installed into the injector with the HS/SPME straight glass empty liner PN 453A1335. 

a. Use tweezers to remove the current liner with the liner seal (O-ring) from the injector.

CAUTION Be careful not to break the glass liner when removing it.
Glass splinters might fall into the lower part of the vaporization chamber.

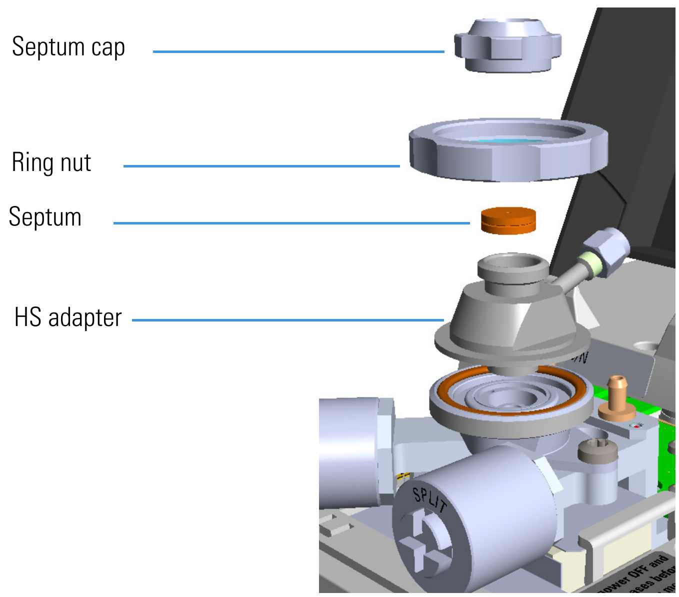
ATTENTION Attention à ne pas casser le liner en verre lors de son extraction. Des éclats de verre pourraient tomber dans la partie inférieure de la chambre de vaporisation.

b. Holding the HS/SPME liner with tweezers, place a new liner seal over the liner.

c. Insert the liner into the injector and push it gently towards the bottom of the injector.

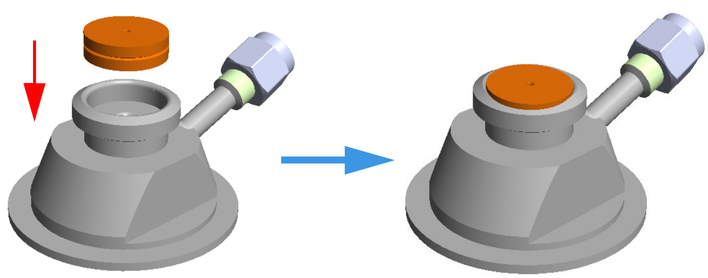
11. Install the HS adapter on the top of the injector. See Figure 371.

Figure 371. HS Adapter (1)



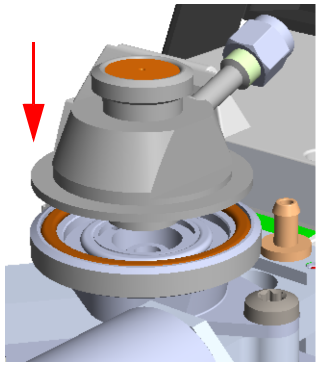
a. Avoid touching the septum with your fingers. Insert a new septum into the septum holder cavity of the HS adapter using tweezers. See Figure 357.

Figure 372. HS Adapter (2)



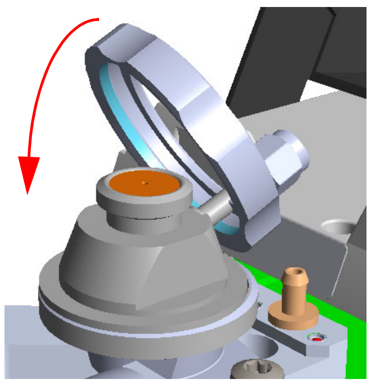
b. Place the HS adapter with the septum on the body head of the injector. See Figure 373.

Figure 373. HS Adapter (3)



c. Guide the ring nut on the HS adapter with the septum, then fix it by screwing in the ring nut. See Figure 374.

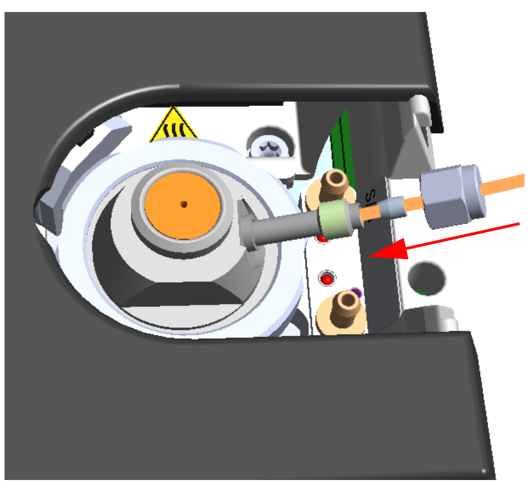
Figure 374. HS Adapter (4)



12. Close the module flap cover.

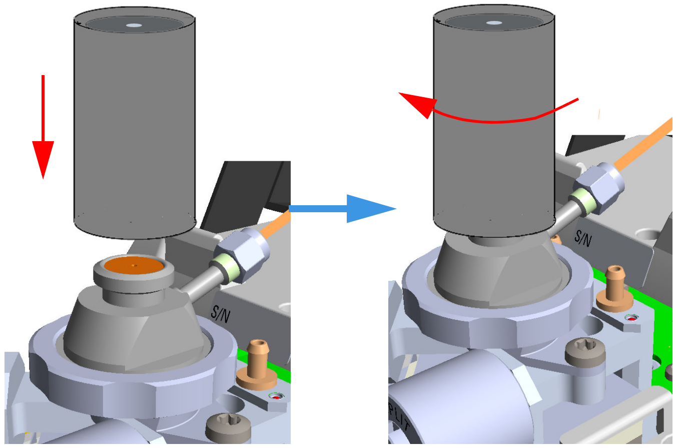
13. Connect the carrier gas line coming from the TriPlus 300 Headspace sampling system to the HS adapter by using the proper nut and ferrule. See Figure 375.

Figure 375. HS Adapter (5)



14. Screw and finger-tighten the septum cap provided. See Figure 376

Figure 376. HS Adapter (6)

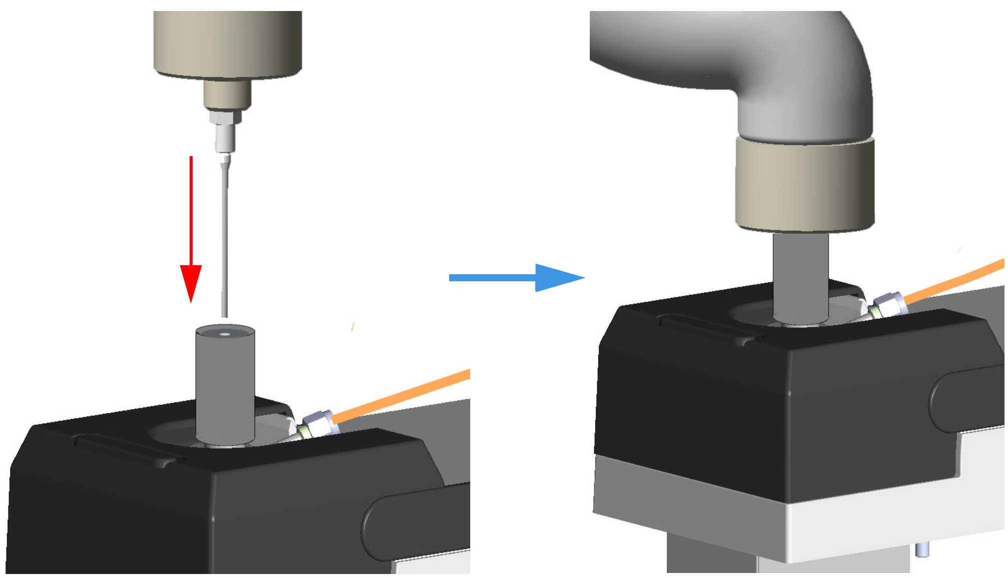


CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

15. Insert the transfer line needle into the septum cap. See Figure 377.

Figure 377. Transfer Line Connection



16. Cut the piece of column end previously connected to the injector.

a. Use a scoring wafer to score and break the column in order to remove the current ferrule and the nut.

17. Connect the column to the injector.

    a. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.

    b. Insert the column through the injector retaining nut and the proper ferrule (open end up). Wipe the column again with a tissue soaked in methanol.

    c. Use a scoring wafer to score and break the column about 1 cm (0.4 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

    Tip Slide a notched septum on the column before the injector retaining nut to make it easier to measure the proper distance between the nut and the end of the column.

    d. Position the column so that the end of the column extends the proper distance of **30 mm** above the end of the ferrule.

    e. Insert the notched septum on the column to hold the retaining nut at this position. Thread the retaining nut into the injector but do not tighten.

    f. Adjust the column position so that the septum contacts the bottom of the retaining nut.

    g. Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn.

    h. Remove the notched septum from the column.

18. Open the gas supplies.

19. Power on the GC.

    a. Plug the power cable into the AC Input connector on the back of the GC and into the wall outlet.

    b. Flip out the power switch (breaker) to the position I.

20. Setup the GC.

    a. Set the oven and injector temperature to 50 °C.

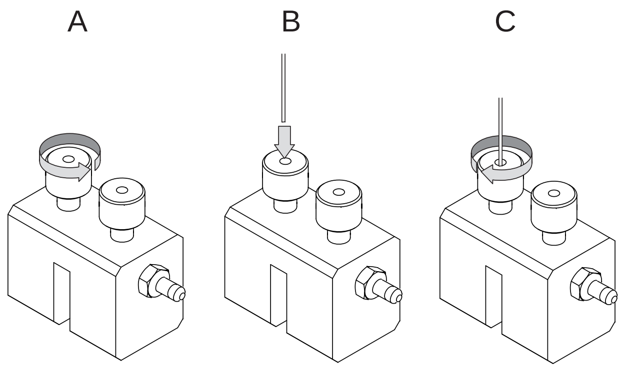
    b. Use the column-flowmeter connector to verify that there is flow through the column. If you do not have a flowmeter, dip the column outlet in a small vial of methanol. Bubbles indicate there is flow through the column. If there is no flow, check that the carrier gas is on, the GC inlet is pressurized, and the column is not plugged. If there is still no flow, consult the section **Analytical Troubleshooting** in the *TRACE 1600/1610 User Guide*, or contact the Technical Support.

    c. Allow the column to purge for few minutes.

21. Perform a column leak check.

    a. Carefully push the capillary column end into the column section of the column-flowmeter connector. See Figure 378.

Figure 378. Using a Flowmeter for Leak Check



b. If your GC is equipped with the touch screen user interface, select the **Leak Check** icon in the **Maintenance** menu, otherwise perform the Leak Check through the Chromatography Data System by selecting the proper function.

c. Start the leak check to begin operation. The split and purge valves of the selected channel are automatically closed and the channel is pressurized with carrier gas to the leak check setpoint.

d. The system monitors the pressure for one minute. If the pressure does not drop more than the maximum allowed sensitivity value, then the leak check will pass.

   If the leak check did not pass, you should use the leak detector to find and fix the leaks.

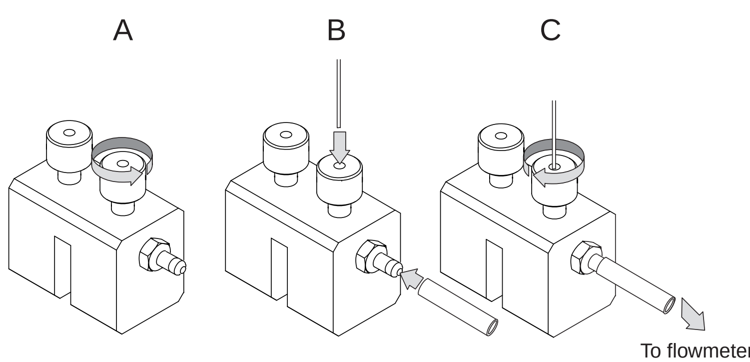
> **Tip** Leaks can be caused by not tightening the fitting on the column-flowmeter connector. We recommend that you check that fitting before looking elsewhere.

e. Repeat the leak check until no leaks are indicated.

22. Calibrate the carrier gas flow (column evaluation).

   a. Carefully push the capillary column end into the flow meter section of the column-flowmeter connector. See Figure 379.

Figure 379. Column Flowmeter Connector



   b. Connect the flowmeter to the dedicated fitting on the column-flowmeter connector.

c. If your GC is equipped with the touch screen as user interface, select **Back** or **Front Column** icon in the **Configuration** menu, otherwise perform the Column Evaluation through the Chromatography Data System by selecting the proper function.

d. Select the column and input the physical characteristics of the column.

e. If a pre-/post-column is present, set the length and nominal internal diameter of the pre-/post-column in the same valid ranges for the column. The following two lines are added to the menu.

f. According to the physical characteristics of the column, the system calculates and displays the relevant Column K-factor.

> **Note** For the most reproducible results, you should conduct a more detailed column evaluation. However, the following steps, while recommended, are not required.

g. Start column evaluation. At the end of the routine, a message will indicate that evaluation was successful.

h. Expect a K-factor of approximately 0.7 – 0.9 for a 15 m, 0.25 mm ID column (1.3 – 2.0 for a 30 m, 0.25 mm ID column). If the column does not report a K-factor within this range or within 0.1 units of the previous stored value, check for a leak or broken column using the leak detector. The K-factor is a measured resistance for the column. A K-factor that is too low may indicate a leak in the system, while a K-factor that is too high may indicate a blockage.

23. Disconnect the column-flowmeter.

a. Disconnect the column from the column-flowmeter connector.

b. Remove the clear plastic component, including its fittings, from the oven and set it aside.

c. Close the GC door.

24. Condition the column.

The column must be conditioned before inserting it into the detector.

Column conditioning consists of passing a carrier gas flow through the column heated at a programmed temperatures as described in the *column manufacturer's instructions*.

In case the column does not have any column conditioning instructions, perform the column conditioning by setting a final temperature up to 10 °C - 20 °C below its recommended maximum temperature.

CAUTION When performing column conditioning, the column should be connected only to the injector leaving the column outlet disconnected to avoid the possibility of contamination of the detector.

Do not use hydrogen as the carrier for conditioning! It could vent into the oven and present an explosion hazard.

ATTENTION Pendant le conditionnement de la colonne, branchez uniquement cette dernière à l'injecteur. La sortie de colonne ne doit pas être branchée, afin d'éviter toute contamination du détecteur.

N'utilisez pas l'hydrogène comme gaz vecteur pour le conditionnement ! Il risquerait de s'échapper dans le four et de présenter un risque d'explosion.

a. Run the temperature program that is recommended by the manufacturer.

INSTRUMENT DAMAGE: Never exceed the column manufacturer's maximum operating temperature.

25. Connect the column to the detector inside the GC.

a. Lower the oven temperature to 30 °C and allow it to cool.

WARNING-BURN HAZARD: The injector, detector, oven, and transfer line may be hot. Allow them to cool to room temperature before touching them.

b. Unwind the column enough to easily connect its ends to the injector and the detector.

Note Wear clean, lint- and powder-free gloves when you handle the column and injector ferrule.

c. Wipe about 100 mm (4 in.) of the column with a tissue soaked in methanol.

d. Use a scoring wafer to score and break the column outlet about 2.5 cm (1 in.) from the end. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

e. Insert the column through the proper detector retaining nut and ferrule (open end up). Wipe the column again with a tissue soaked in methanol.

Tip Slide a notched septum on the column before the detector retaining nut to make it easier to measure the proper distance between the bottom nut and end of the column.

f. Position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 16.
For **PDD** see the instruction described at the step g on page 391.

Table 16. Column Insertion Depth For FID, NPD, TCD, ECD, FPD, and PDD Detectors

FID	NPD	TCD	ECD	FPD	PDD
Insert the column as far as goes and withdrawn about 2 mm			23 mm	125 mm	136 mm

i. For **FID**, **NPD**, **TCD**, insert the column into the detector, paying attention to not force it further. Finger-tighten the retaining nut, then withdraw the column 2-3 mm. Tighten the retaining nut an additional a quarter turn.

ii. For **ECD** and **FPD**, insert the notched septum on the column to hold the retaining nut in this position. Thread the retaining nut into the detector but do not tighten.
Finger-tighten the retaining nut until it starts to grip the column plus a quarter turn. Remove the notched septum from the column.

g. For **PDD** the column must penetrate **136 mm** inside the capillary column adapter.

Note When inserting the capillary column into the PDD detector it might rarely happen to feel a slight resistance. In this case, for proper column installation, pull the column out slightly and adjust the angle before inserting it further.

IMPORTANT To install a packed column, the pre-installed capillary column adapter must be replaced with the **packed columns adapter** that enters into the PDD cell for the correct length.

26. End of the column installation.

a. Close the front door of the GC.

Installing the Large Volume Splitless Kit

This section provides instruction for installing the Large Volume Splitless kit (PN 19050725) on your TRACE 1600/1610.

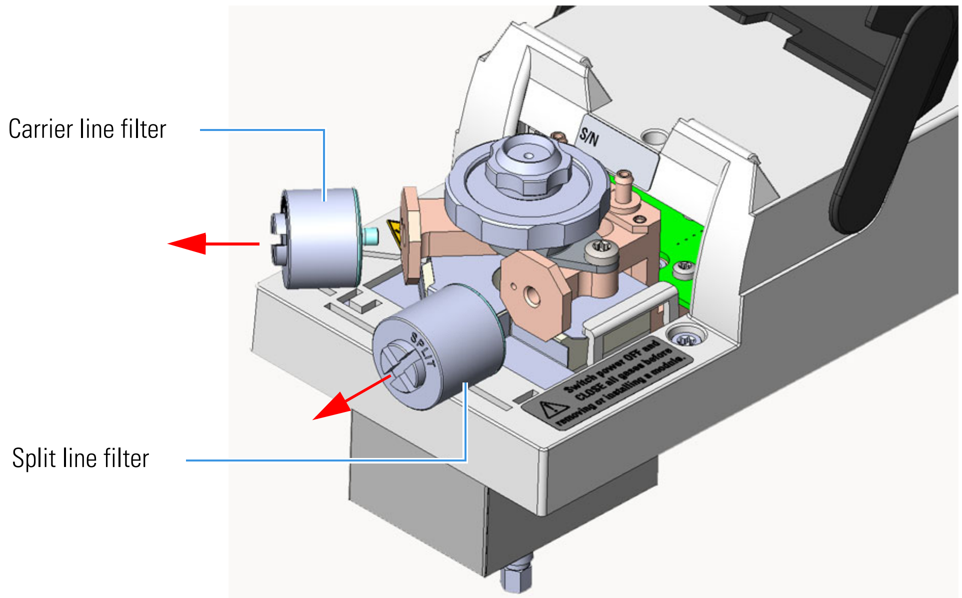
The Large Volume Splitless injector is a setup of the standard splitless injector, where the introduction of large number of liquid samples can be performed manually, or with the TriPlus RSH, TriPlus 100 Liquid Sampler, or AI/AS 1610 autosampler.

Large Volume-Splitless kit includes:

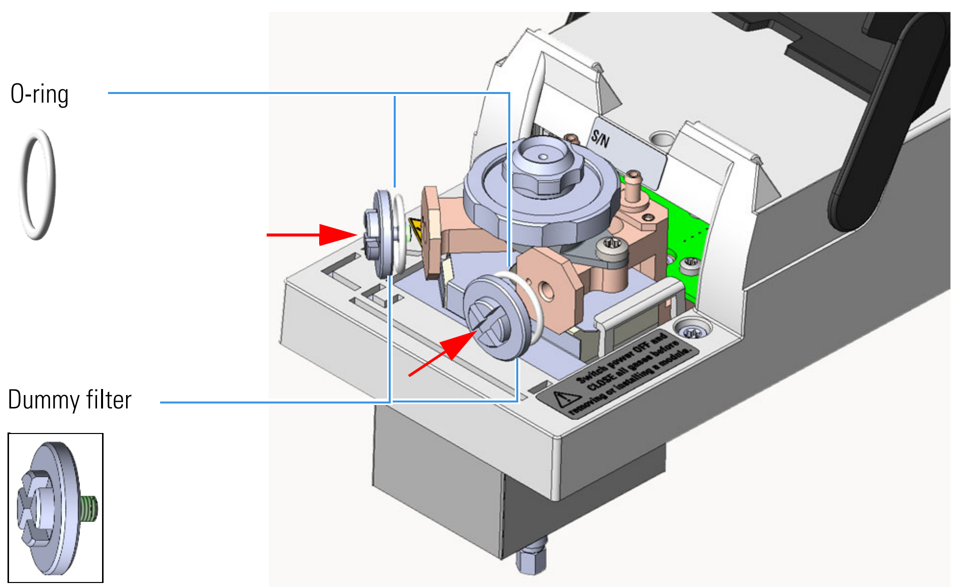
- Two dummy filters
- Two O-rings for dummy filters
- A deactivated connector (press-fit)
- An uncoated precolumn (5 m x 0.32 mm ID)
- A dedicated splitless liner (set of 5)
- LV-SL Assistant software

❖ To install the large volume splitless kit

1. Put the GC in standby condition.
2. Cool the oven and injector to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.
4. Put the autosampler away if present.
5. Open the module flap cover
6. Replace the filters with the dummy filters.
   a. Remove both the filters from their seats by turning them counter-clockwise.



b. Install the dummy filters in their seats interposing the O-ring, then turn them clockwise.



7. Replace the current liner installed into the Split/Splitless injector with the dedicated splitless liner.

8. Close the module flap cover.

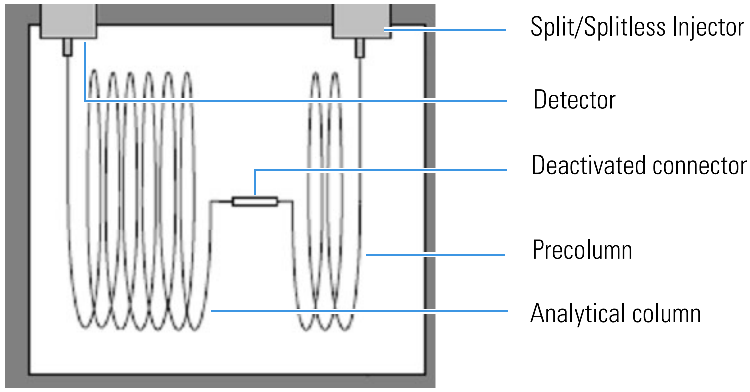
9. Install the uncoated precolumn.

   a. Open the oven door.

   b. Disconnect the analytical column from the bottom of the injector.

c. Connect an end of the precolumn to the bottom of the injector by using the proper nut and ferrule. Position the precolumn so that its end extends a distance of 5 mm above the end of the ferrule.

10. Couple the precolumn to the analytical capillary column.

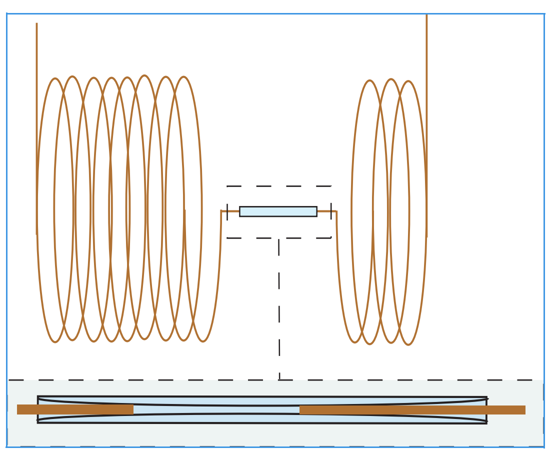


a. Properly cut the fused silica column ends pay attention to achieve a clean square cut by using a ceramic scoring wafer or sapphire scribe.

CAUTION A poor cut to the fused silica will result in an insufficient seal.

ATTENTION Une coupe imprécise pourrait entraîner un problème d'étanchéité.

b. insert the precolumn and analytical column ends into the relevant ports of the deactivated connector.



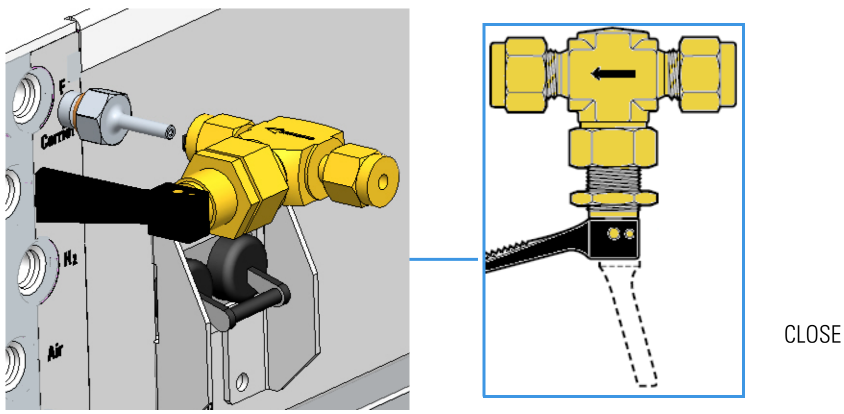
Note To create a good seal between all the parts, will be necessary to increase the oven temperature up to 200 °C.

11. Close the oven door.
12. If present, move the autosampler towards the module to restore the original alignment.
13. Turn the carrier gas on.
14. Set the injector, detector, and GC working conditions.

Installing the Manual On/Off Valve for Single Gas Line

This section provides instructions for installing the manual on/off toggle valve for single gas line kit (PN 19050756) on a GC gas inlet of your TRACE 1600/1610. See Figure 380.

Figure 380. Manual Toggle Valve Installation



The manual toggle valve is used for manually opening and closing the gas flow coming from the supply line.

It is particularly useful when for any reason you need to manually interrupt the flow of a gas into the GC, for example: before the replacement of a module, to save the consumption of a gas when its flow is unnecessary, and so on.

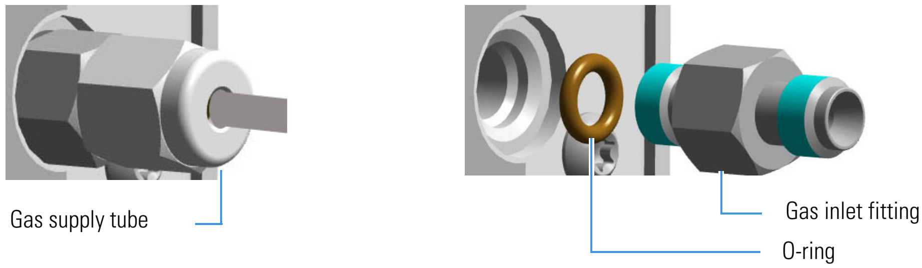
The kit can be installed only on a single gas line, then if you need managing more gas lines, up to six kits can be installed accordingly.

❖ To install the manual on/off valve kit

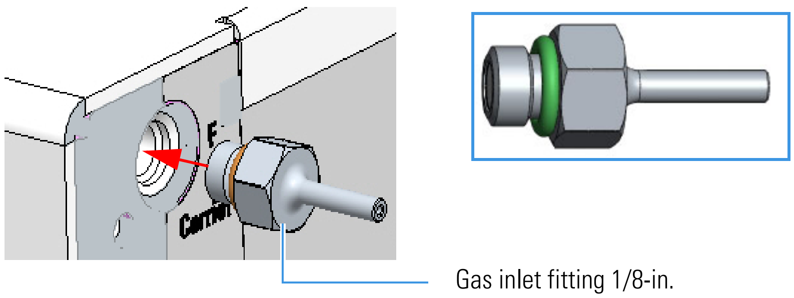
Note This procedure describes the installation of a manual on/off valve on a single gas line. In the example the installation of the valve on the Front Carrier gas line is considered.

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.
3. Turn the carrier gas off, and wait for the carrier pressure to go to zero.
4. On the back of the GC disconnect the gas supply tube and the gas inlet fitting with its O-ring from the GC gas inlet where the manual on/off valve must be installed.

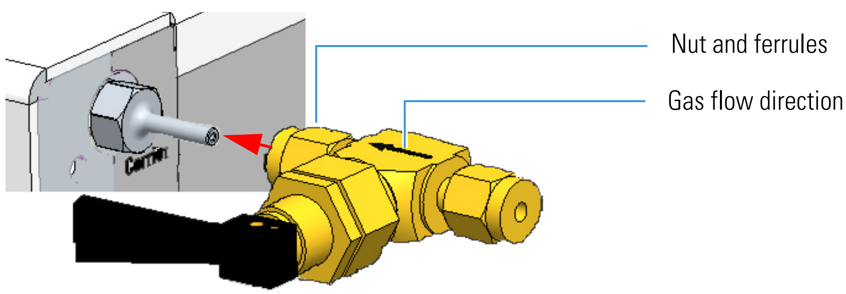
Use a 7/16-in. wrench for unscrewing the fittings.



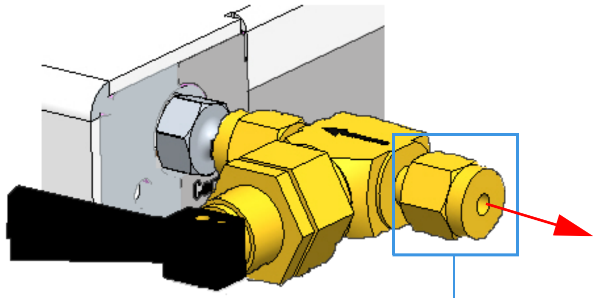
5. Screw the gas inlet fitting 1/8-in. provided into the gas inlet port interposing the O-ring. Use a 7/16-in. wrench for tightening the fitting.



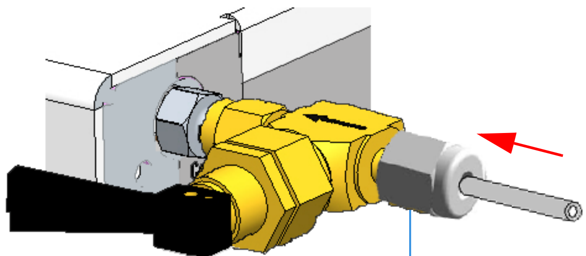
6. Using the nut and ferrules provided, connect the valve outlet to the gas inlet fitting 1/8-in. Make sure that the arrow marked on the valve body indicating the direction of the flow is turned forward the GC gas inlet. Use a 7/16-in. wrench for tightening the fittings.



7. Remove the nut and the ferrules provided from the valve inlet.



8. Connect the gas supply tube previously disconnected (see the step 4). Use a 7/16-in. wrench for tightening the fittings.



9. Turn the carrier gas on.
10. Open or close the flow of the supply gas turning the black handle of the valve up or down respectively.
11. Set the injectors, detectors, and GC working conditions.

Connecting a SSL/PTV Backflush System

This section provides instructions for connecting your SSLBKF/PTVBKF injector modules with precolumn and analytical capillary column into the oven. Refer to the chapters SSLBKF Injector Module and PTVBKF Injector Module in the *TRACE 1600/1610 User Guide*.
This system operates up to 300 °C.

CAUTION Before starting make sure the SSLBKF/PTVBKF injector module is correctly installed into its seat.

ATTENTION Avant de commencer, vérifiez que le module d'injecteur SSLBKF / PTVBKF est bien installé dans son logement.

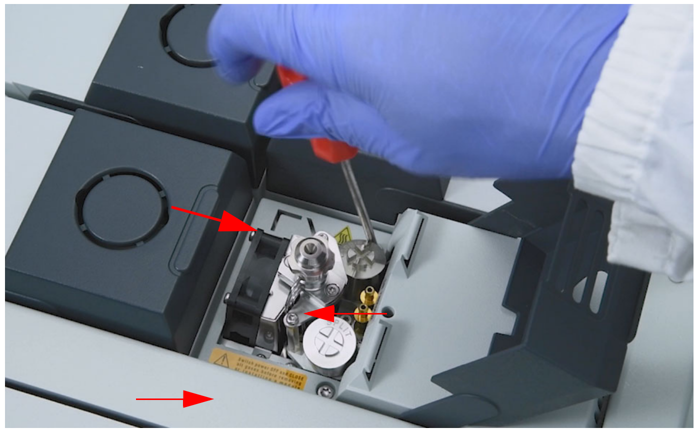
❖ To install the SSL/PTV Backflush system

1. Put the GC in standby condition.
2. Power off the GC and let it cool.

   Note You can press the **Maintenance** button to allow the GC to cool down automatically.

3. Turn the carrier feeding line off.
4. Put the autosampler away if present.
5. Install the injector module into the mainframe.
   a. Make sure the gas net O-rings are in the correct place.
   b. Place the injector module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the bottom of the injector housing.
   c. Open the module flap cover.
   d. Use a T-20 Torx head screwdriver to tighten the three captive fixing screws without overtightening. See Figure 381.

Figure 381. Module Fixing Screws



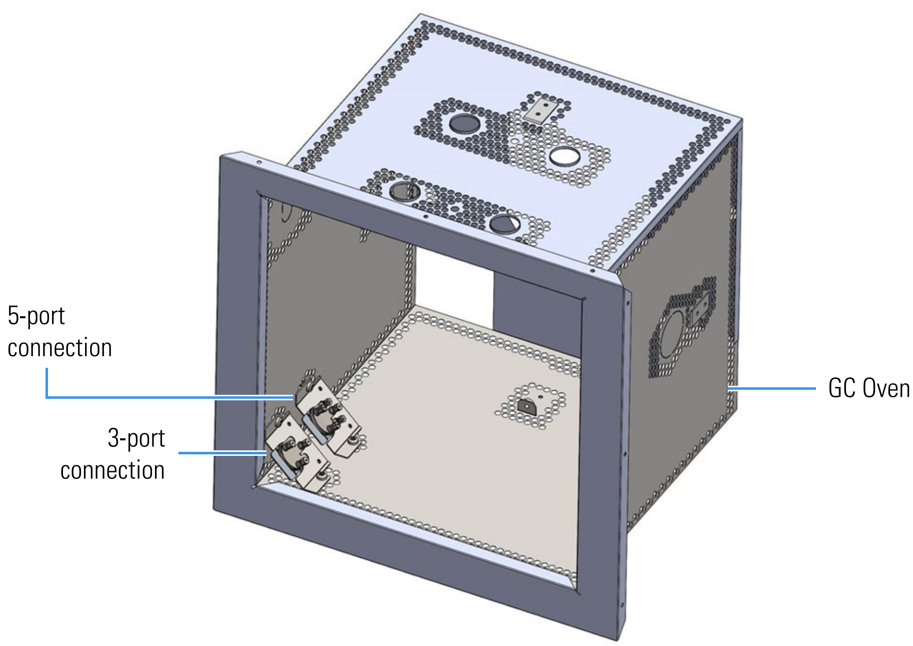
6. Close the module flap cover.
7. If present, move the autosampler towards the module to restore the original alignment.
8. Power on the GC and turn on the carrier gas.

❖ To install the bracket in the GC oven

1. Attach the bracket to the oven in one of the following areas.

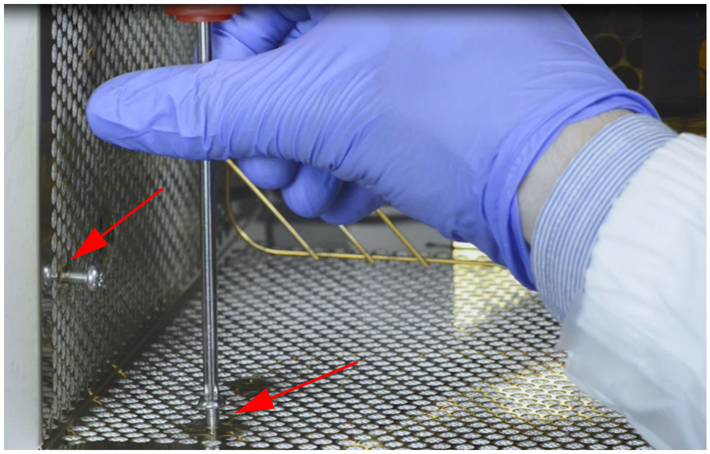
   See the following figure for the mounting bracket locations.

   Figure 382. Brackets Attached to the Pre-Drilled Holes in the GC Oven



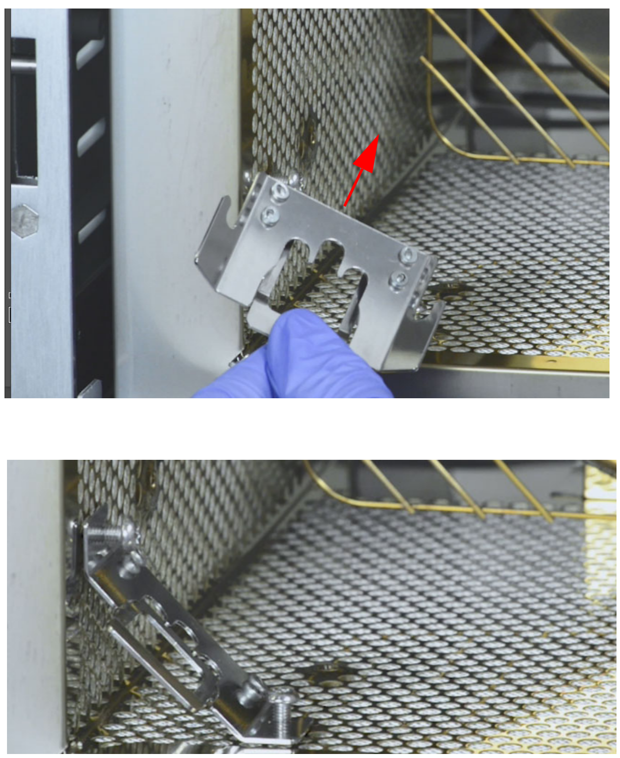
2. Screw one of the fixing screws halfway into the pre-drilled holes.

Figure 383. Attaching Fixing Screws to the Oven Wall and Floor



3. Insert the 3-port BKF Silflow device into the bracket until it snaps in.

   Figure 384. Inserting the Bracket



4. To remove the Silflow device, push the spring and pull the Silflow device out of the bracket.

Preparing and Connecting the Tubing to the SilFlow™ Device

You will need the following items to connect the tubing to the new ferrule and nut. They are all included in the complete kit.

Table 17. PTV BKF Kit Contents

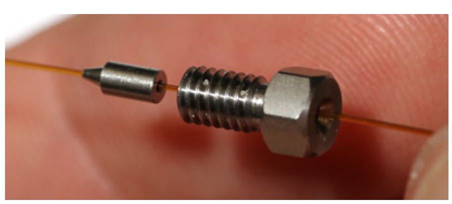
Description	Thermo Scientific Part Number
SilFlow 3-port splitter	60201-396
SilFlow FingerTite ferrules 0.50 mm (ID) (5/pk)	29063467
SilFlow FingerTite ferrules 0.40 mm (ID) (10/pk)	29063466
SilFlow FingerTite ferrules 0.35 mm (ID) (10/pk)	29063465
SilFlow SilTite ferrule 1.1 mm (5/pk)	29063463
SilFlow FingerTite tool	60201-401
Pre-swage tool, 0.4 mm	60201-415
Pre-swage tool, 0.5 mm	60201-416
SilFlow nuts (5/PK)	290SF302
Blanking pins (5/PK)	290ST414
VSD deactivated column	60201-393

Note For a 0.25 mm (ID) column, use the narrowest SilFlow ferrule fitting (typically 0.35 mm, or 0.40 mm) and a 0.40 mm Silflow FingerTite jig. For a 0.32 mm (ID) column, use a 0.50 mm SilFlow ferrule and a 0.50 mm SilFlow FingerTite jig.

❖ **To prepare the tubing**

1. Position a SilFlow nut and SilFlow ferrule onto the tubing, as shown in Figure 385.

   Figure 385. Positioning the SilFlow Nut and SilFlow Ferrule Correctly on the Tubing

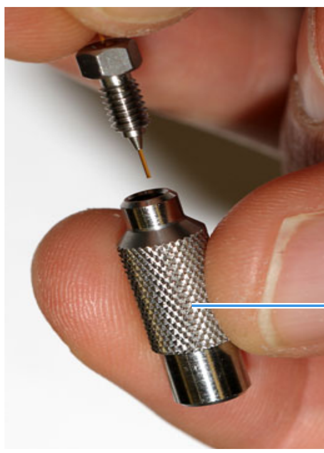
2. Use a scoring wafer to cut the tubing after inserting it through the ferrule. See Figure 346. Then use the SilFlow pre-swage tool to secure the ferrule into position.

   When done correctly, the tubing will extend slightly past the tip of the ferrule. It is important to use the SilFlow pre-swage tool to prevent crushing the tip of the fused silica.

Figure 386. Cutting the Tubing with the Scoring Wafer

3. Place the fused silica and ferrule into SilFlow pre-swage tool until the tubing reaches the bottom of the tool. When done correctly, the tubing will extend slightly past the tip of the ferrule. It is important to use the pre-swage tool to prevent crushing the tip of the fused silica. See Figure 387.

Figure 387. Inserting the Column and Ferrule into the SilFlow Pre-Swage Tool



4. Use the SilFlow FingerTite tool to swage the ferrule to the tubing. Be sure to keep the tip of the fused silica bottomed out in the pre-swage tool. See Figure 388.

Figure 388. Swaging the Ferrule Using the SilFlow FingerTite Tool

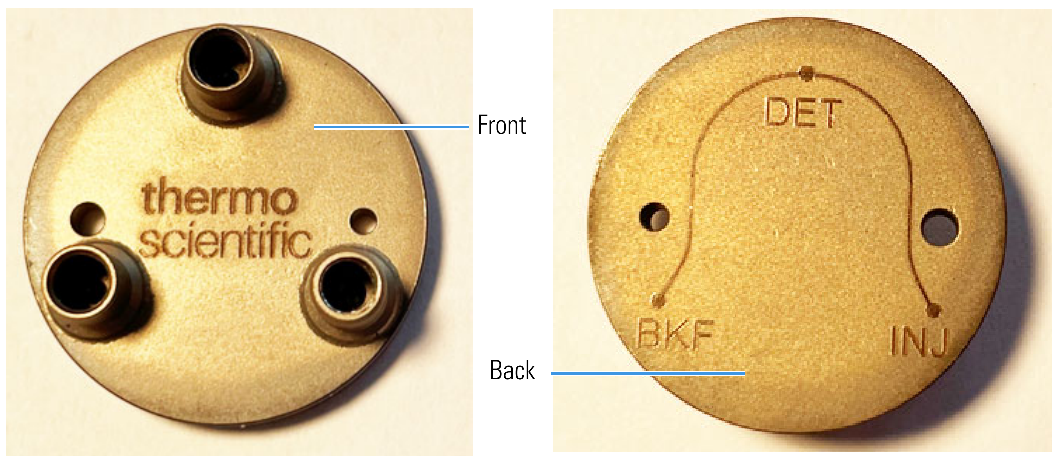
5. Remove the jig and lay the tubing carefully on the bottom of the GC until you are ready to connect it to the 3-port BKF SilFlow device.

> **Note** The metal backflush line that connects to the module has a pre-installed metal ferrule and nut.

Deactivated 3-Port Silflow Connections

The deactivated 3-port BKF Silflow device has three dedicated connections: **BKF**, **DET**, and **INJ**, as shown in Figure 389.

Figure 389. 3-port BKF Connections



Depending on your backflush configuration, the **DET** and **INJ** position can be connected to a Pre-Column, Mid-Column, or Post-Column.

The 1.1 mm metal tubing from the BKF module is always connected to the **BKF** port on the Silflow.

The fused silica is connected to the **INJ** and **DET** port and configured depending on the following:

- **Pre-Column backflush**—Install the column in the **DET** port on the 3-port Silflow and connect the pre-column to the **INJ** port.

> **Note** The two pre-columns provided in the standard outfit are: 5 m, 0.32 mm (ID) and 2 m, 0.53 mm (ID) - 0.2 m, 0.32 mm (ID) The wide bore pre-column is suggested when using polar solvents, such as acetone, methanol, or acetonitrile, which are used in QuEChERS analysis. The wide bore precolumn must be connected in the following way: the 0.53 mm (ID) to the injector and the 0.32 mm (ID) to the Silflow.

> **Note** When using the 2 m, 0.53 mm (ID) – 0.2 m 0.32 mm (ID) pre-column, the PTV injector bottom fitting must be replaced with the 1 mm (ID) bottom fitting (P/N 35008429) included with the module standard outfit.

> **CAUTION** When using standard 0.53 mm (ID) pre-columns, you must use the dedicated BKF kit for 0.53 mm pre-columns (P/N MI-190AC6-0049).

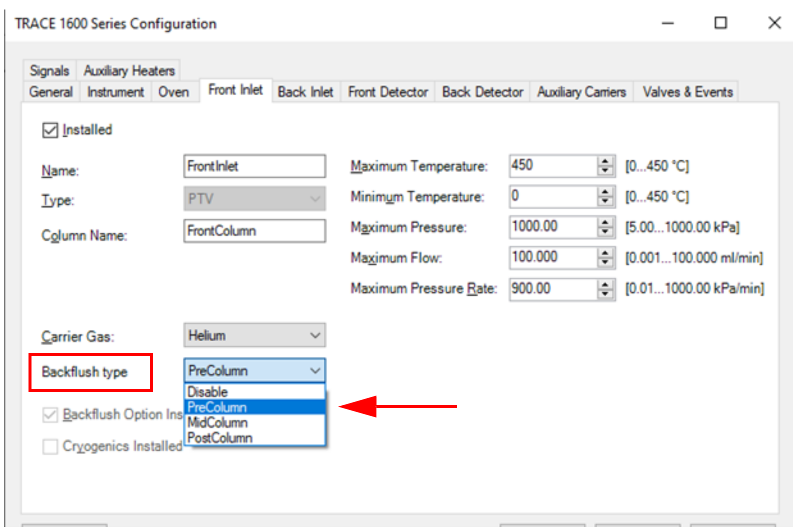
- **Mid-Column backflush**—Install the first part of the column in the **INJ** port on the Silflow and the second part of the column to the **DET** port.
- **Post-Column backflush**—Install the column in the **INJ** port on the 3-port Silflow and the dedicated 1 m, 0.1 mm (ID) fused silica post-column (P/N 60201-393) in the **DET** port.

Column I.D. (mm)	Ferrule (mm)
0.25	0.35 or 0.40
0.32	0.50

CDS Column Configuration

In the CDS configuration page, choose the **Backflush type** according to the BKF hardware installed (Pre-Column, Mid-Column, Post-Column BKF).

Figure 390. Selecting the Backflush Type



Connecting a GSV Backflush System

This sections provides instructions for connecting your Gas Sampling Valve module with precolumn and analytical capillary column into the oven of the TRACE 1600/1610 GC. Refer to the chapters Gas Sampling Valve (GSV) Module in the *TRACE 1600/1610 User Guide*.

The Gas Sampling Valve backflush system is provided with the kit PN 19050764.

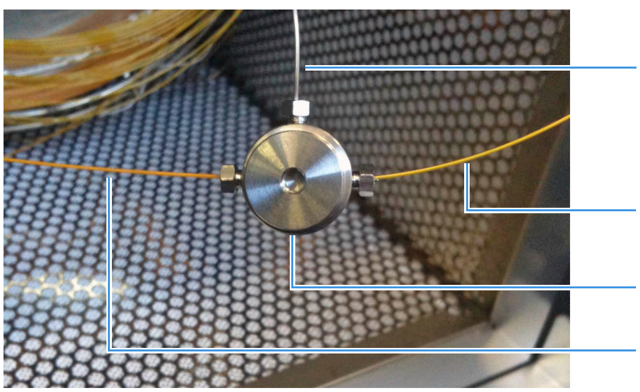
❖ **To connect backflush line, precolumn, and analytical capillary column**

CAUTION Before starting make sure the Gas Sampling Valve (GSV) module is correctly installed into its seat.

ATTENTION Avant de commencer, vérifiez que le module à vanne d'échantillonnage de gaz (GSV) est bien installé dans son logement.

The result of this operation is schematically shown in the example of Figure 391.

Figure 391. Connecting GSV Backflush Line, Precolumn, and Analytical Capillary Column



Note Could be necessary to adjust the position of the three-way connector when installing backflush line, precolumn, and capillary column to stress as minimal as possible.

When the GSV module is inserted into its position on the upper deck of the GC, the backflush line metal tubing protrudes into the GC oven.

1. Open the front door of the GC.

2. Remove nut and ferrule from the metal tubing of the GSV nodule.

3. Connect the backflush line metal tubing coming from the bottom of the Gas Sampling Valve module to the three-way connector.

   a. Slide the 1/32-in. nut and the Vespel/Graphite ferrule PN 29003428 onto the end of the backflush line with the beveled end facing towards the three-way connector.

   b. Insert the backflush line into the central position of the three-way connector.

   c. Slide the retaining nut onto the backflush line through its side cut.
   d. Use the 5 mm wrench to tighten the retaining nut. Use enough pressure necessary to obtain a good seal without overtighten.

4. Connect the precolumn to the Tee connector.
   a. Place the precolumn on the column support.
   b. Slide the 1/32-in. nut and the proper Vespel/Graphite ferrule onto the precolumn with the beveled end facing towards the three-way connector. Always use a new ferrule of the correct diameter.
   c. Cut 1 cm from the precolumn end.
   d. Insert the precolumn in one of the two external positions of the three-way connector.
   e. Finger-tighten the precolumn retaining nut until it starts to grip the precolumn.
   f. Use the 5 mm wrench to tighten the retaining nut. Use enough pressure necessary to obtain a good seal without overtighten.

5. Connect the precolumn to the injector base.
   a. Slide the M6 nut and the graphite ferrule onto the fused silica precolumn with the beveled end facing towards the injector.
   b. Cut 1 cm from the precolumn.
   c. Insert the precolumn into the injector and slide the ferrule up to the injector base. Insert the precolumn until it reaches the mechanical stop, then draw it back 1 mm.
   d. Finger-tighten the precolumn retaining nut until it starts to grip the precolumn.
   e. Use the 1/4-in. wrench to tighten the retaining nut. Use enough pressure necessary to obtain a good seal without overtighten.

6. Connect the capillary column to the three-way connector.
   a. Place the capillary column on the column support.
   b. Slide the 1/32-in. nut and the proper Vespel/Graphite ferrule onto the capillary column with the beveled end facing towards the three-way connector.
   c. Cut 1 cm from the end of the capillary column.
   d. Insert the end of the capillary column in the free position of the three-way connector.
   e. Finger-tighten the column retaining nut until it starts to grip the column.
   f. Use the 5 mm wrench to tighten the retaining nut. Use enough pressure necessary to obtain a good seal.

7. Connect the capillary column to the detector base.
   a. Slide the nut and the graphite ferrule onto the capillary column with the beveled end facing the detector base.

b. Be careful to avoid damaging the graphite ferrule when inserting the capillary column.

c. Cut 2–3 cm from the end of the capillary column.

d. Insert the capillary column into the detector base body and slide the ferrule up to the detector base.

e. Finger-tighten the capillary column retaining nut until it starts to grip the column.

f. Push the capillary column through the detector base according to the detector in use.

g. Use the 1/4-in. wrench to tighten the retaining nut.

h. Use enough pressure necessary to obtain a good seal without overtighten.

Installing the NoVent Microfluidics

This section provides instructions for installing the NoVent™ Microfluidics on your TRACE 1600 or TRACE 1610 GC, and your ISQ or TSQ 8000 Series mass spectrometer.

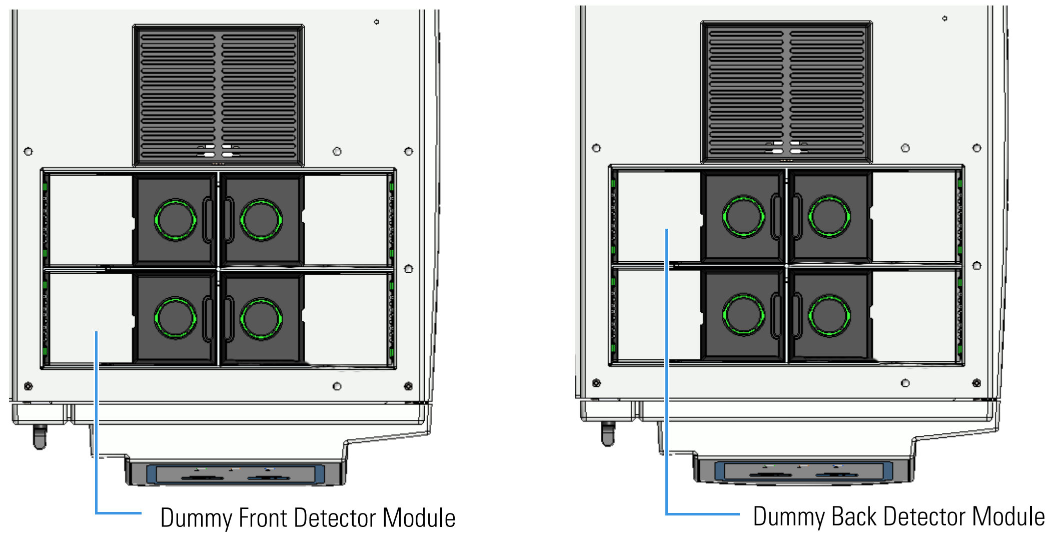
Contents

Connecting the NoVent Microfluidics Module to the TRACE 1600/1610

According to the configuration of your TRACE 1600 or TRACE 1610 GC, a dummy module is present in the free site where the detector module is not installed.

If no dummy module is present, and no vacant module position is present on either the TRACE 1600 or TRACE 1610 GC or on the optional gas valve oven (if you have one), you must take one of the existing and installed modules off in order to install the NoVent Microfluidics.

Figure 392. Location of Detector Modules on your TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

❖ To connect the NoVent Microfluidics module to the TRACE 1600/1610 GC

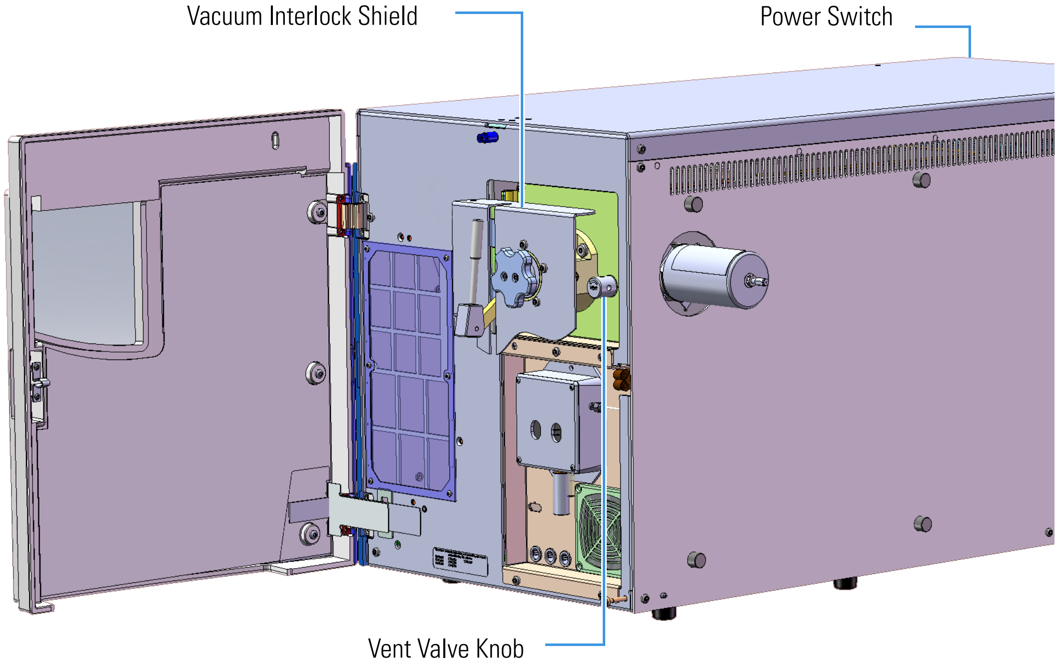
1. Cool the oven, injector or injectors, transfer line, ion source, and any installed GC detectors to room temperature and shut down the GC.

WARNING - BURN HAZARD: The injectors, detectors, oven, and transfer line may be hot. Allow them to cool to room temperature before touching them.

2. Push down on the power switch to power off the GC.
3. Shut down the TSQ 8000 Series or ISQ mass spectrometer using the software. See your mass spectrometer's user guide for more information. The heaters and the turbomolecular pump power off.
4. If you are using hydrogen as a carrier gas, unscrew the hydrogen safety screw on the front door of the mass spectrometer.

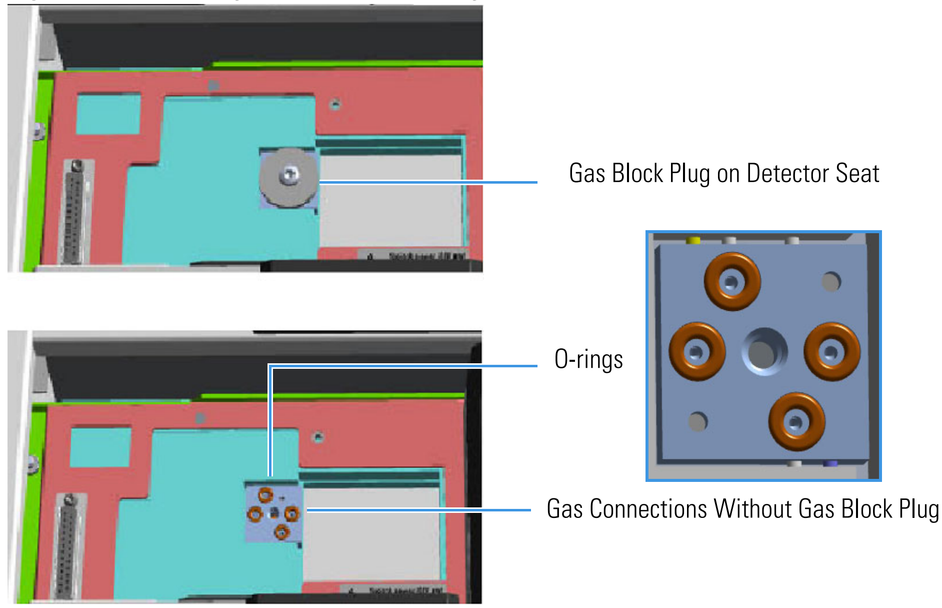
WARNING - FIRE HAZARD: If you are using hydrogen, do NOT reach over the top of the instrument to power it off. Instead, reach around the right side or go to the back of the instrument and flip down the power switch.

Figure 393. Finding the Vent Valve on the Mass Spectrometer



5. Open the front door of the mass spectrometer.
6. Look behind the right side of the vacuum interlock shield and twist the vent valve knob
7. one and a half times in a counter-clockwise direction to open the vent valve.
8. Wait five minutes for the mass spectrometer to vent.
9. Open the front door of the GC and loosen the transfer line nut. Then pull the column back (into the oven) about 5 cm to ensure the column is no longer in the ion source.
10. Close all GC gas supplies. Shut the carrier gas supply off at its source, such as the tank.
11. Remove the dummy module from the position where the NoVent Microfluidics will be installed. The most convenient location for accessing the tubing connections is the front position.
    a. Open the module flap cover.
    b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.
    c. Keeping the dummy module flap cover open, lift up the module from its seat in the detector housing. Place the dummy module on a clean surface.
    d. Remove the gas plug by unscrewing its fixing screw using a T20 Torxhead screwdriver.

Figure 394. Removing the Detector Gas Plug



WARNING Make sure all four O-rings are correctly seated on the gas connection. Do not install the module if the O-rings are missing.

12. Install the No-Vent module.
    a. Open the module flap cover.
    b. Keeping the module flap cover open, place the module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the detector seat of the detector housing.
    c. Use a T20 screwdriver to tighten the three captive fixing screws without overtightening.

    Note Tighten the center screw first and then secure the side screws.

    d. Close the module flap cover.
13. Power on the GC.
14. Switch the module on so that the LED light glows green and start the carrier gas flowing to purge the line.

Note This module requires a constant carrier gas pressure of 60 psig (410 kPa).

Installing the Mounting Bracket

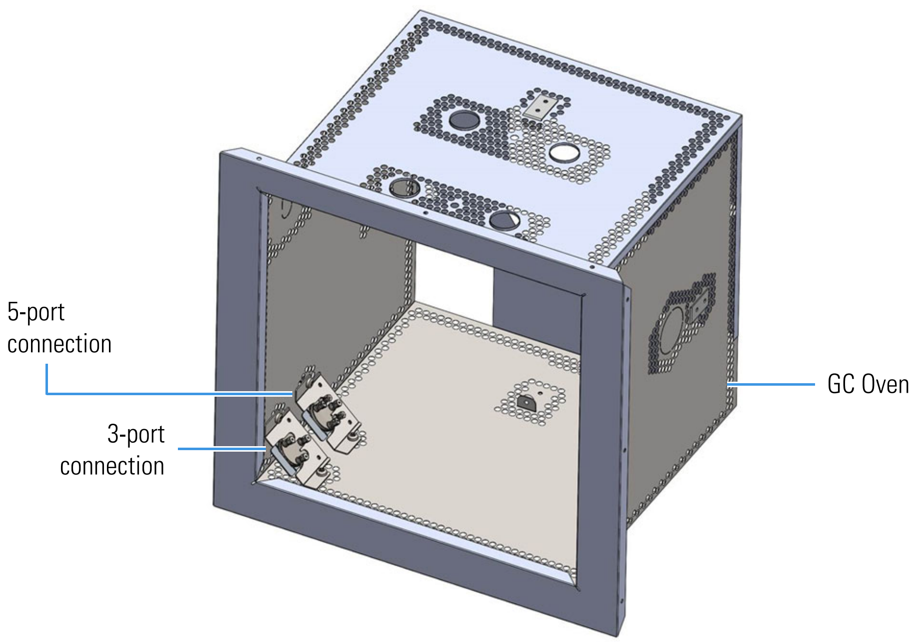
Install the mounting bracket near the front of the GC oven on the right-hand side. This will keep the mounting bracket out of the way of the column.

Note If you already have a mounting bracket installed in your GC with either the SSL backflush or PTV backflush system, skip this step.

❖ To install the bracket in the GC oven

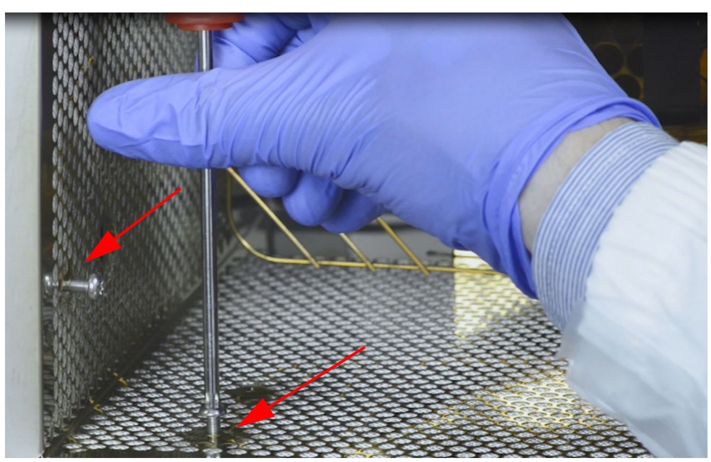
1. Attach the bracket to the oven in one of the following areas. See the following figure for the mounting bracket locations.

Figure 395. Brackets Attached to the Pre-Drilled Holes in the GC Oven



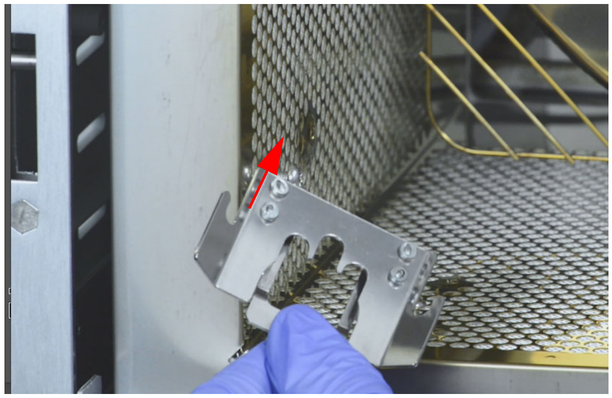
2. Using a T20 Torxhead screwdriver, insert both of the fixing screws halfway into the pre-drilled holes.

Figure 396. Attaching Fixing Screws to the Oven Wall and Floor



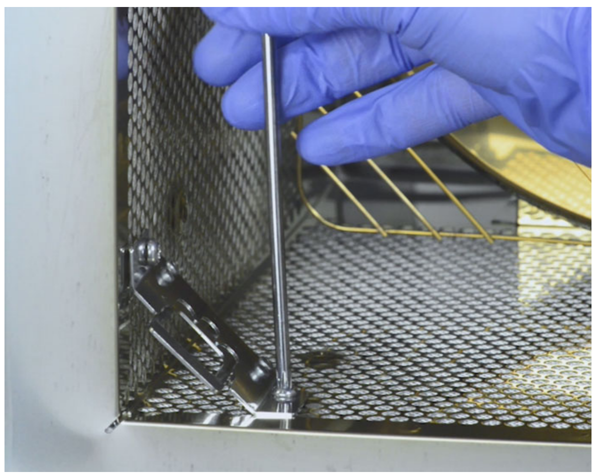
3. Slide the bracket until the screws snap into place.

Figure 397. Inserting the Bracket



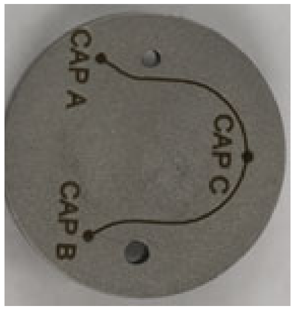
4. Tighten the two fixing screws to mount the bracket in place. See Figure 398.

Figure 398. Tightening the Fixing Screws



5. Attach the Thermo Scientific™ Microfluidics splitter to the mounting bracket. The microfluidics splitter snaps into place.

Figure 399. Microfluidics Splitter



Preparing the NoVent Microfluidics Restrictor Tubing

If you are using helium as a carrier gas, use the 30 cm length of 75 µm fused silica tubing in your kit (two are supplied) to connect the NoVent Microfluidics module to the splitter.
If you are using hydrogen as a carrier gas, use the 80 cm length of 75 µm fused silica tubing in your kit (one is supplied) to connect the NoVent Microfluidics module to the splitter.
This tubing acts as a flow restrictor to limit the helium flow from the NoVent microfluidics module. You must swage a SilTite™ ferrule to this tubing.

You will need the following materials to connect the tubing to new ferrule and nut. They are all included in the complete kit.

- SilTite FingerTite™ pre-swage tool—to pre-swage the SilTite FingerTite ferrule to the GC module
- SilFlow™ pre-swage tool and SilFlow FingerTite tool—to pre-swage the SilFlow ferrule to the microfluidics splitter
- SilFlow nut—to connect the tubing to the microfluidics splitter
- SilTite ferrule (1)
- SilFlow ferrules (3)

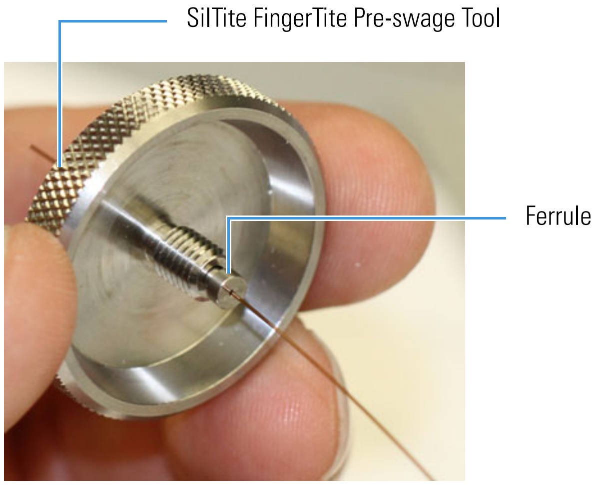
Note For a 0.25 mm i.d. column, use the narrowest SilFlow ferrule fitting (typically 0.35 mm, or 0.4 mm) and a 0.4 mm Silflow FingerTite jig.

For a 0.32 mm i.d. column, use a 0.5 mm SilFlow ferrule and a 0.5 mm SilFlow FingerTite jig.

1. Use a scoring wafer to cut the end off the tubing.
2. Use the SilTite FingerTite pre-swage tool in your kit to pre-swage the SilTite ferrule to your tubing. See Figure 400. The tubing should extend just past the tool when pre-swaging the ferrule. After the ferrule is swaged, remove the tool and confirm the ferrule does not slide on the tubing.

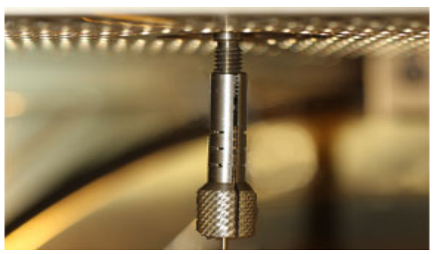
   Then cut the tubing to about 2 mm past the tip of the ferrule. See Figure 400.

Figure 400. Pre-swaging the Ferrule to the 30 cm Fused Silica Tubing



3. Insert the ferrule and the tubing into the NoVent microfluidics module. See Figure 401.

   Figure 401. Securing the 30 cm Fused Silica Restrictor to the No-Vent Microfluidics Module

4. Add the FingerTite screw to the module and tighten.

5. Now you must prepare the other end of the tubing to connect to the microfluidics 3-port splitter. It is much easier to attach the ferrule to the tubing while it is outside the GC. You will connect it to the splitter later.

6. Position a SilFlow nut and SilFlow ferrule onto the tubing as shown in Figure 402.

   Figure 402. Positioning the SilFlow Nut and SilFlow Ferrule Correctly on the Tubing

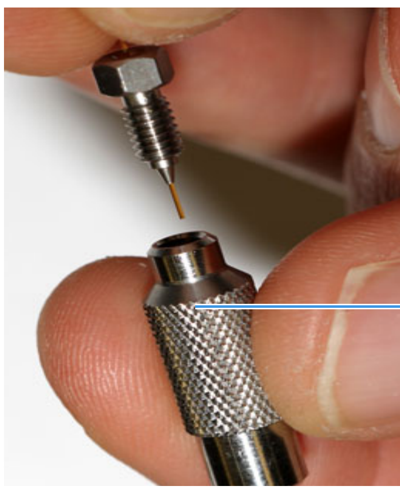
7. Use a scoring wafer to cut the tubing after inserting it through the ferrule. See Figure 403. Then use the SilFlow pre-swage tool to secure the ferrule into position. When done properly, the tubing will extend slightly past the tip of the ferrule.

It is important to use the SilFlow pre-swage tool in order to prevent crushing the tip of the fused silica. See Figure 403.

Figure 403. Cutting the Tubing with the Scoring Wafer

8. Place the column and ferrule into SilFlow pre-swage tool until the tubing reaches the bottom of the tool. When done properly, the tubing will extend slightly past the tip of the ferrule. It is important to use the pre-swage tool in order to prevent crushing the tip of the fused silica. See Figure 404.

Figure 404. Inserting the Column and Ferrule into the SilFlow Pre-Swage Tool



9. Use the SilFlow FingerTite tool to swage the ferrule to the tubing. Be sure to keep the tip of the fused silica bottomed out in the pre-swage tool. See Figure 405.

Figure 405. Swaging the Ferrule Using the SilFlow FingerTite Tool

10.Remove the jig, and lay the tubing carefully on the bottom of the GC until you are ready to connect it to the microfluidics splitter.

Attaching the Ferrule and Nut to the GC Column

You will need the following materials to connect the column to new ferrule and nut. They are all included in the complete kit.

- SilFlow FingerTite tool
- SilFlow pre-swage tool
- SilFlow nut
- SilFlow ferrules

Note For a 0.25 mm i.d. column, use the narrowest SilFlow ferrule fitting (typically 0.35 mm, or 0.4 mm) and a 0.4 mm Silflow FingerTite jig.

For a 0.32 mm i.d. column, use a 0.5 mm SilFlow ferrule and a 0.5 mm SilFlow FingerTite jig.

❖ To add the new ferrule and nut to the column

1.Attach the ferrule to the column while it is outside the GC. You will connect it to the module later.

2. Position the SilFlow nut and SilFlow ferrule onto the column as shown in Figure 406.

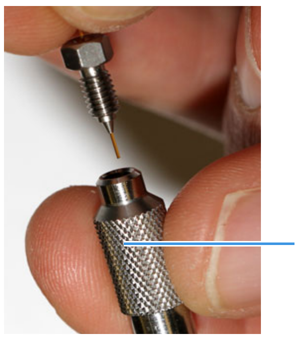
Figure 406. Positioning the Nut and Ferrule Correctly on the Column

3. Use a scoring wafer to cut the column after inserting it through the ferrule. Then use the appropriate pre-swage tool to secure the ferrule into position. When done properly, the tubing will extend slightly past the tip of the ferrule. It is important to use the pre-swage tool in order to prevent crushing the tip of the fused silica. See Figure 407.

Figure 407. Cutting the Column with the Scoring Wafer

4. Place the column and ferrule into the SilFlow pre-swage tool until the column reaches the bottom of the jig. See Figure 408.

Figure 408. Inserting the Column and Ferrule into the SilFlow Pre-Swage Tool



5. Use the FingerTite tool to swage the ferrule to the column. Be sure to keep the tip of the fused silica bottomed out in the pre-swage tool. See Figure 409.

Figure 409. Swaging the Ferrule Using the SilFlow FingerTite Tool

6. Remove the pre-swage tool, and lay the column carefully on the bottom of the GC until you are ready to connect it to the microfluidics splitter.

Attaching the New Tubing to the Transfer Line

Your kit comes with a 0.6 m and 1.2 m deactivated segments of fused silica tubing having an internal diameter of 0.17 mm. This tubing has fused ends. You must cut these ends off the tubing and attach a SilFlow ferrule before connecting it. Use this tubing to connect the microfluidics splitter to the transfer line.

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Note Use the 60 cm tubing if you are using helium as a carrier gas. Use the 120 cm length of tubing if you are using hydrogen as a carrier gas.

When connecting the column to the transfer line, you may use either the regular transfer line nut or the spring loaded transfer line nut with the graphite Vespel® ferrule.

❖ **To connect the column using the regular transfer line nut**

1. Lower the oven temperature and allow it to cool.
2. Confirm that the MS is vented and remove the current transfer line nut and ferrule.
3. Unwind about one turn of the column from the column outlet end.

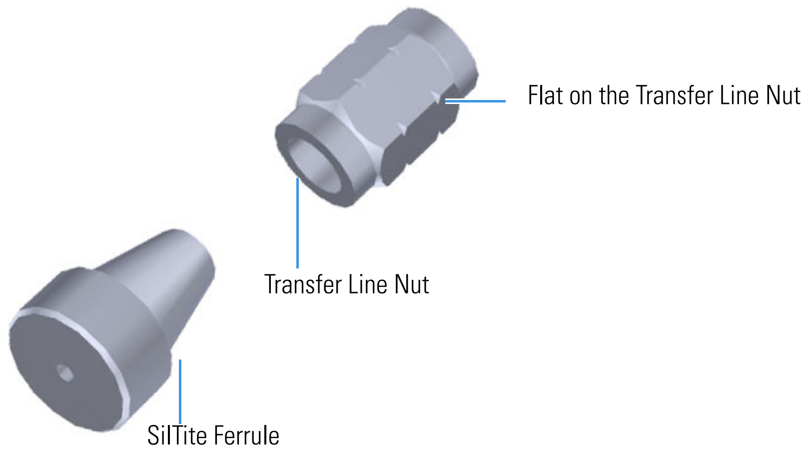
   Note Wear clean, lint- and powder-free gloves when you handle the column and transfer line ferrule.

4. Wipe approximately 300 mm (12 in.) of the column with a tissue soaked in methanol.
5. Choose an appropriate ferrule for the outer diameter of your column.

   Note If the maximum oven temperature in your method is ≥ 290 °C (554 °F), Thermo Fisher Scientific recommends using a spring loaded transfer line nut with a graphite Vespel® ferrule or a SilTite™ nut and ferrule. By cycling the oven at and above this temperature, expansion and contraction of the graphite Vespel® material can cause leaks in the transfer line.

6. Insert the column through the transfer line nut and ferrule, entering through the tapered end of the ferrule. Wipe the column again with a tissue soaked in methanol.

Figure 410. Transfer Line Nut and SilTite Ferrule Orientation

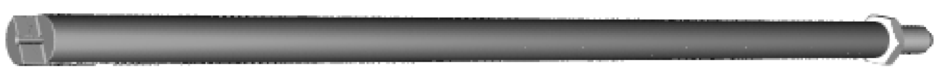


7. Insert the column into the column measuring tool (see Figure 411), which is in the ISQ Toolkit, so that it is even with the lines at the end of the column. Figure 412 indicates proper positioning of the column in the tool for accurate measuring.

8. Use a scoring wafer to score and break the column. Use a magnifying glass to check for an even, flat cut. Repeat if necessary.

9. Use a 5/16 in. wrench to hold the column measuring tool steady.

Figure 411. Column Measuring Tool

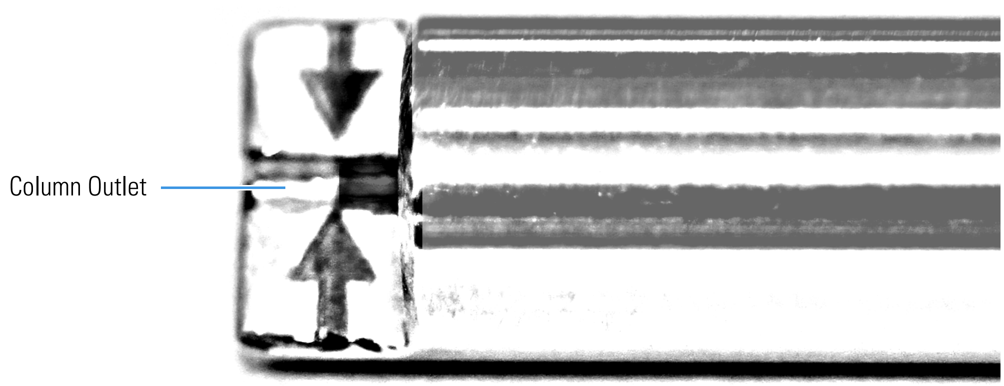


10. While holding the column measuring tool steady, tighten the transfer line nut with a 1/4 in. wrench until the column just stops moving in the ferrule.

11. Turn the transfer line nut 1 flat backward so the column is able to move in the ferrule with slight resistance.

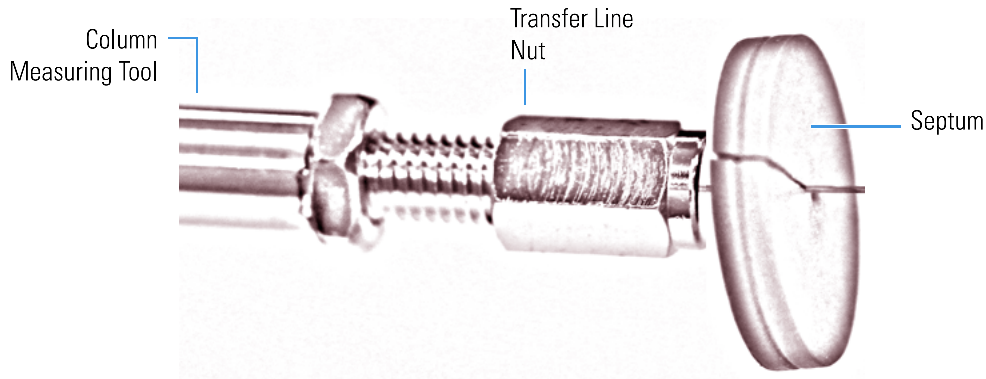
12. Line up the outlet of the column with the arrows on the end of the column measuring tool.

Figure 412. Lining Up the Column in the Column Measuring Tool



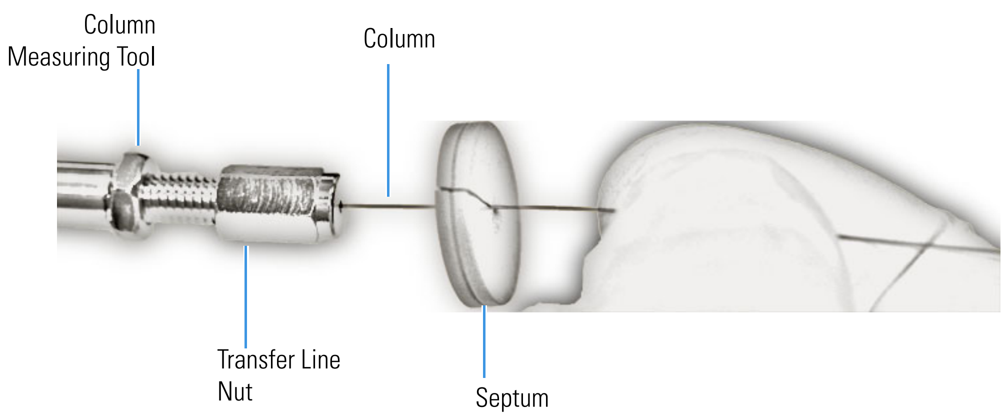
13. Place a septum with a notch cut into it behind the transfer line nut. The septum marks the place on the column where it should exit the nut.

Figure 413. Positioning the Septum



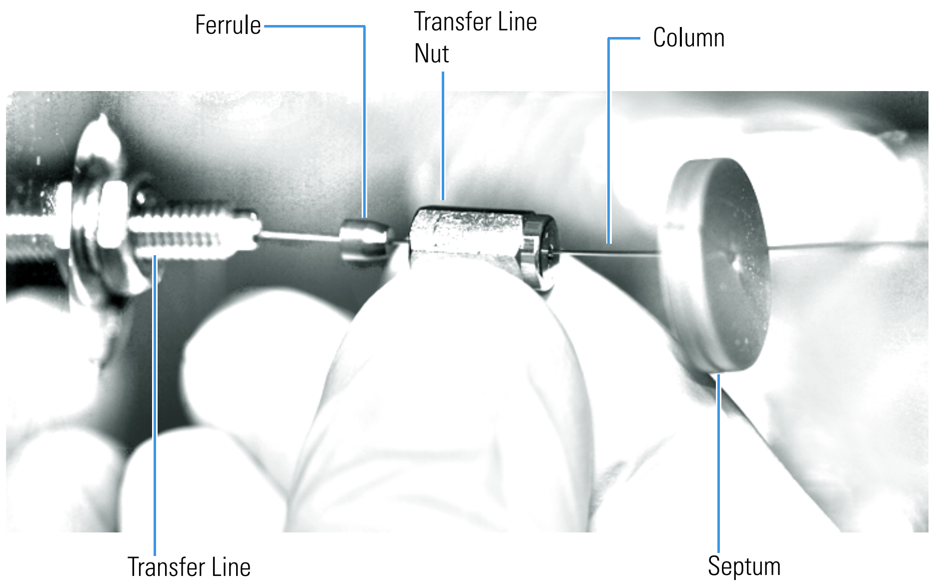
14. Pull the column back from the transfer line nut. Do not move the septum from its position on the column.

Figure 414. Pulling the Column Back from the Transfer Line Nut



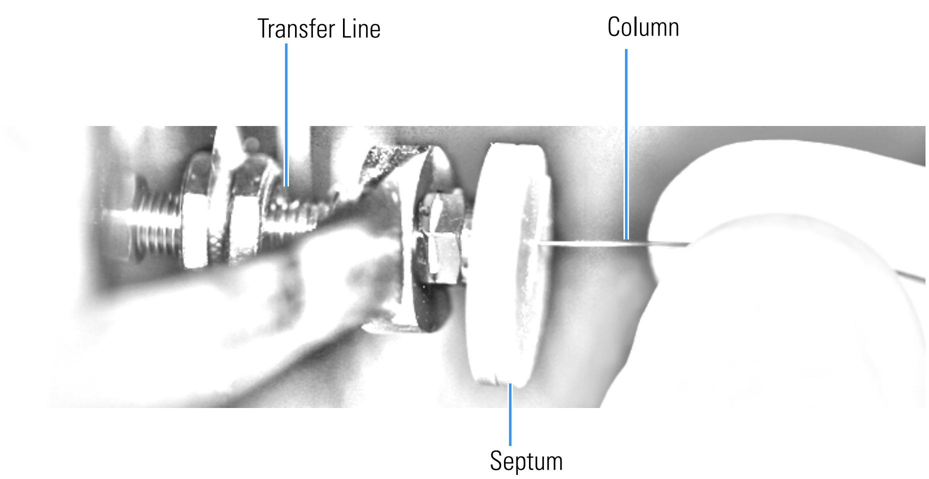
15. Loosen the transfer line nut from the column measuring tool.
16. Remove the column, transfer line nut and ferrule from the column measuring tool, making sure not to move the septum from its location on the column.
17. Insert the column into the transfer line.

Figure 415. Inserting the Column into the Transfer Line



18. Tighten the transfer line nut until it is just secure enough so that you cannot move it.
19. Loosen the nut by turning it exactly 1 flat backward.
20. Position the column in the transfer line. Use the septum as a guide to measure the correct length you should insert the column. Be careful not to change the location of the septum on the column.

Figure 416. Positioning the Column in the Transfer Line



21. Tighten the nut 1 flat forward—back to where it is secure enough in the transfer line that you cannot move it.
22. Tighten the nut 1 additional quarter turn.
23. Remove the cut septum.

24. Close the front door of the GC.

Note If you are using a SilTite ferrule, follow the instructions that come with SilTite ferrules. If you are using a graphite Vespel ferrule, they require conditioning to ensure a leak-tight seal. See the *ISQ Spare Parts Guide* for information about ordering these ferrules.

25. Condition the graphite Vespel ferrule:
    a. Raise the oven temperature to the maximum temperature you will operate the GC column.
    b. Wait 10 minutes.
    c. Lower the oven temperature to 40 °C (104 °F) and allow it to cool before continuing.

WARNING BURN HAZARD The oven may be hot. Allow it to cool to room temperature before opening it. The injector will still be hot, so do not touch it.

    d. Retighten the transfer line nut.

26. Restore working conditions.
    a. Raise the oven temperature to the initial temperature that you will use.
    b. Turn on vacuum compensation on the GC.
    c. Twist the vent valve clockwise to close the valve. Be sure not to pin. the O-ring.
    d. If you are using hydrogen as a carrier gas, replace the front panel screw.
    e. Replace all remaining hydrogen safety screws if you are using hydrogen.

27. Power on the mass spectrometer.

WARNING - FIRE HAZARD: If you are using hydrogen, do NOT reach over the top of the instrument to power it on. Instead, reach around the side or go to the back of the instrument and flip up the power switch.

28. Once the instrument is pumped down and able to scan, click **Air & Water / Tune** on the Dashboard view air water spectra and look for evidence of leaks with a large *m/z* 28 signal. If you observe a leak, stop scanning and gently tighten the nut in small increments until no leaks appear when scanning.

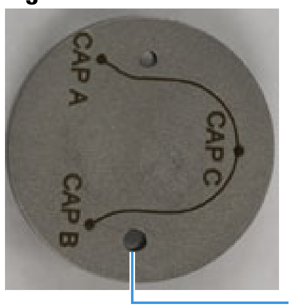
Connecting the Capillaries to the Microfluidics Splitter

You can attach now attach all the capillaries to the microfluidics splitter.

❖ To connect the capillaries to the microfluidics splitter

1. Place the ferrule connected to the original GC column into capillary B location on the microfluidics splitter. See Figure 417. This corresponds to the bottom of the three holes on a correctly installed splitter.

Figure 417. Correct Orientation for the Microfluidics Splitter

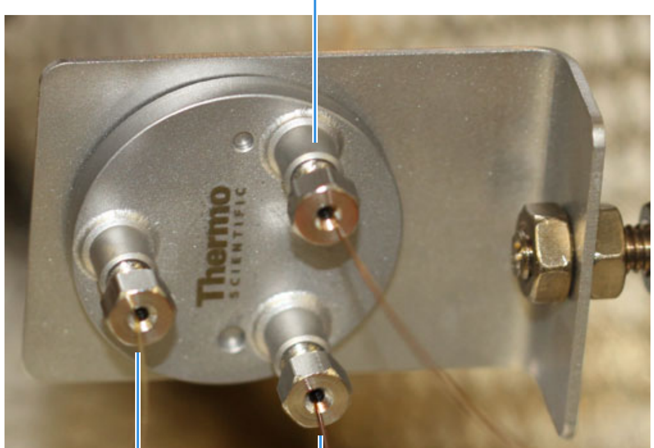


> **Tip** If a ferrule gets stuck in the microfluidics splitter, use a thumbtack or similar pointed tool for removal. Insert the point of the tool between the ferrule and threads and press so that the ferrule is forced off center. This will dislodge the ferrule.

2. Use the FingerTite tool to secure the nut you previously attached to the column to top of the three holes on the microfluidics splitter.

3. Orient the capillary connected to the transfer line and the one attached to the no-vent module as shown in Figure 418.

Figure 418. Correct Orientation of Columns to Microfluidics Splitter



4. Close the GC door.

5. Close the vent valve knob.

6. Power on the mass spectrometer.
7. Ensure the switch is set to **Off** on the NoVent microfluidics module.
8. Let the mass spectrometer pump down for a minimum of one hour and then check the air-water spectrum for gross leaks. Assuming the convection gauge and ion gauge (if present) indicate appropriate pressures, small leaks can be located by spraying with Freon, argon, or another suitable gas near the tubing connections.

Configuring the Post-Column

After installing the NoVent Microfluidics, you must enter the post-column length and ID before running samples. This section contains instructions for configuring your post-column settings on both a TRACE 1610 and a TRACE 1600.

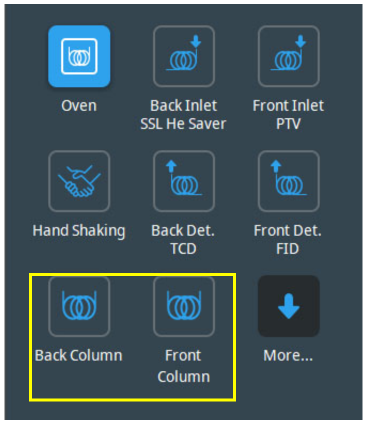
❖ To enter post-column settings on a TRACE 1610

1. On the home page of the TRACE 1610 touchscreen, click the **Configuration** icon.

Figure 419. Locating the Configuration Icon on the TRACE 1610 Touchscreen

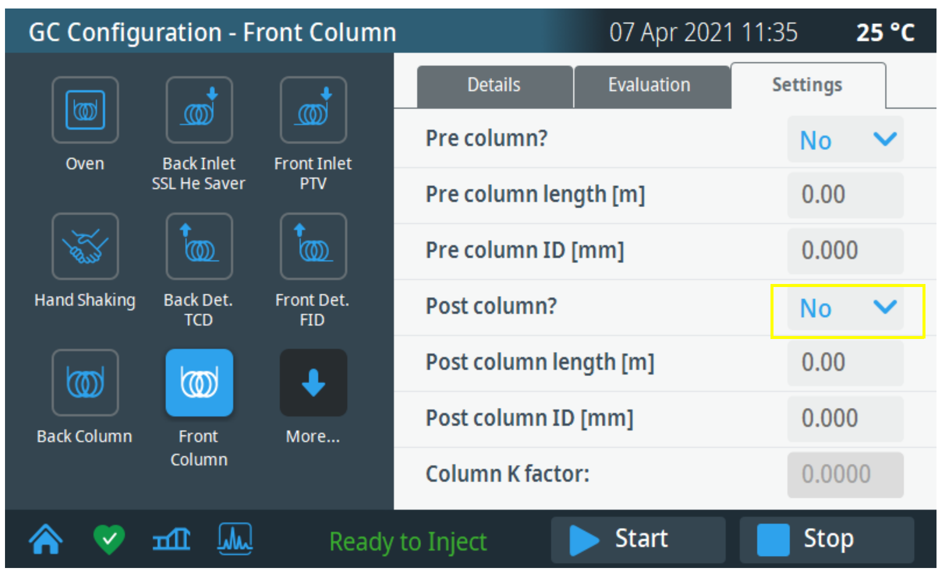
2. The default **GC Configuration** screen opens. Click the **Back Column** or **Front Column** button, depending on where you installed the No-vent Microfluidics.

Figure 420. Back Column and Front Column Icons



3. The **GC Configuration (Front or Back Column)** screen opens. Click the **Settings** tab to access the post column settings.

Figure 421. Configuring the Post Column Settings



4. Select **Yes** from the **Post Column?** menu. Enter the post column length and ID in the boxes below.

IMPORTANT For hydrogen, the **Post Column Length** is 1.2 m. For helium, the **Post Column Length** is 0.6 m. The **Post Column ID** is 0.17 mm for both hydrogen and helium.

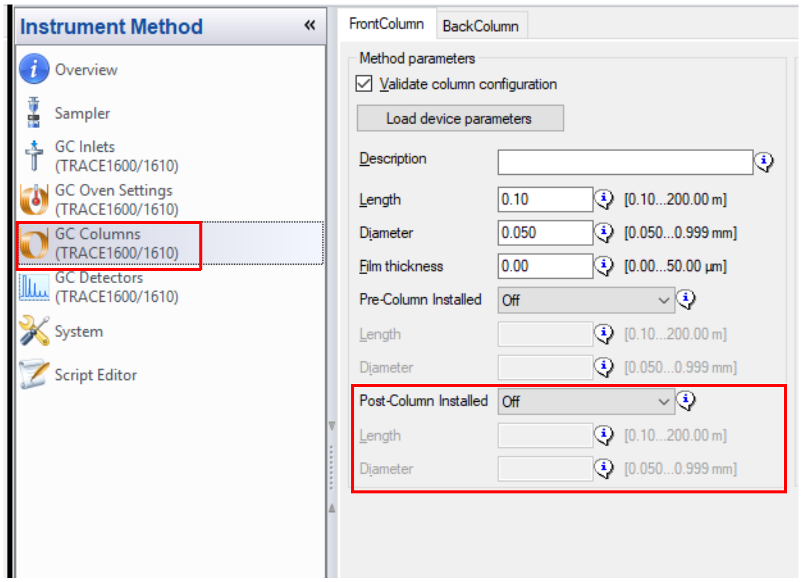
5. Click the home icon when you are finished.

❖ To enter the post-column settings on a TRACE 1600

1. Open Chromeleon Configuration window by clicking the icon on your desktop.
2. In the **Front Inlet** or **Back Inlet** tab, select **PostColumn** for **Backflush Type**.

3. Click **Ok**.
4. Open Chromeleon and select **GC Columns** in the **Instrument Method** pane.

Figure 422. GC Columns



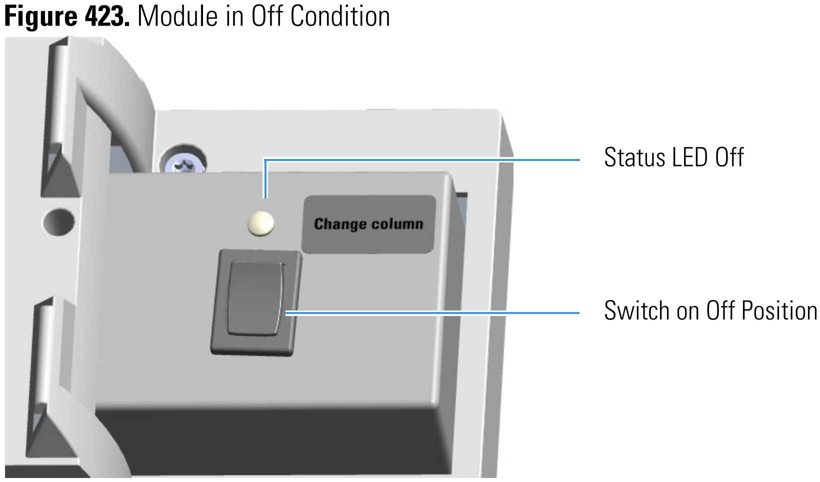
5. Choose the **FrontColumn** or **BackColumn** tab. Next, select the **Post-Column Installed** drop down box and choose **On**. Enter the post-column length and diameter.

Using the Module

The GC does not recognize the presence of the NoVent microfluidics, so it is invisible to the system. The module receives only the voltages for supplying the solenoid valve and the On/Off light from the GC.

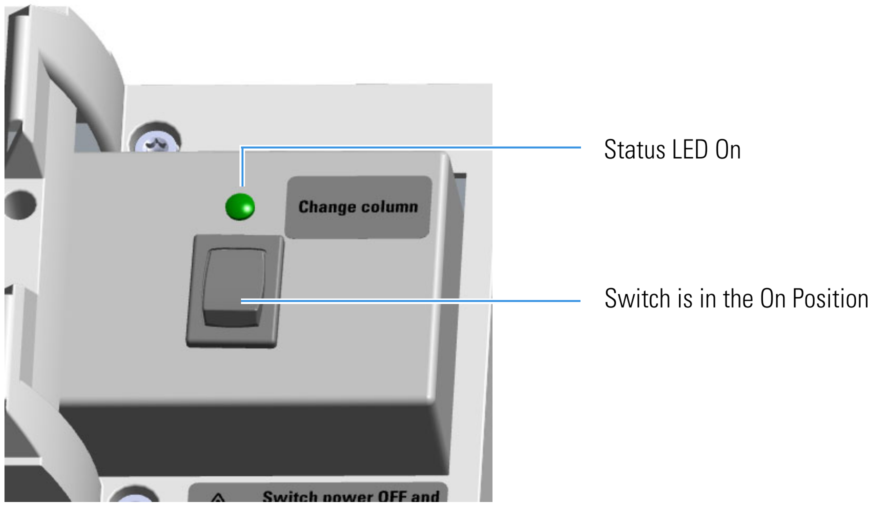
The normal condition of the module is **Off**. If the switch is in the **Off** position, the Status LED is **off**. See Figure 423.

Figure 423. Module in Off Condition



Before replacing the column or performing maintenance on an injector module, flip the switch to the **On** position. Ensure the mass spectrometer is in standby mode and the filament is off. The status LED lights up as solid green indicating that the solenoid valve is activated. The carrier gas flows into the mass spectrometer to avoid breaking vacuum. See Figure 424.

Figure 424. Module in On Condition

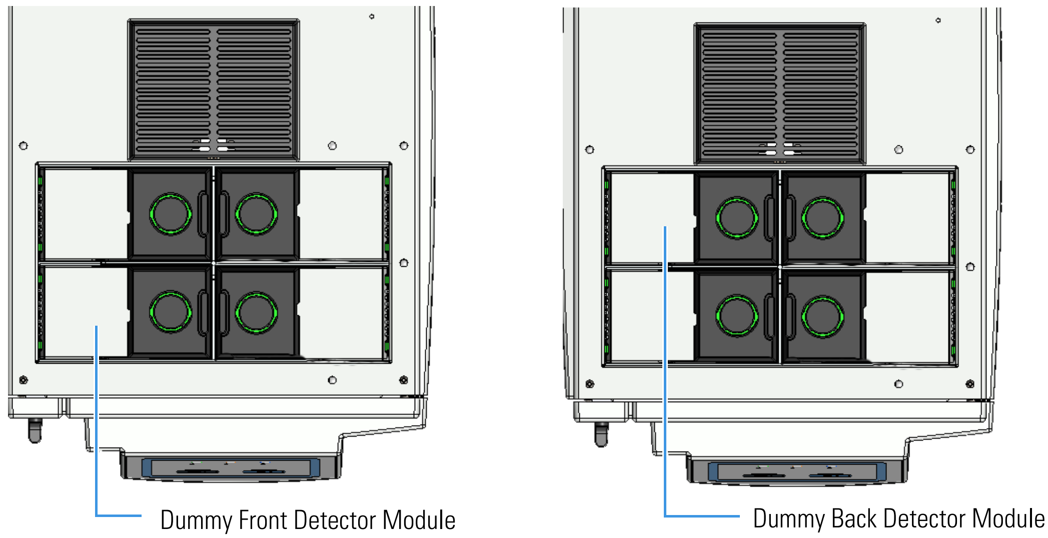


When you have completed your tasks, flip the switch to the **Off** position. The status LED turns **Off** indicating the solenoid valve is deactivated.

Installing a FTIR Make-up Module

This section provides instructions for installing the FTIR Make-up module on your TRACE 1600/1610 for the connection with the Thermo Scientific Nicolet iS50 FT-IR Spectrometer. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the detector module is not installed. See Figure 425.

Figure 425. Add a Front/Back Detector Module



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

The FTIR Make-up module must be installed into the detectors housing, and supplied through the line of the front/back carrier gas.

IMPORTANT If the front/back carrier gas is not already used by an injector module, you must install the front/back carrier gas inlet, and connect the carrier gas line as described in the section "Making the Gas Supply Plumbing Connections" on page 8.

The module is equipped with an ON/OFF needle valve for the regulation of the gas flow.

- Open the needle valve manually turning the knob counter-clockwise.
- Close the needle valve manually turning the knob clockwise.

Perform the regulation of the gas flow using a little flat head screwdriver.

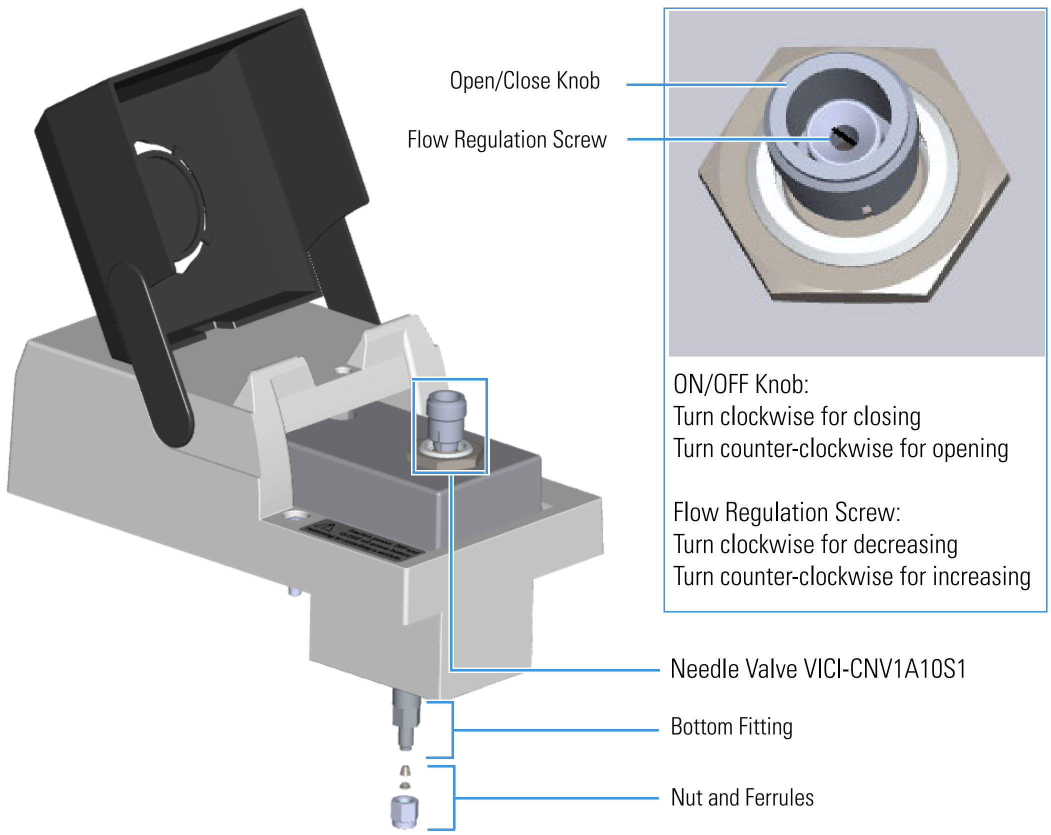
- Increase the gas flow turning the flow regulation screw counter-clockwise.
- Decrease the gas flow turning the flow regulation screw clockwise.

The standard operating value is in the range 0.2- 0.3 mL/min. Refer to the *Nicolet iS50 FT-IR Spectrometer Manual* for details.

IMPORTANT The flow of the carrier gas depends on the inlet pressure. Set the carrier gas flow according to the working pressure.

The components of the FTIR module are shown in Figure 426.

Figure 426. FTIR Make-up Module



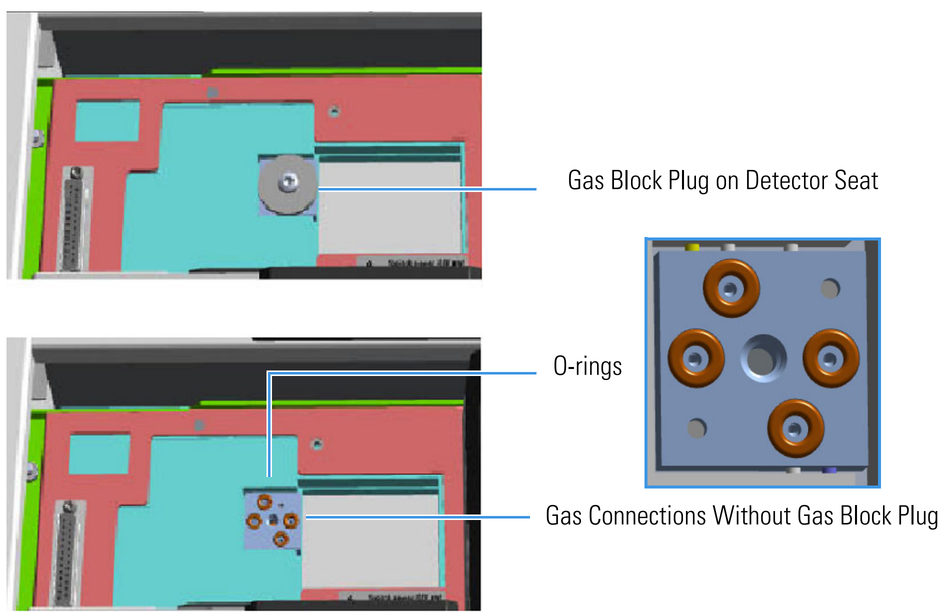
❖ To add a FTIR Make-up module

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Remove the dummy module from the position where the FTIR module will be installed.
    a. Open the module flap cover.
    b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.
    c. Keeping the dummy module flap cover open, lift up the module from its seat in the detector housing. Place the dummy module on a clean surface.
    d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver. See Figure 427.

Figure 427. Detector Gas Block Plug



WARNING Make sure all four O-rings are placed into their seat on the gas connection. See Figure 427.

Do not install the module if the O-rings are missing.

7. Open the front door of the GC.

8. Plug the FTIR Make-up module into the main frame.
    a. Open the module flap cover.
    b. Keeping the module flap cover open, place the module in its seat.
    c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

    d. Close the module flap cover.

9. Connect the 1/16-in tubing provided.
    a. Connect an end of the 1/16-in tubing to the bottom fitting of the module using the Swagelock® nut and ferrules provided.
    b. Connect the other end of the tubing to the transfer line of the FT-IR spectrometer. Refer to the *Nicolet iS50 FT-IR Spectrometer Manual* for details.

10. Open the gas supplies.

11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

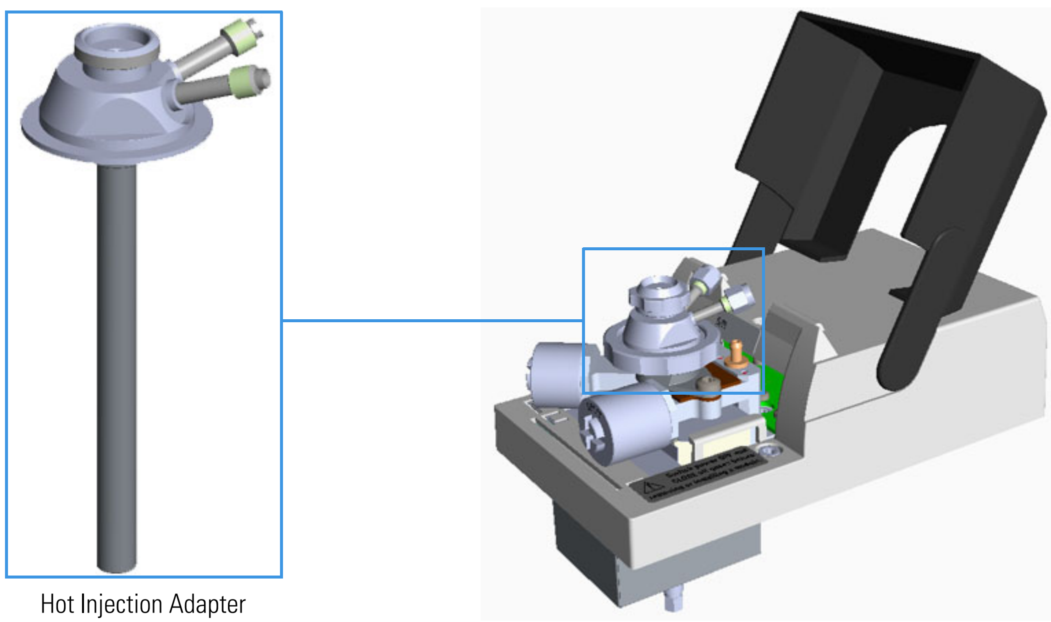
12. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.

13. Close the front door of the GC.

Installing the Hot Injection Adapter Kit on the SSL/SSLBKF Injector

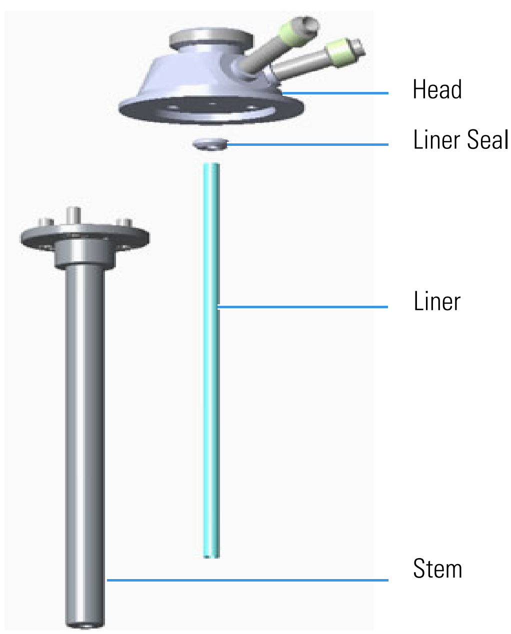
This section provides the instruction for installing the Hot Injection Adapter kit (PN 19050733) on the SSL/SSLBKF injector for the use with an external device for gas sampling. See Figure 353.

Figure 428. Hot Injection Adapter



The Hot Injection Adapter consists of the following parts: head, liner for hot injection adapter, liner seal, and stem. See Figure 429.

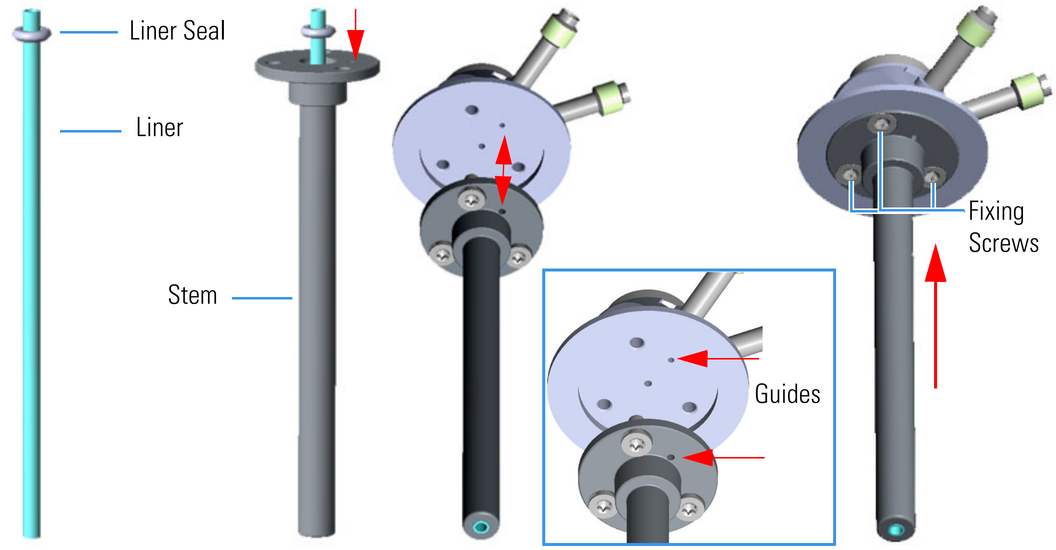
Figure 429. Hot Injector Adapter Assembly



❖ To install the hot injection adapter on the injector

1. Assemble the hot injection adapter if not already done. See Figure 430.

Figure 430. Adapter Assembly



   a. Place the liner seal on the liner.

   b. Insert the liner into the stem.

   c. Couple the head and the stem paying attention to properly align the corresponding holes doing match the polarizing guides on the head and on the flange of the stem.

   d. Fix the stem to the head screwing the three fixing screws using a T8 Torxhead screwdriver.

   > **Note** The stem conducts heat from the body of the SSL/SSLBKF injector to the head of the adapter allowing a hot injection.

2. Put the GC in standby condition.

3. Cool the oven, injector, and detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

4. Close the gas supplies.

5. Power off the GC.

   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

6. Remove the column end from the injector.

a. Open the front door of the GC.

b. Loosen the retaining nut from the injector fitting on the upper interior wall of the GC oven.

c. Remove the analytical column with its nut and ferrule from the bottom of the injector.

7. Put the autosampler away if present.

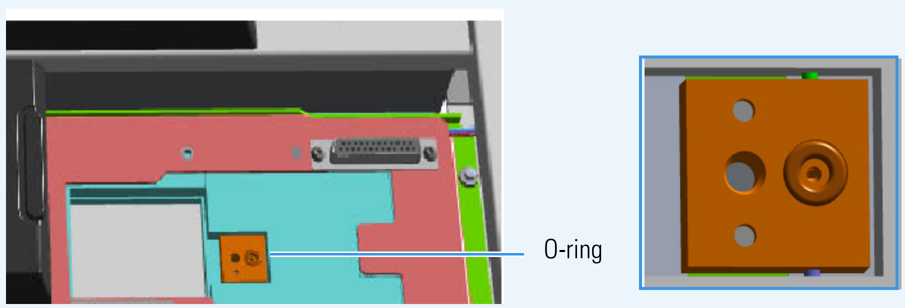
8. Remove the SSL/SSLBKF injector module from its seat.

a. Open the module flap cover.

b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.

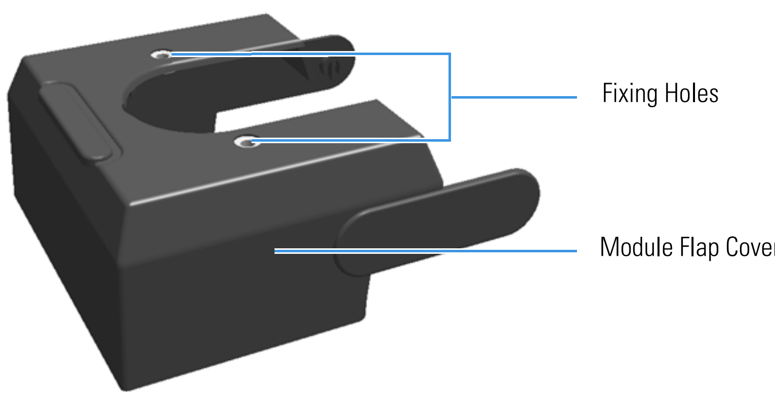
c. Throw upward the module from its seat of the injector housing. Place the SSL/SSLBKF module on a clean surface.

WARNING Make sure the O-ring remains into its seat on the gas connection. **Do not install the module if the O-ring is missing**.



9. Replace the module flap cover with the one provided. See Figure 354.

Figure 431. Module Flap Cover for Hot Injection



Note The fixing holes present on the top of the module flap cover can be used for making more stable a sampling device that requires to be seat directly on the injector.

10. Reinstall the injector module into the main frame.

a. Open the module flap cover.

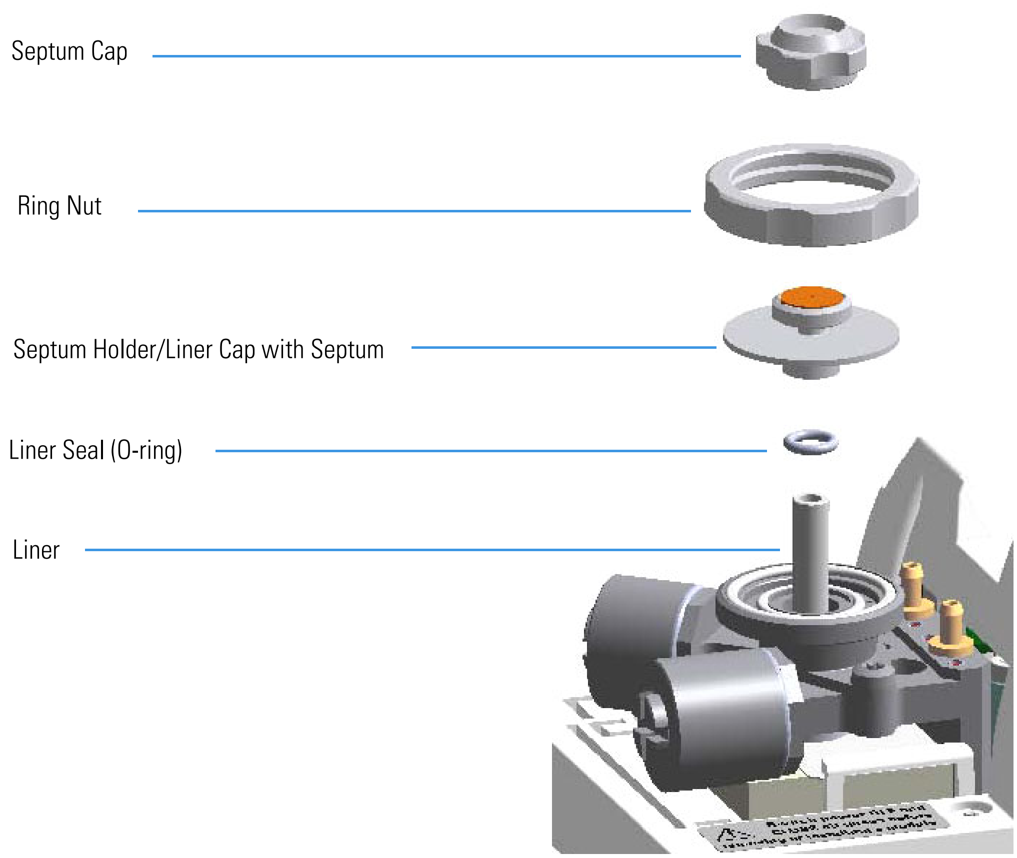
b. Place the injector module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtighten.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

11. Remove the top parts of the injector. See Figure 355.

Figure 432. Injector Top Parts Removal



a. Unscrew the septum cap of the injector.

b. Unscrew the ring nut.

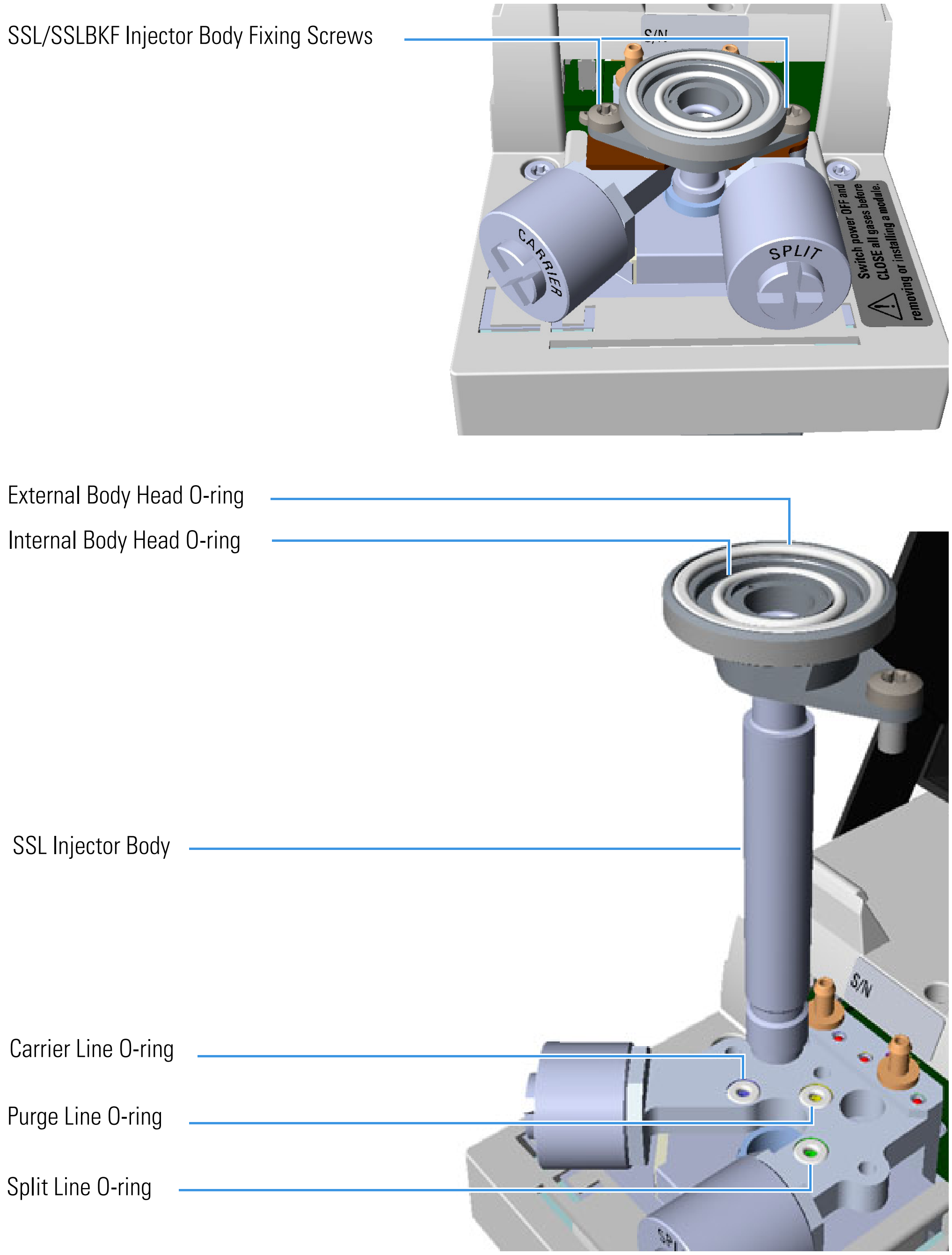
c. Remove the septum holder/liner cap with septum from the injector body head.

12. Remove the liner and its seal.

a. Use tweezer to remove the current liner with the liner seal (O-ring) from the injector.

13. Remove the injector body. See Figure 433.

Figure 433. SSL Injector Body Removal

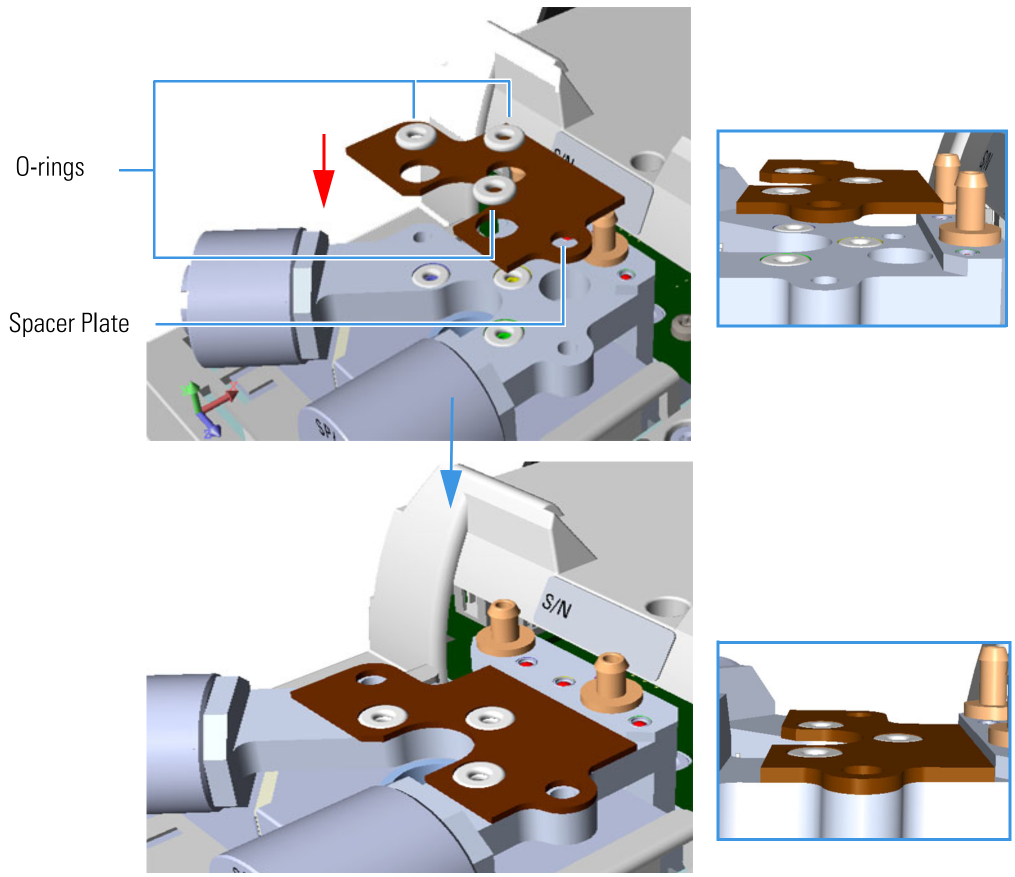


a. Using a T20 Torxhead screwdriver, undo the two injector body fixing screws, and extract the injector body from its housing.

> **Note** Do not remove the carrier, split, and purge lines O-rings.

14. Install the spacer plate. See Figure 434.

Figure 434. Spacer Plate

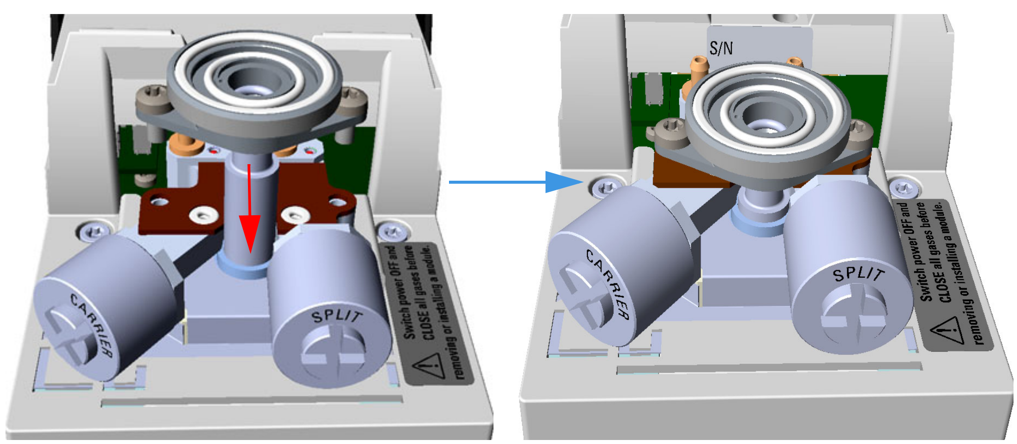


a. Place the spacer plate and its three O-ring on the injector base.

> **Note** The three O-ring of the spacer plate do not replace the carrier, purge, and split lines O-rings but are put on them, then six O-rings are present on the base.

15. Reinstall the injector body. See Figure 435.

Figure 435. Injector Body Reinstallation

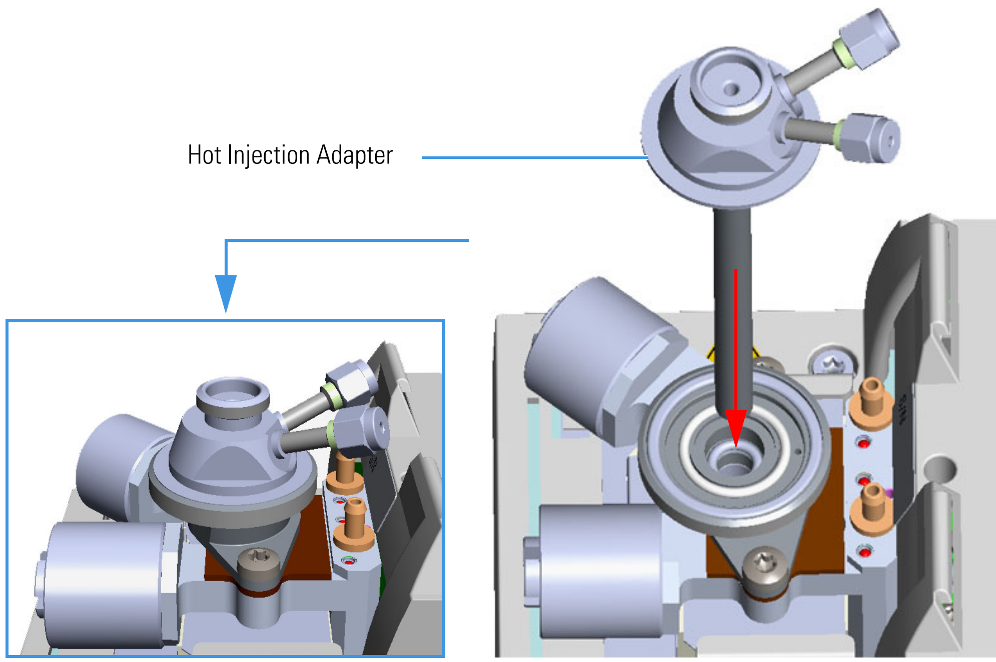


a. Reinstall and fix the injector body into its housing by screwing the two fixing screws.

b. If required, replace both the internal and external body head O-rings using tweezers.

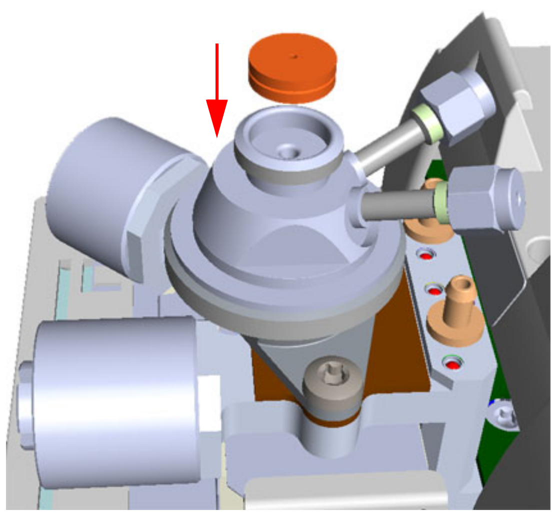
16. Install the hot injection adapter on the top of the injector. See Figure 356.

Figure 436. Hot Injection Adapter (1)



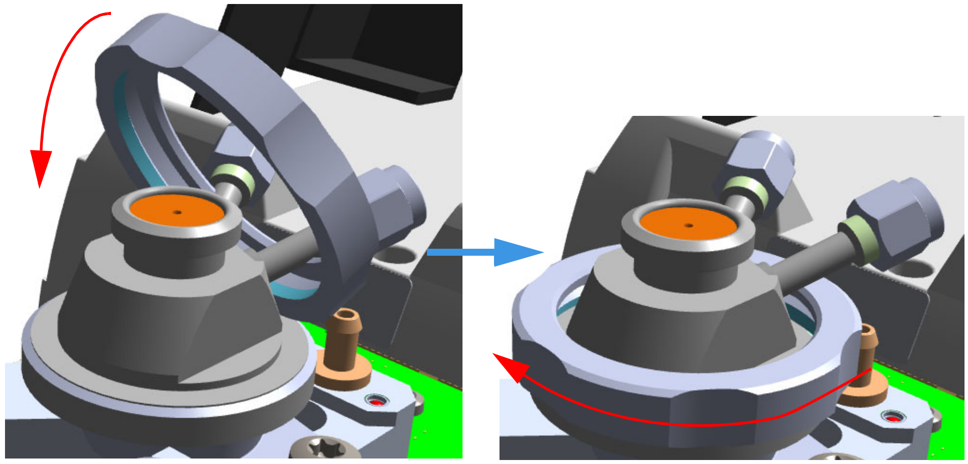
a. Avoid touching the septum with your fingers. Insert a new septum into the septum holder cavity of the hot injection adapter using tweezers. See Figure 357.

Figure 437. Hot Injection Adapter (2)



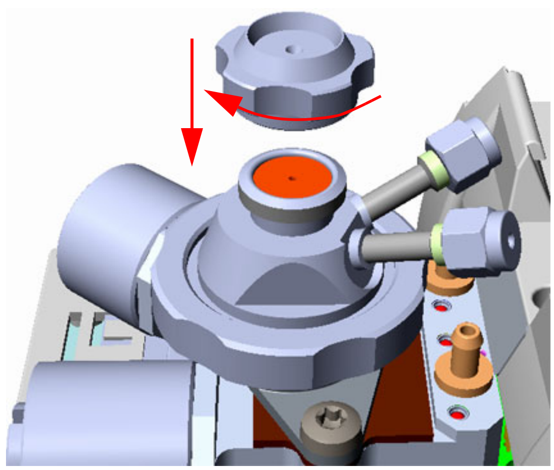
b. Guide the ring nut on the hot injection adapter with the septum, then fix it screwing the ring nut. See Figure 359.

Figure 438. Hot Injection Adapter (3)



c. Screw and tighten the septum cap to finger-tight. See Figure 439.

Figure 439. Hot Injection Adapter (4)



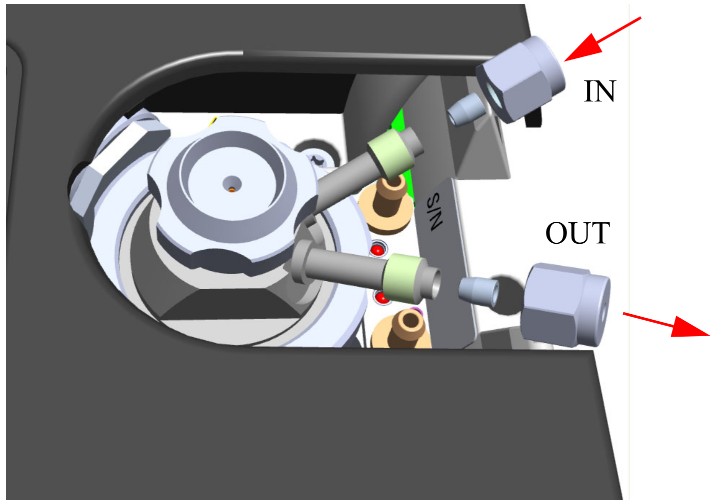
CAUTION Do not overtighten the septum cap because you might damage the septum and affect instrument performance.

ATTENTION Ne serrez pas excessivement le capuchon du septum, car cela pourrait endommager le septum et affecter les performances de l’instrument.

17. Close the module flap cover.

18. Connect the hot injection adapter to the device for the sampling of gas. See the example in Figure 440.

Figure 440. Hot Injection Adapter (5)



Note If only a port of the adapter is connected to the device for the sampling of gas, close the other one with the blind nut provided.

19. Reconnect the column end to the injector and verify the connection point.

20. Open the gas supplies.

21. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip out the power switch (breaker) to the position I.

22. Pressurize the module with the carrier gas.

23. Check for leaks.

    a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check the two fitting for leaks.

    b. If you detect a leak, tighten the connection and retest it.

    c. Repeat this process until all connections are leak free.

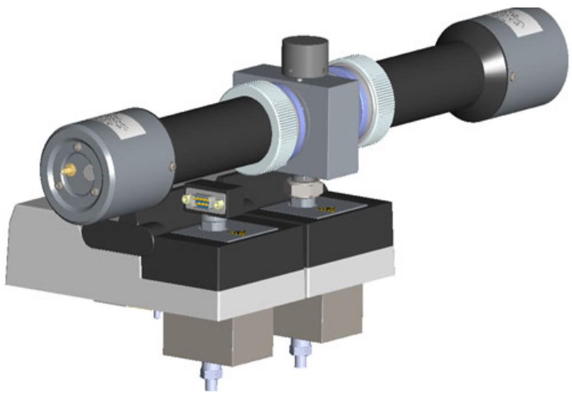
24. Close the front door of the GC.

25. If present, update the autosampler for the new injection position.

Performing the Dual FPD Detector Configuration

This section provides the instructions for performing the Dual FPD configuration by connecting a second photomultiplier tube with a different interferential filter on the same detector control module. See Figure 441.

Figure 441. Dual FPD Configuration



To perform the Dual FPD configuration you need the following devices:

- Two Flame Photometric Detector modules
- A Dual FPD upgrade kit PN 19050783

IMPORTANT The Dual FPD must be installed onto the FPD control module placed into the **back** site of the detectors housing.

The FPD control module placed into the **front** site of the detector housing must be equipped with the **PT100 simulator**, provided with the kit, instead of the FPD detector, and will supply the second photomultiplier of the configuration.

The operation consists of the following steps:

- Remotion of the **front** and **back** FPD Detectors from the relevant detector control module.
- Disassembling the photomultiplier tube from a FPD detector.
- Assembling the second photomultiplier tube on the other FPD detector to obtain the Dual FPD configuration.
- Remotion of the **jet** from the **front** detector control module.
- Installation of the **PT100 simulator**, provided with the kit, on the detector base of the front detector control module.

Note For writing convention, we consider the disassembling of the photomultiplier tube from the FPD detector installed on the **front** detector control module, and the assembling of the Dual FPD configuration on the FPD detector installed on the **back** detector control module. We name them **secondary FPD detector** and **primary FPD detector** respectively.

❖ To assemble the Dual FPD configuration

Note Some of the cleaning procedures in this section require the use of methanol. If methanol is unavailable or prohibited, substitute LCMS-grade or GC-grade ethanol or isopropyl alcohol. Do not use denatured ethanol as it may contain impurities that contaminate the GC-MS system.

Materials needed
Dual FPD Upgrade Kit PN 19050783
Gloves
FPD fixing tools
Appropriate interferential filter (394 nm for Sulphur; 526 nm for Phosphorous; 610 nm for Tin
Methylene chloride or GC-grade methanol
Screwdriver
T6 Torxhead key
T10 Torxhead screwdriver
1-mm Allen wrench
5 mm wrench
5/16-in tube wrench

Initial operations

1. Put the GC in standby condition.
2. Switch off the flame. Hydrogen and air are automatically closed.
3. Cool the detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

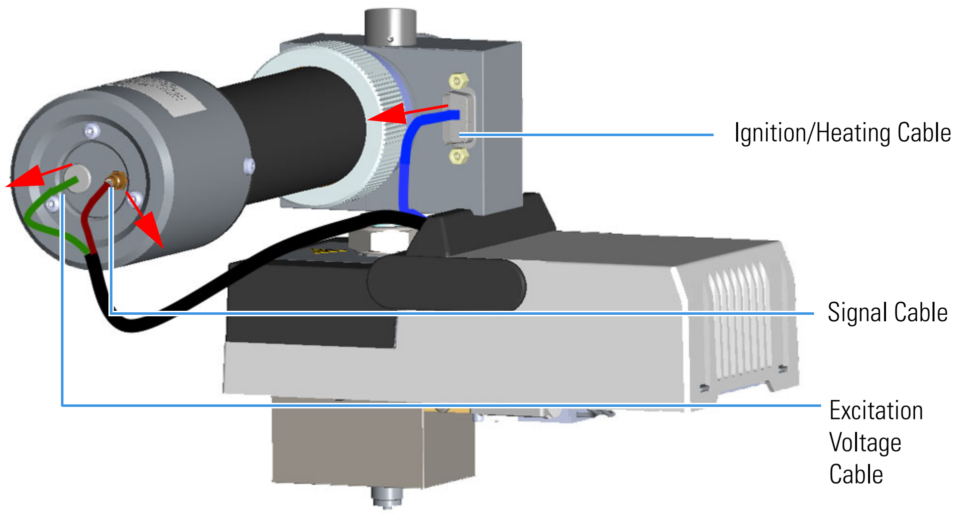
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If other external modules are present, unplug the power cable from the AC Input connector of each module, and from the wall outlet.

6. Remove the FPD detectors from the base of the respective detector control module.

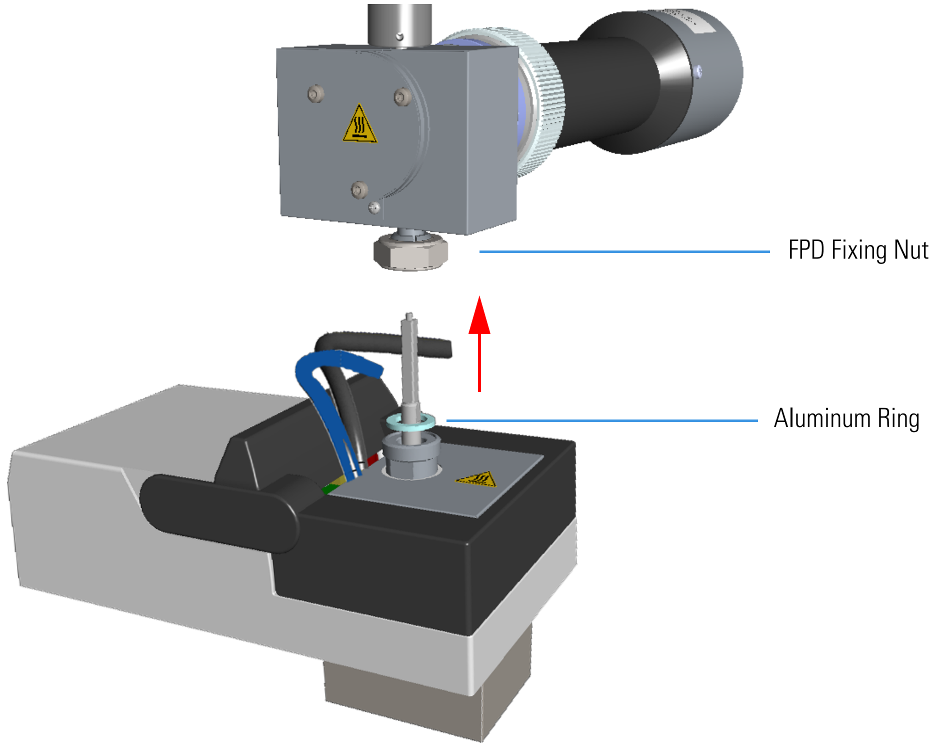
   a. Disconnect the signal, excitation voltage, and ignition/heating cables from the detector. See Figure 442.

Figure 442. FPD Cable Disconnection



   b. Using the tool provided with the system, loosen the fixing nut on the base of the detector and remove it. See Figure 443.

Figure 443. FPD Detector Removal



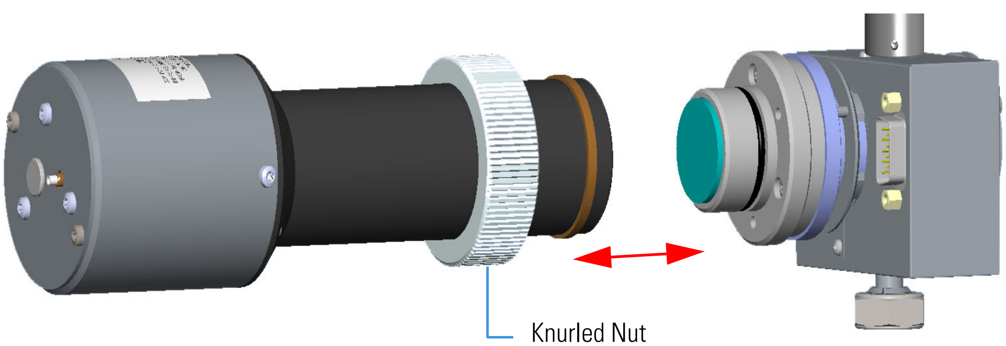
> **Note** Do not lose the Aluminum ring inserted between the detector head and the base body.

c. Place both the FPD detectors on a clean and free workbench.

Disassembling the secondary FPD detector

7. Remove the photomultiplier tube assembly and the filter from the cell of the secondary FPD detector. See Figure 444.

Figure 444. Photomultiplier Assembly Removal



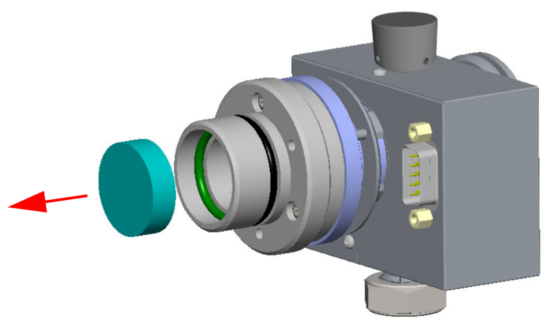
a. Loosen the knurled nut that fixes the photomultiplier assembly and remove it from the detector body.

CAUTION The photomultiplier tube could damage if exposed to ambient light with the excitation voltage On. Make sure the power supply has been switched off before disconnecting the tube from the detector body.

ATTENTION Le tube photomultiplicateur pourrait être endommagé en cas d’exposition à la lumière ambiante alors que la tension d’excitation est activée. Assurez-vous que l’alimentation a été coupée avant de débrancher le tube du corps du détecteur.

b. Remove the interferential filter from its housing, handling it very gently. Keep it using a clean paper towel. See Figure 445.

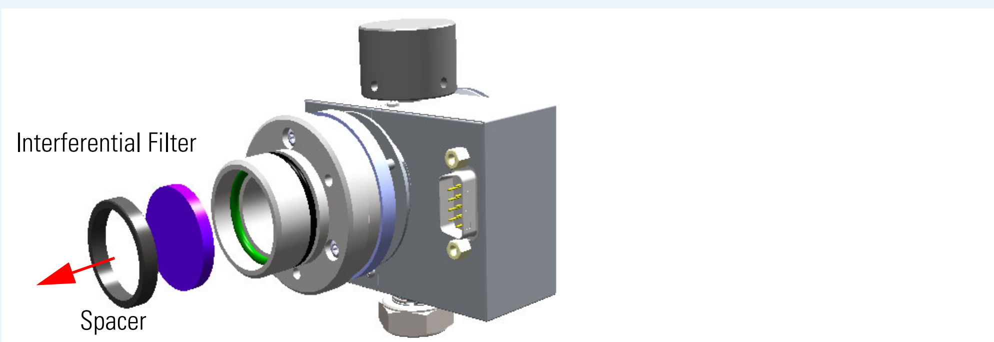
Figure 445. Filter Removal



CAUTION Filters are fragile. Pay attention not to let the filter fall down and damage.

ATTENTION Les filtres sont fragiles. Assurez-vous de ne pas faire tomber et endommager le filtre.

CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first remove the spacer, and then the filter.

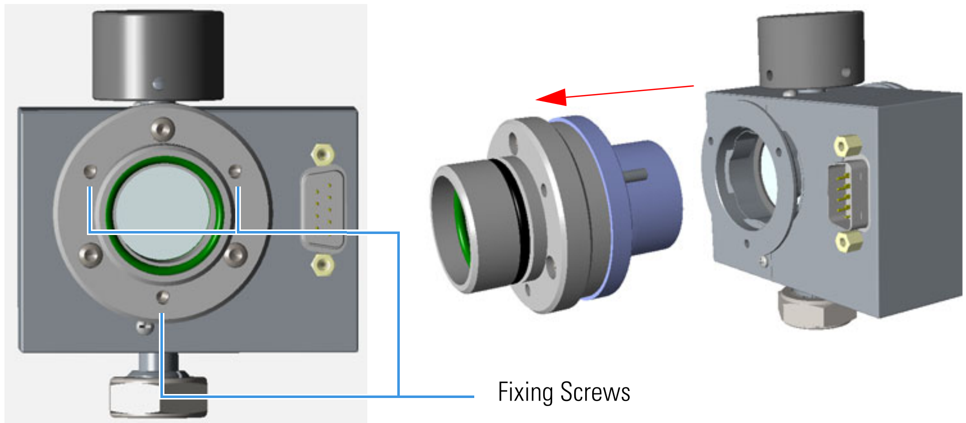


ATTENTION Si le filtre installé est équipé d’un espaceur (voir les kits réf. 19050785 et réf. 19050786), retirez d'abord le filtre, puis l'entretoise.

8. Remove the filter a support and the flange assembly from the cell of the secondary FPD detector.

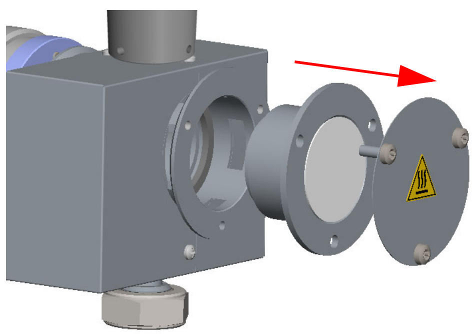
   a. Loosen the three smaller Allen screws that fix the flange to the detector body and remove it with the spacer that should remain inserted in the flange See Figure 446.

   Figure 446. Filter Support and Flange Assembly Removal

   b. Now you could access the flame-side heat shield, and the relevant graphite seal. Loosen the Allen screws that fix the mirror plug and remove it. See Figure 447.

   Figure 447. Mirror Plug Removal

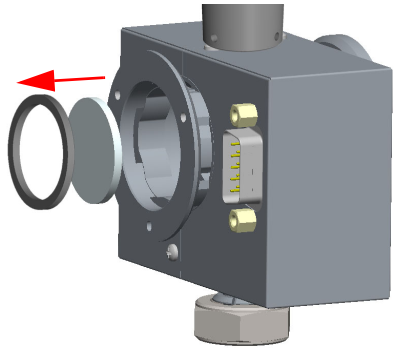
   

   c. Insert the handle of a screwdriver or other un-sharpened tool in the combustion chamber and push the flame-side heat shield and its graphite seal out from its housing. Act gently to avoid breaking of the heat shield. See Figure 448.

CAUTION While pushing out the heat shield, pay attention not to damage the ignition coil.

ATTENTION Pendant l’extraction de l’écran thermique, veillez à ne pas endommager la bobine d’allumage.

Figure 448. Filter-side Heat Shield Removal



d. Remove with care traces of graphite due to the breaking of the seal.

e. Reinstall the mirror plug.

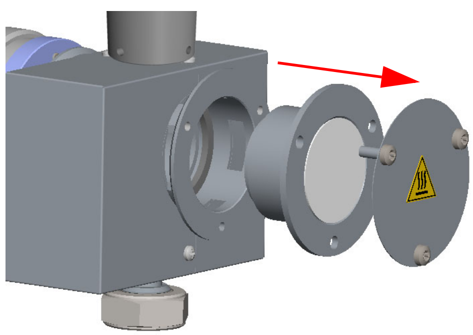
Assembling the primary FPD detector in Dual FPD configuration

Perform the Dual FPD configuration on the primary FPD detector using the components removed from the secondary FPD detector.

9. Remove the mirror plug from the cell of the primary FPD detector.

   a. Loosen the Allen screws that fix the mirror plug and remove it. See Figure 449.

Figure 449. Mirror Plug Removal



10. Insert the filter support and the flange assembly into the primary FPD detector.

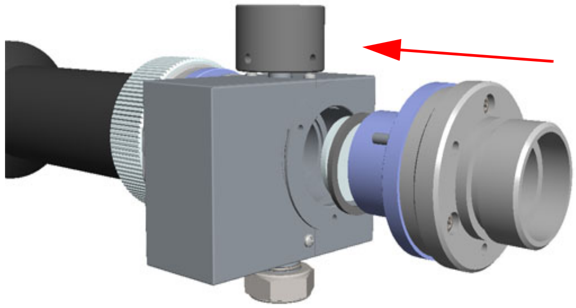
    a. Insert the heat shield into its housing inside the detector body.

    b. Insert the spacer into the flange, letting it stand out for about 5 mm.

    c. Insert the graphite seal on the spacer, pushing it slowly until it touches the flange.

    d. Fix the assembly tightening the three Allen screws. See Figure 450.

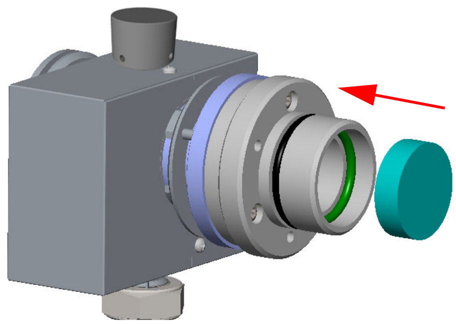
Figure 450. Filter Support and Flange Assembly Installation



11. Place the appropriate filter and the photomultiplier tube assembly.

    a. Reinsert the filter into the support. The mirror face must be oriented towards the flame. See Figure 451.

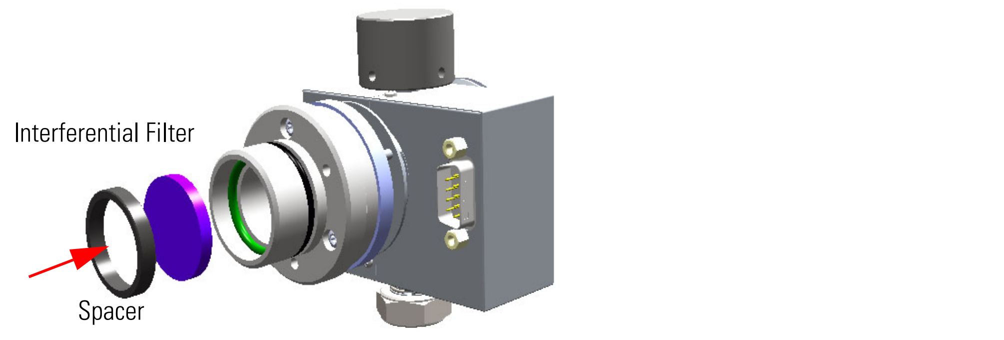
    Figure 451. Filter Remounting

CAUTION Avoid touching the filter with your fingers. If you see fingerprints on the filter, clean it using GC-grade methanol and air dry before remounting.

ATTENTION Évitez de toucher le filtre avec vos doigts. Si vous voyez des traces de doigts sur le filtre, nettoyez-le avec du méthanol de qualité GC et séchez-le à l'air avant de le remonter.

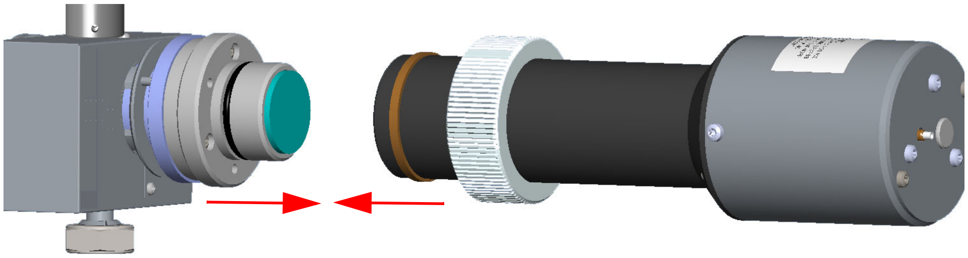
CAUTION If the filter installed is equipped with the spacer (see the kits PN 19050785 and PN 19050786), first insert the filter, and then the spacer.



ATTENTION Si le filtre installé est équipé d'un espaceur (voir les kits réf. 19050785 et réf. 19050786), insérez d'abord le filtre, puis l'espaceur.

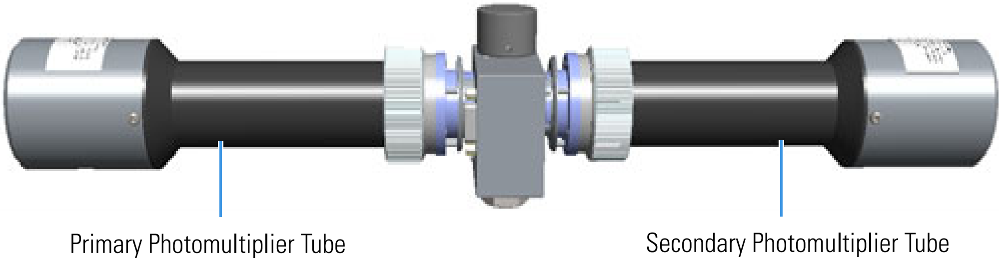
b. Mount the photomultiplier tube assembly then fix it tightening the knurled nut. See Figure 452.

Figure 452. Photomultiplier Tube Assembly Mounting



The result of the operation is shown in Figure 453.

Figure 453. Result of the Dual FPD Configuration

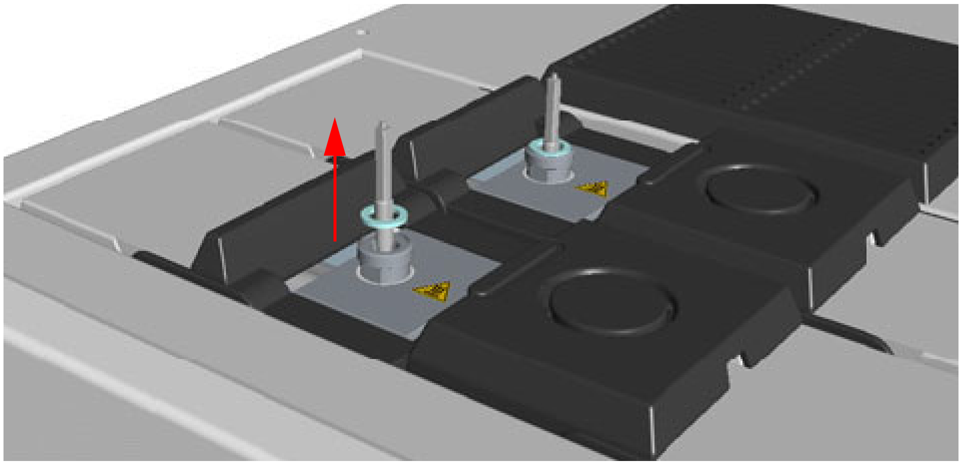


Installing of the Dual FPD and electrical connections

12. Remove the jet of the front detector control module.

    a. Using the 5 mm wrench provided with the GC, loosen the jet and remove it from the detector base body. See Figure 454.

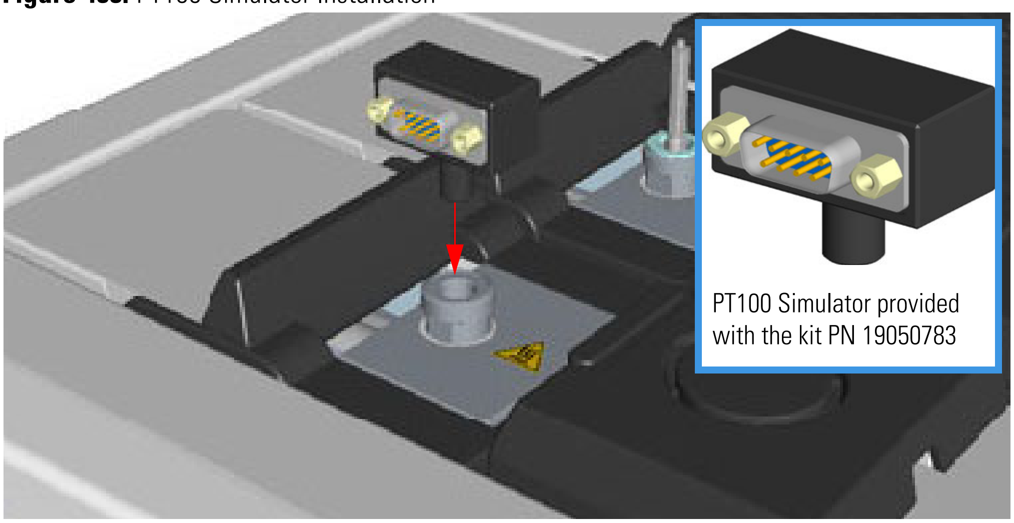
Figure 454. FPD Jet Removal



IMPORTANT Save the jet and the Aluminum ring in a safe place because will be reused when you restore the original configuration of the FPD modules.

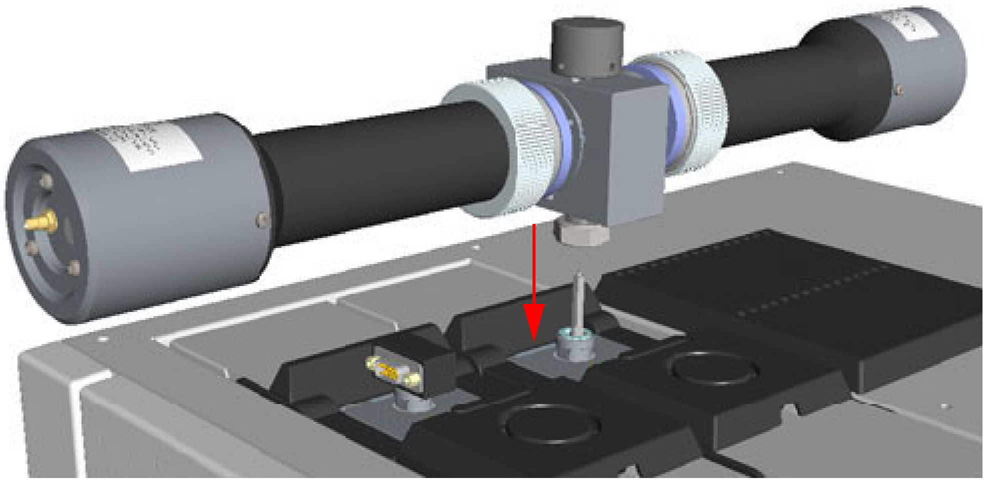
13. Install the PT 100 simulator, provided with kit PN 19050783, on the detector base of the front detector control module. See Figure 455.

Figure 455. PT100 Simulator Installation



14. Install the Dual FPD on the detector base of the detector control module placed into the back site of the detector housing. See Figure 456.

Figure 456. Dual FPD Installation

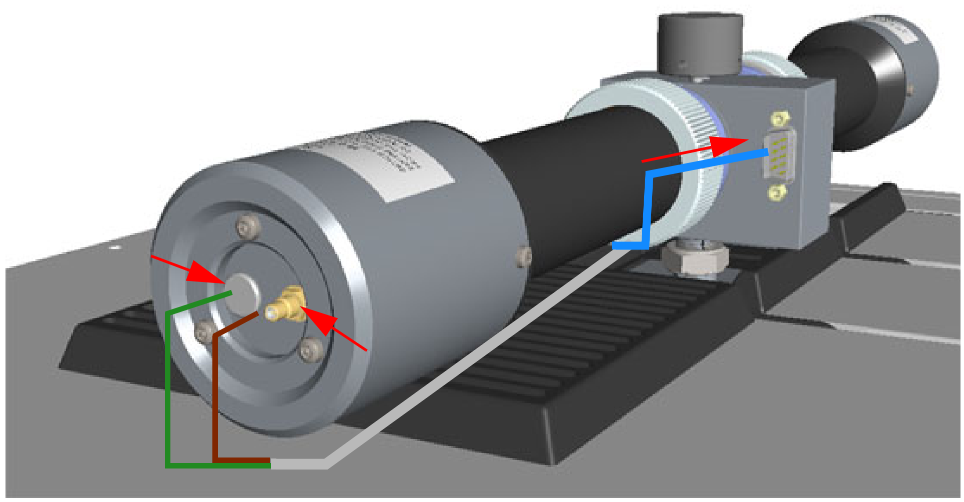


a. Place the detector on its base body, ensuring that the Aluminum ring has been inserted in the correct position, then tighten the fixing nut.

15. Connect the cables to the FPD detectors.

 a. Connect the signal, excitation voltage and ignition/heating cables coming from the control module installed into the back site to the primary FPD detector. See Figure 457.

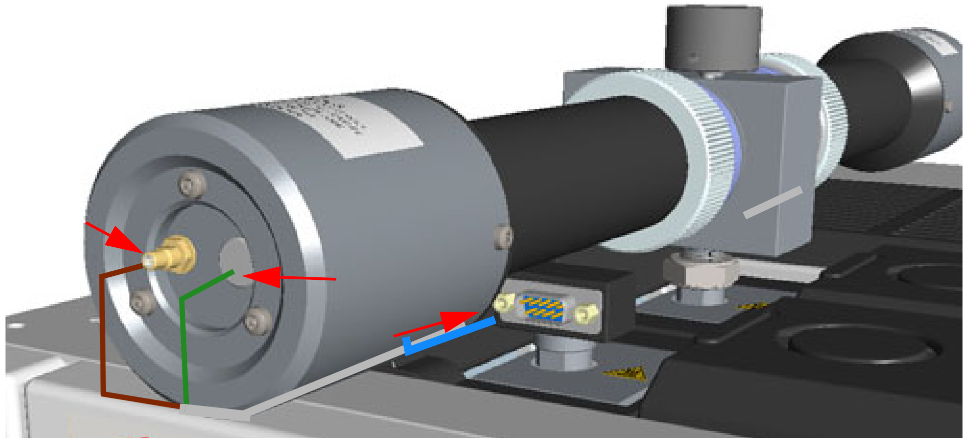
Figure 457. Primary FPD Detector Cables Connection



Excitation Voltage Cable Signal Cable Ignition Heating Cable

 b. Connect the signal, excitation voltage and ignition/heating cables coming from the control module installed into the front site to the secondary FPD detector. See Figure 457.

Figure 458. Secondary FPD Detector Cables Connection



Excitation Voltage Cable | Signal Cable | Ignition Heating Cable

Restart the GC and set the working parameters

16. If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

17. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

Set the working parameters

18. Set the parameters for the primary FPD detector (back).

    a. Set the flow of the gases, the temperatures, the ignition threshold, and the PMT voltage for the primary photomultiplier tube according to the working analytical conditions.

19. Set the parameters for the secondary FPD detector (front).

    a. Set the flow of the gases and the temperatures to **Off**.

    b. Set the PMT voltage for the secondary photomultiplier tube.

20. Turn on the Flame On parameter of the primary FPD detector.

Installing the Pressure Regulator Kit for Gas Sampling Valve

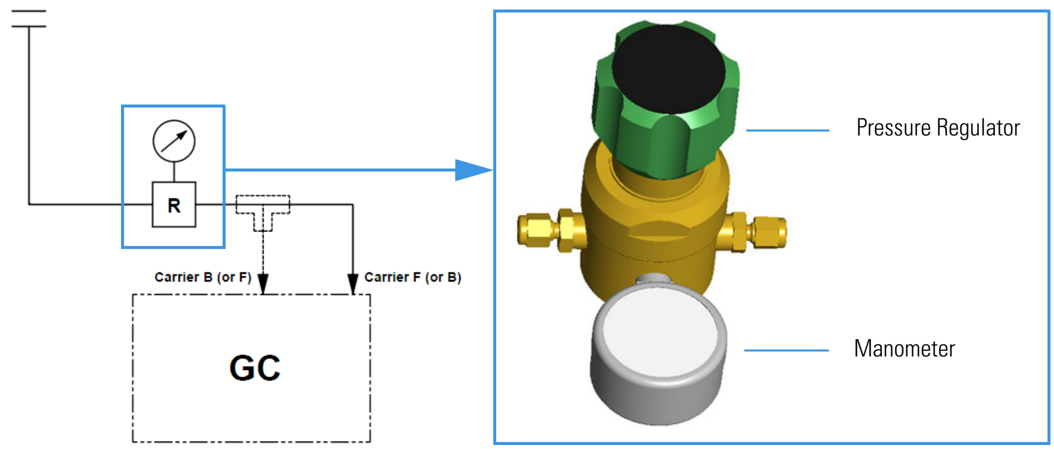
This section provides the instructions for installing the kit P/N 19050763 for adjusting the pressure of the carrier gas to correctly supply the Gas Sampling Valve (GSV) injector.

This kit is useful in the case your carrier line is not able to adjust the pressure of the carrier gas to a range of 450 kPa (65 psi; 4.5 bar) to 690 kPa (100 psi, 6.9 bar) required for the correct functioning of the GSV injector.

There is not a precise point of connection of the kit on the carrier gas line. You connect the kit on the carrier gas line where it is easier for you adjusting the carrier pressure. For example you could connect the kit near the carrier gas cylinder, or near the GC.

Figure 459 shows the pneumatic diagram for connecting the kit.

Figure 459. Schematic Diagram



The kit consists of the following parts:

- Pressure regulator and manometer
- Tee union (in case you connect both the front and back carrier gas)
- Fittings
- Bracket (in case you hook the kit on the back cover of the GC)
- Copper tubing (3-m long for connecting the kit to the carrier gas line)

Figure 460 shows the connection to the front or back carrier gas inlet on the GC.

Figure 460. Front or Back Gas Carrier Inlet Connection

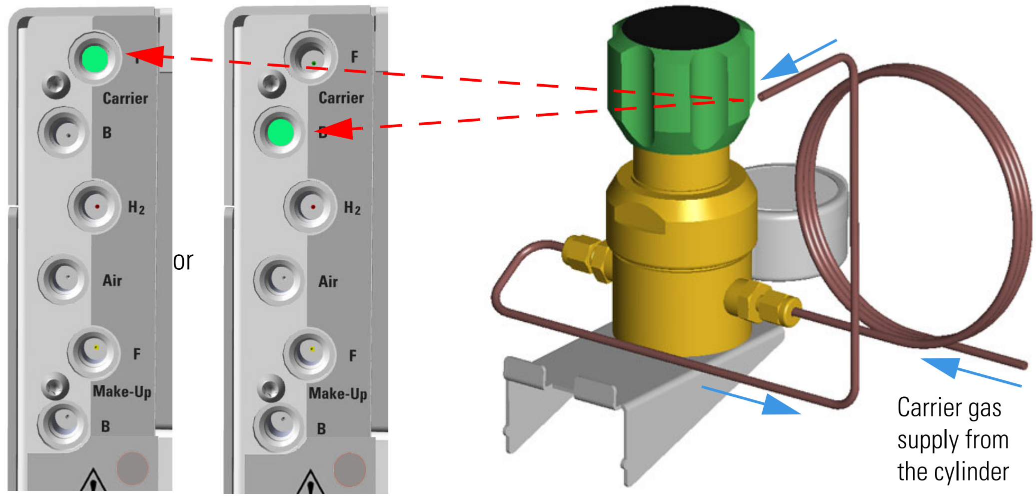
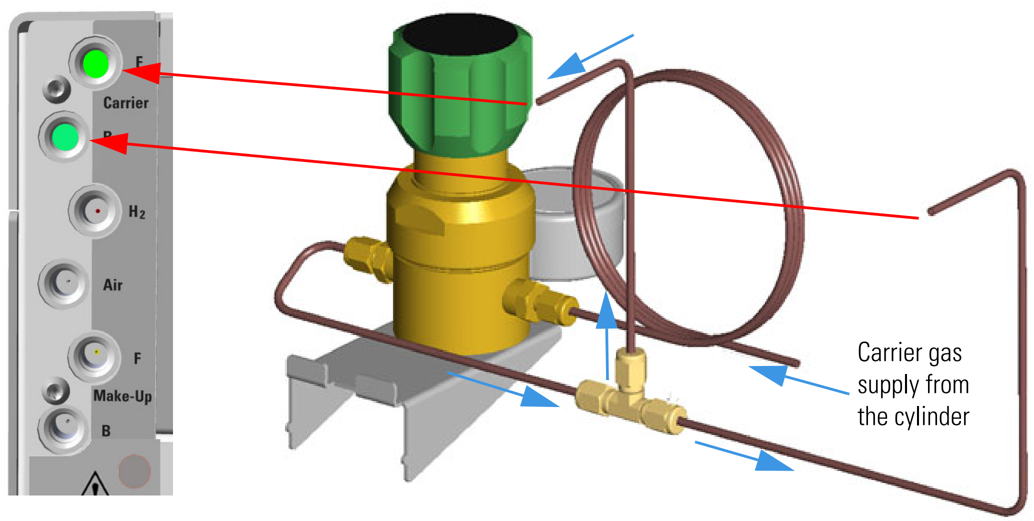


Figure 461 shows the connection to both the front and back carrier gas inlets on the GC.

Figure 461. Front and Back Gas Carrier Inlets Connection

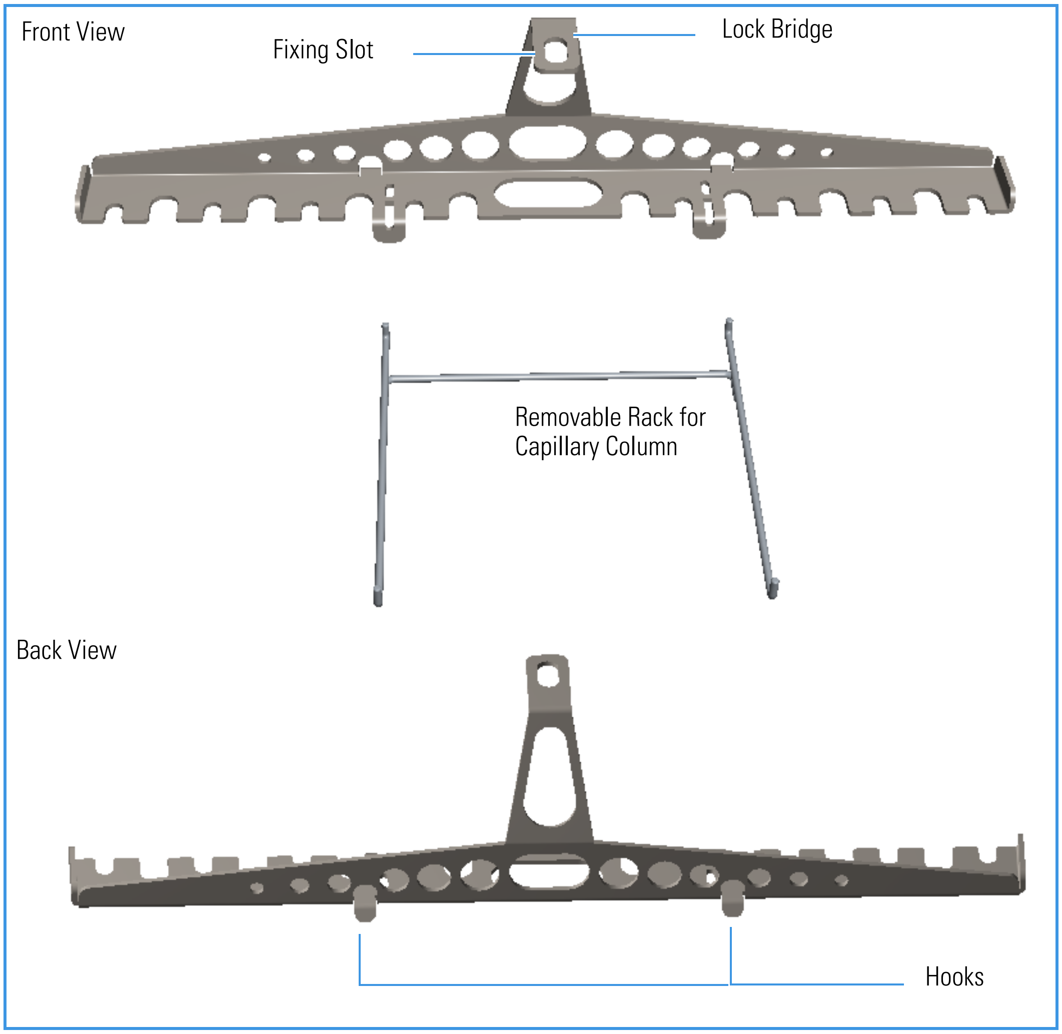


Installing the Packed Columns Support Kit

This section provides instructions for installing the support kit for packed columns PN 19070124 into the oven of the TRACE 1600/1610 GC.

Figure 462 shows the support for packed columns.

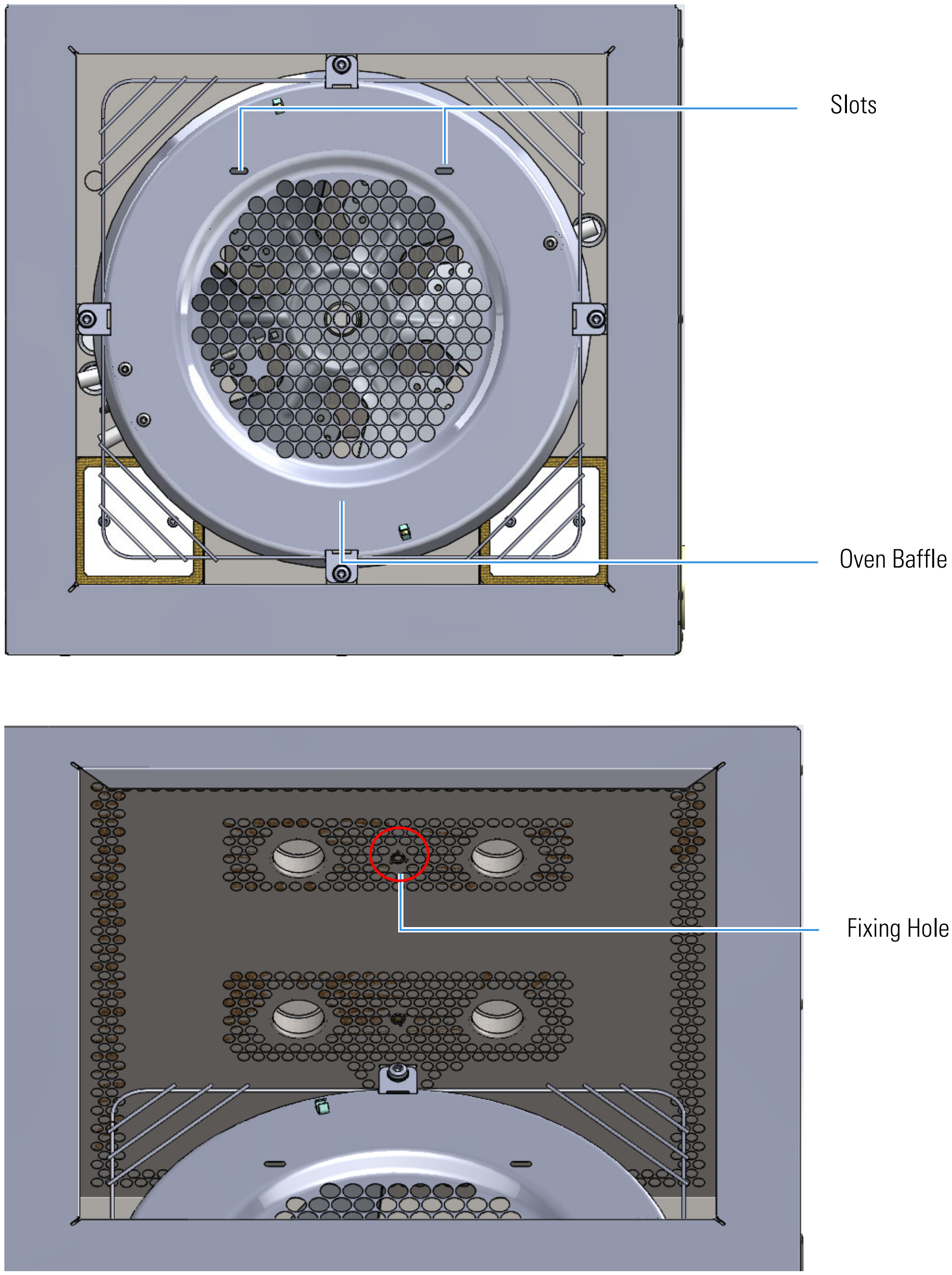
Figure 462. Support for Packed Columns



❖ To install the support for packed column kit

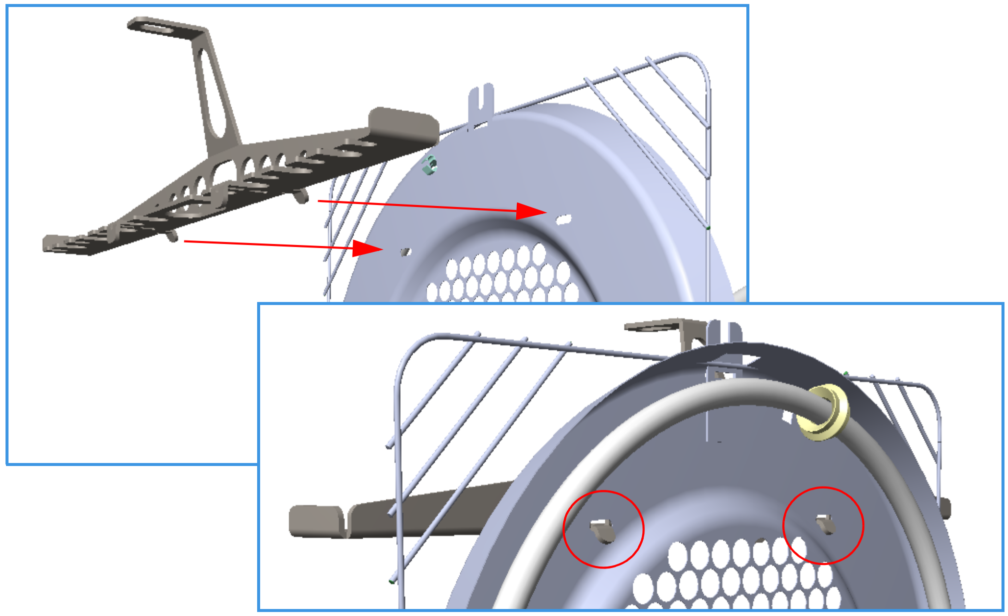
1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.
3. Open the front door of the GC.
4. Locate the two slots on the upper section of the oven baffle and the fixing hole on the ceiling of the oven. See Figure 463.

Figure 463. Kit Installation (1)



5. Insert the two hooks of the packed column adapter into the two slots on the oven baffle. See Figure 464.

Figure 464. Kit Installation (2)



6. Fix the lock bridge of the adapter to fixing hole on the oven ceiling using the screw and washer provided. See Figure 464.

Figure 465. Kit Installation (3)

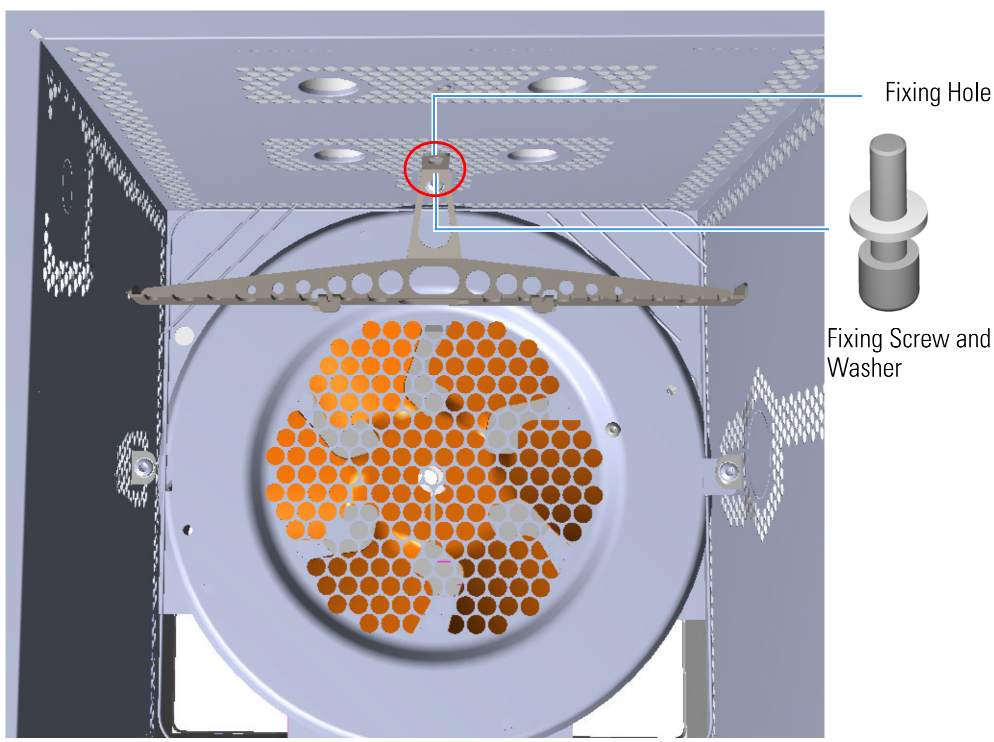
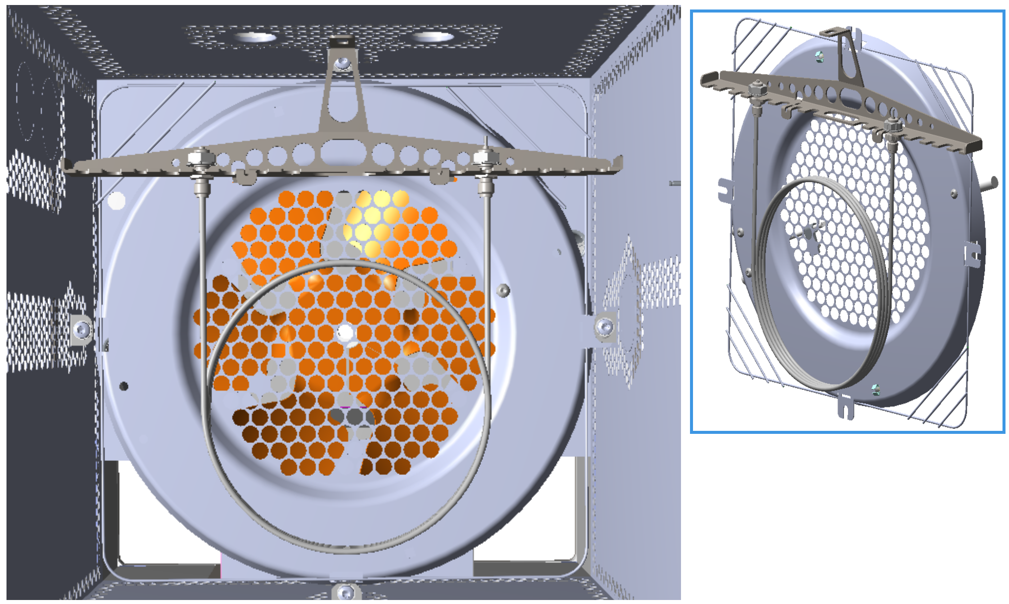


Figure 466 shows an example of packed column and fitting placed on the support.

Figure 466. Kit Installation (4)



> **Note** If a capillary column must be also installed into the oven, the removable rack for capillary column must be inserted into the dedicated slots provided on the packed columns adapter. See the sequence in Figure 467.

Figure 467. Hooking the Removable rack for Capillary Column

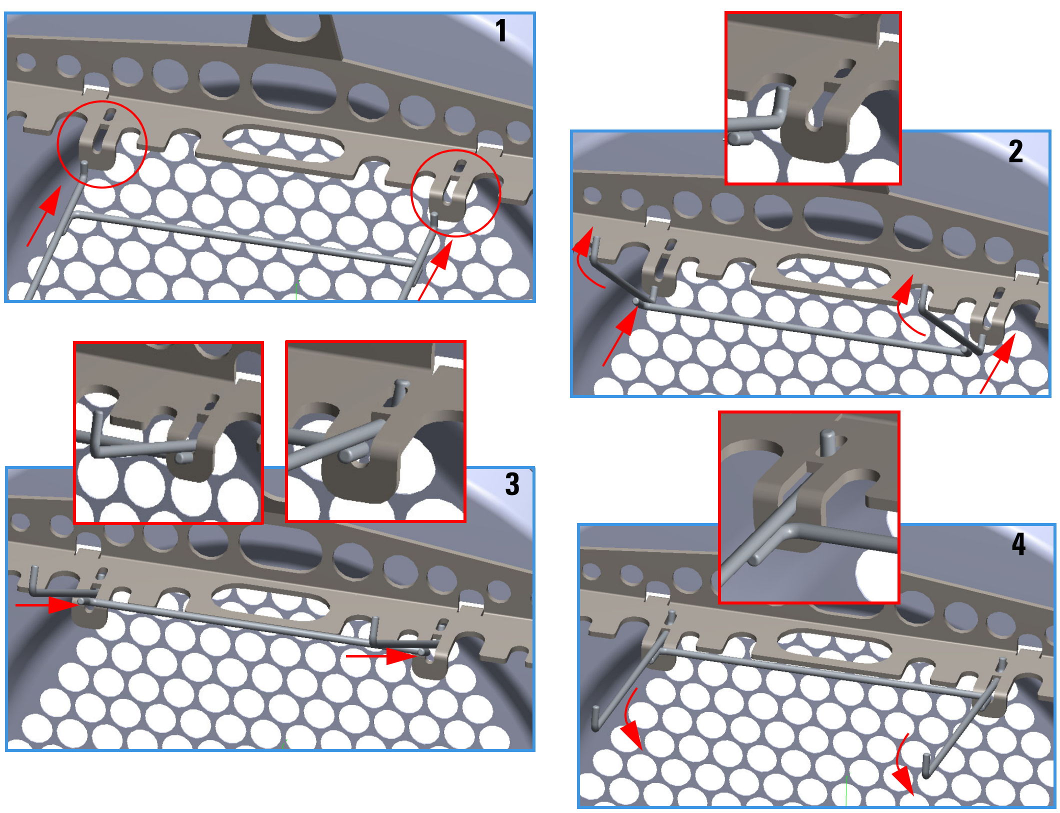
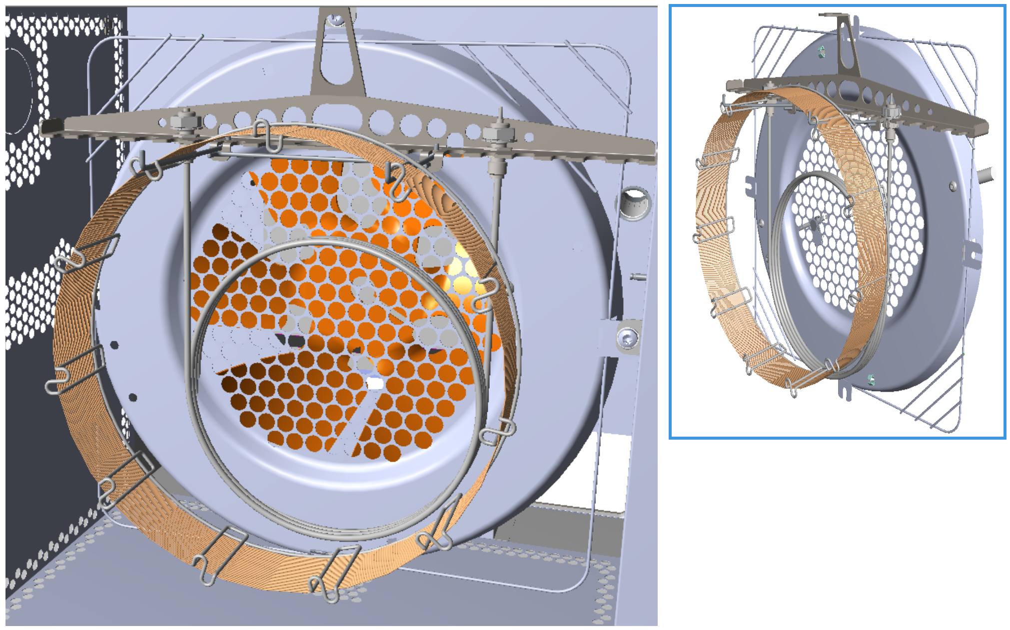


Figure 468 shows an example of a capillary column and a packed column installed into the oven of the GC.

Figure 468. Example of Columns Installation



Installing the ECD Exhaust Vent Kit

The ECD Exhaust Vent Kit (PN 19070024) is used to vent the exhaust gases to a fume hood (or other exhaust system) when toxic compounds are analyzed.

The kit consists of a fitting M5, an Aluminum washer and a silicone rubber tubing.

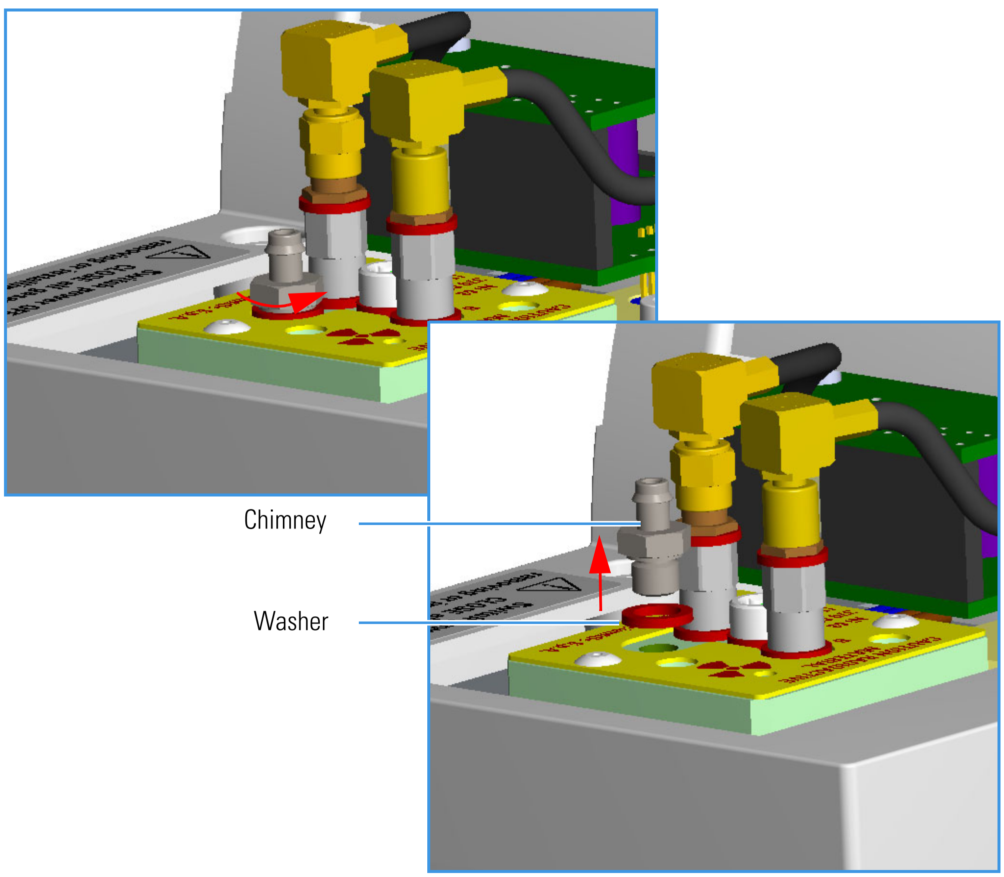
❖ To install the ECD exhaust vent kit

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

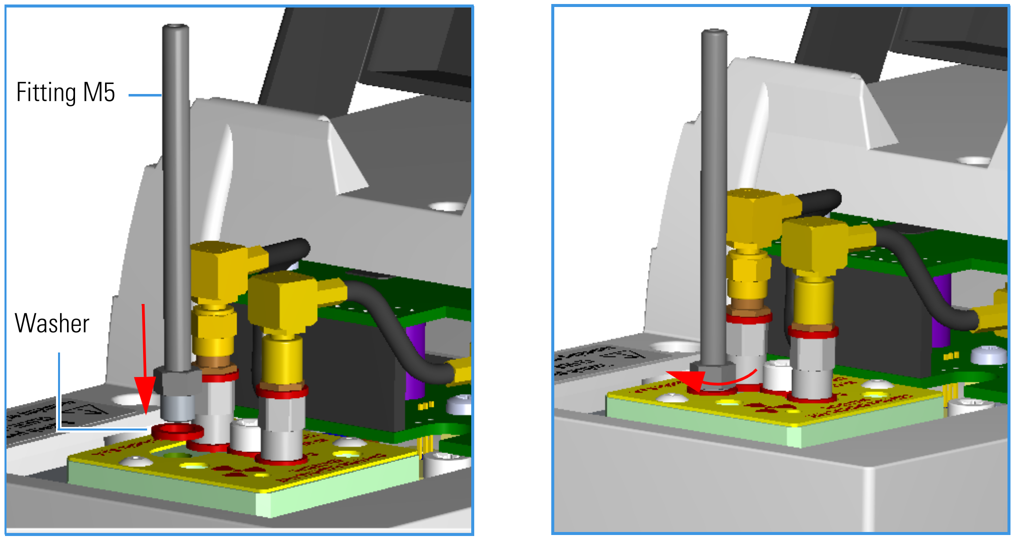
3. Close the gas supplies.
4. Open the module flap cover.
5. Using a 1/4-in. open-end wrench unscrew and remove the chimney and its washer. See Figure 469.

Figure 469. ECD Exhaust Vent Kit Installation (1)



6. Replace the chimney and its washer with the washer and the fitting M5 provided in the kit. Then screw the fitting M5 using the 1/4-in open-end wrench. See Figure 470.

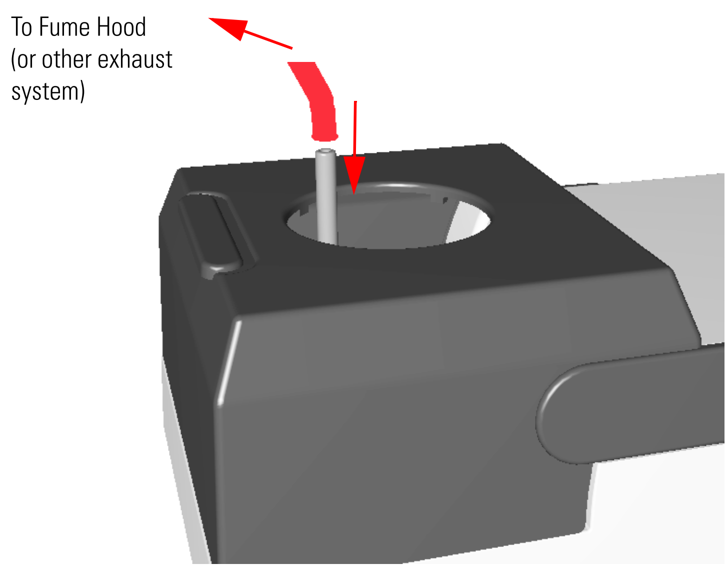
Figure 470. ECD Exhaust Vent Kit Installation (2)



7. Close the module flap cover.

8. Connect an end of the silicone rubber tubing provided on the fitting M5, then guide the other end to the fume hood. See Figure 471.

Figure 471. ECD Exhaust Vent Kit Installation (3)



9. Open the gas supplies.

10. Set the normal detector working conditions.

9

Adding Modules

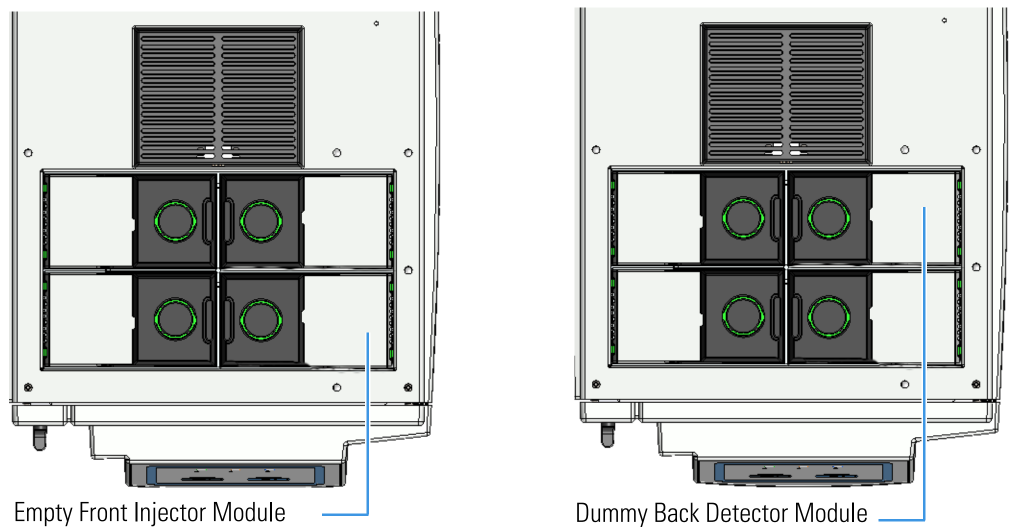
This chapter describes how to install any added injector, detector, external, module that is available for the TRACE 1600/1610. See the *TRACE 1600/1610 Spare Parts Guide* for information about ordering the equipment in this chapter.

Contents

Adding a SSL, SSLBKF, PTV, or PTVBKF Injector Module

This section provides instructions for adding a front/back SSL, SSLBKF, PTV, or PTVBKF injector module. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the injector module is not installed.
See Figure 472.

Figure 472. Location of Injector Modules on the TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

❖ **To add an SSL, SSLBKF, PTV, or PTVBKF injector module**

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

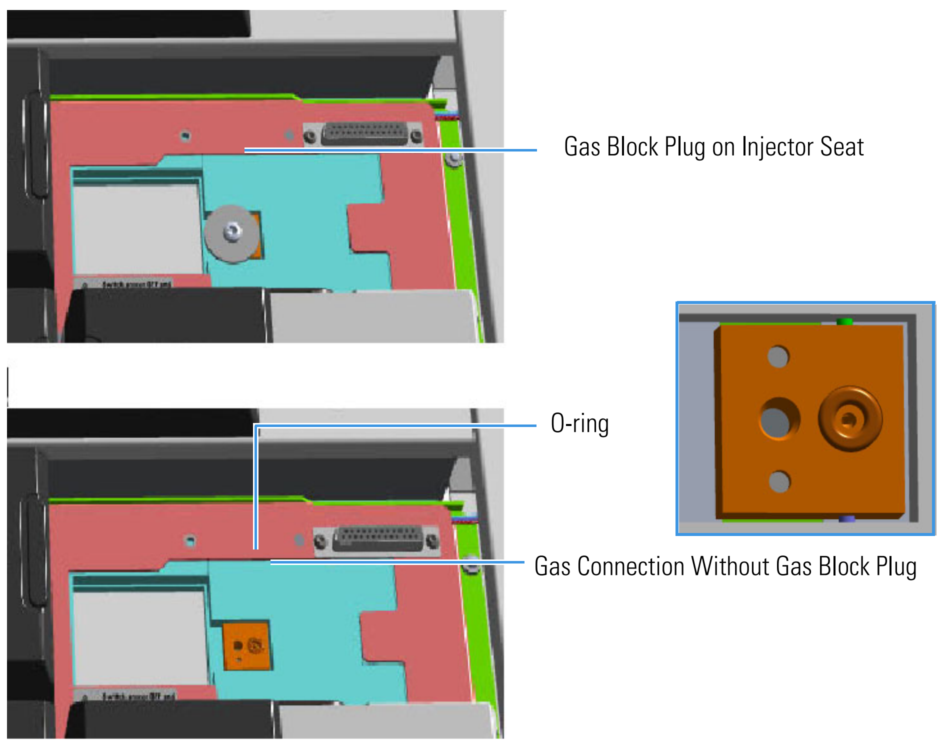
   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Put the autosampler away if present.
7. Remove the dummy module from the position where the injector module will be installed.
   a. Open the module flap cover.
   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.
   c. Keeping the dummy module flap cover open, lift up the module from its seat into the injector housing. Place the dummy module on a clean surface.
   d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver. See Figure 473.

Figure 473. Injector Gas Block Plug



WARNING Make sure the O-ring is placed into its seat on the gas connection. See Figure 473. **Do not install the module if the O-ring is missing.**

8. Open the front door of the GC.
9. Plug the injector module into the main frame.

a. Open the module flap cover.

b. Keeping the module flap cover open, place the module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the injector seat of the injector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

d. Close the module flap cover.

e. Keep the plug connected to the bottom.

10. Open the gas supplies.
11. Check the gas supply for leaks.

    a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.

    b. If you detect a leak, tighten the connection and retest it.

    c. Repeat this process until all connections are leak free.
12. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
13. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.
14. Pressurize the module with the carrier gas.
15. Check the module gas connections for leaks.
16. Remove the plug from the bottom.
17. Connect the analytical column end to the injector and verify the connection point.

    a. Position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 18.

Table 18. Column Insertion Depth For SSL, SSLBKF, PTV, and PTVBKF Injectors

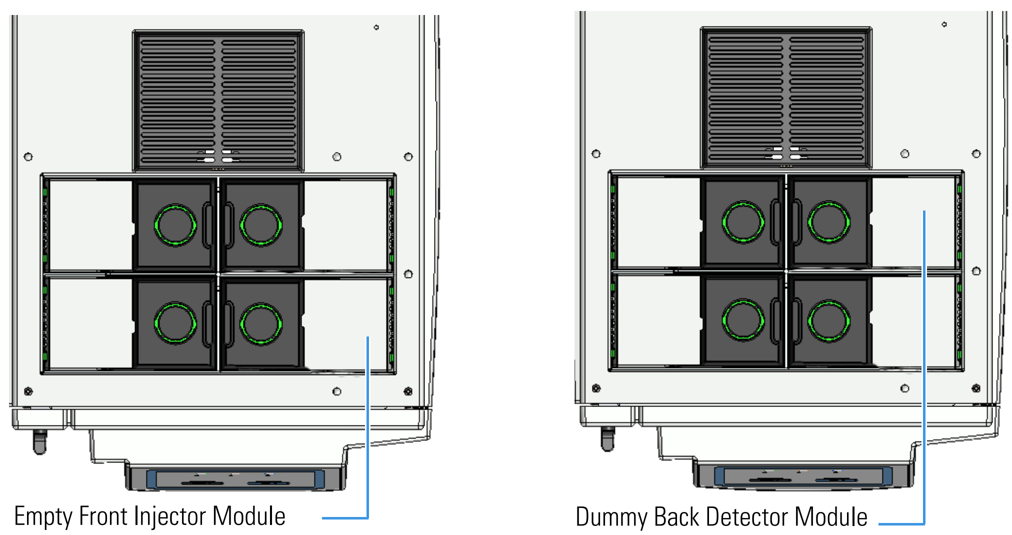
SSL	SSLBKF	PTV	PTVBKF
5 mm (splitless)	5 mm (splitless)	30 mm	30 mm
10 mm (split)	10 mm (split)	As far as possible into the bottom when the PTV is used as an On-Column injector.	

18. Close the front door of the GC.
19. If present, move the autosampler towards the module to restore the original alignment.

Adding a GSV Injector Module

This section provides instructions for adding a front/back Gas Sampling Valve injector module. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the injector module is not installed. See Figure 474.

Figure 474. Location of Injector Modules on the TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

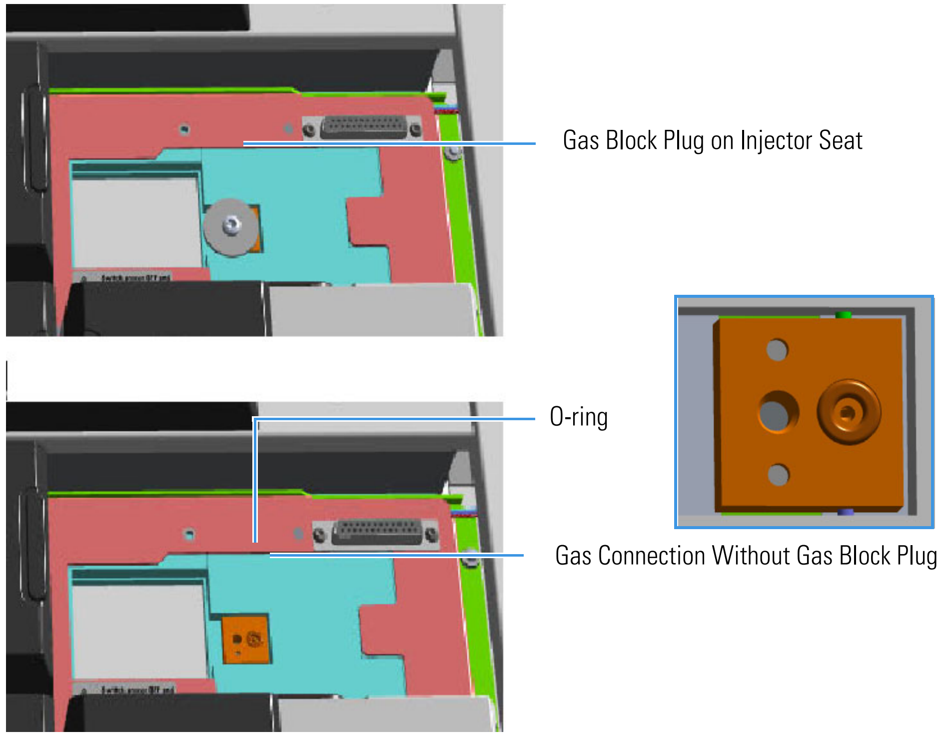
❖ To connect the gas sampling valve module to the TRACE 1600/1610 GC

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Put the autosampler away if present.
7. Remove the dummy module from the position where the injector module will be installed.
   a. Open the module flap cover.
   b. Using a T20 Torxhead screwdriver, unscrew the three captive fixing screws.
   c. Keeping the dummy module flap cover open, lift up the module from its seat into the injector housing. Place the dummy module on a clean surface.
   d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver. See Figure 475.

Figure 475. Injector Gas Block Plug



> **WARNING** Make sure the O-ring is placed into its seat on the gas connection. See Figure 473. **Do not install the module if the O-ring is missing.**

8. Open the front door of the GC.

9. Plug the Gas Sampling Valve module into the main frame.

   a. Open the module flap cover.

   b. Keeping the module flap cover open, place the module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the detector seat of the detector housing.

   c. Use a T20 screwdriver to tighten the three captive fixing screws without overtightening.

   > **Note** Tighten the center screw first and then secure the side screws.

   d. Close the module flap cover.

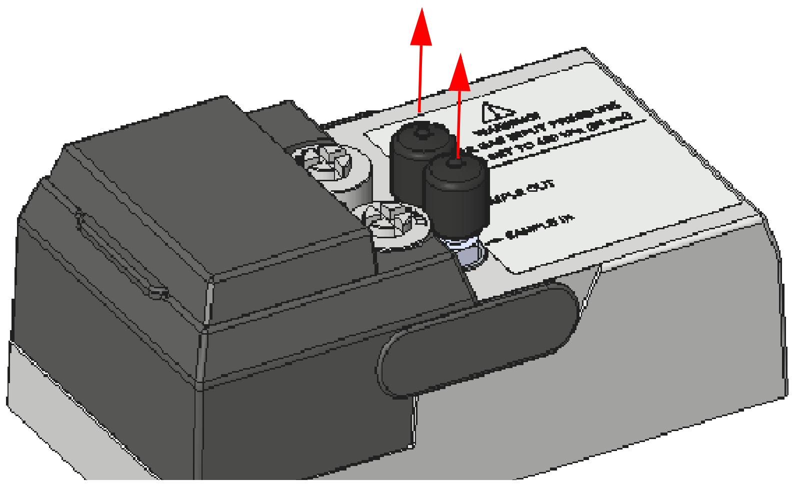
10. Connect the analytical column end insert it as far as goes and withdrawn about 2 -3 mm. See the section “Installing the Column” on page 53.

> **Note** If you need the **backflush**, connect the **backflush system** into the GC oven following the instructions provided in the section **Connecting the GSV Backflush System** in Chapter 8 of the *TRACE 1600/1610 Hardware Manual*.

11. Close the front door of the GC.

12. Remove the protective caps from the Sample In and Sample Out fittings. See Figure 476.

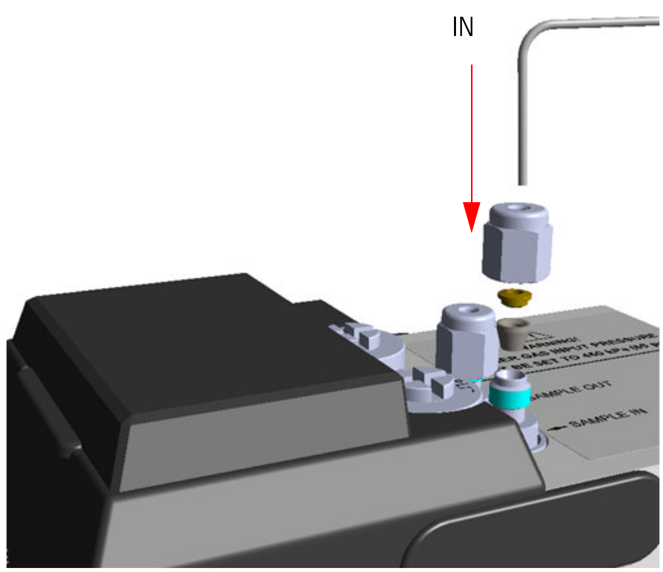
Figure 476. Protective Caps



13. Connect the Sample In and Sample Out lines.

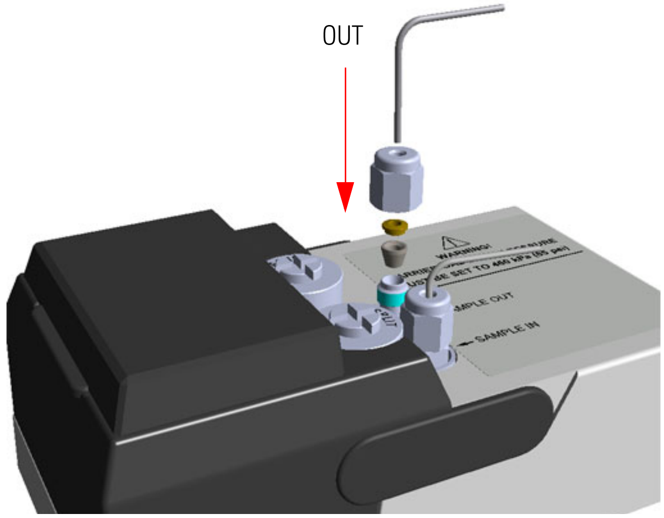
    a. By using the proper 1/8-in. tubing, nut and ferrule, connect the inlet sample line to the **Sample IN** port on the GSV module. See Figure 477.

Figure 477. Sample In Line Connection



b. By using the proper 1/8-in. tubing, nut and ferrule, connect the **Sample OUT** port on the GSV module to an exhaust system. See Figure 478.

Figure 478. Sample Out Line Connection



14. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

15. Power on the GC.

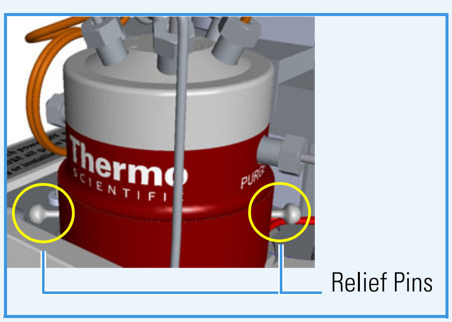
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker) to the position I.

16. Open the module flap cover.

17. Remove the relief pins from the valve body.

IMPORTANT The valve is delivered with relief pins. These pins MUST BE removed from the valve body before working with the valve.



WARNING The carrier gas input pressure must be set in a range of **450 kPa (65 psig; 4.5 bar)** to **690 kPa (100 psi, 6.9 bar)**. OTHERWISE, THE VALVE MAY BE DAMAGED.

DO NOT USE HYDROGEN AS CARRIER GAS. The module is not compatible with Hydrogen carrier gas. The same gas used as carrier gas is used to purge and to actuate the valve and must be an inert gas.

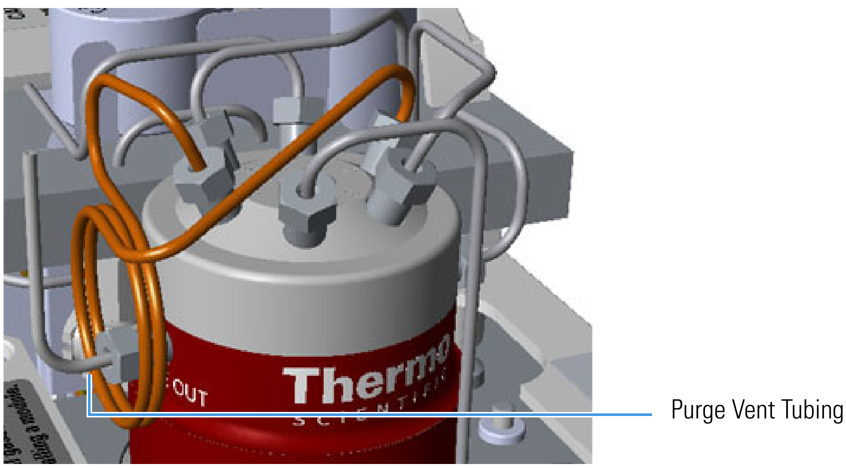
a. Open the gas supplies.

b. Adjust the gas pressure to range from 450 kPa (65 psig; 4.5 bar) to 690 kPa (100 psi, 6.9 bar), actuate the valve and remove the pins.

   You may need to increase the pressure a little to ease hand removal of the pins. Remember, make sure to properly readjust the actuating operating pressure after removing the pins, if you had to change it. Keeps these pins in a safe place.

18. For critical applications, where air diffusion must be the lowest possible, we suggest you replace the purge vent tubing with the longer one provided. See Figure 479.

Figure 479. Purge Vent Tubing



a. Remove the purge valve tubing from the **Purge Out** port on the valve body.

b. Connect to the 24-in. long tubing from the Purge port on the valve body by using the proper nut and ferrule.

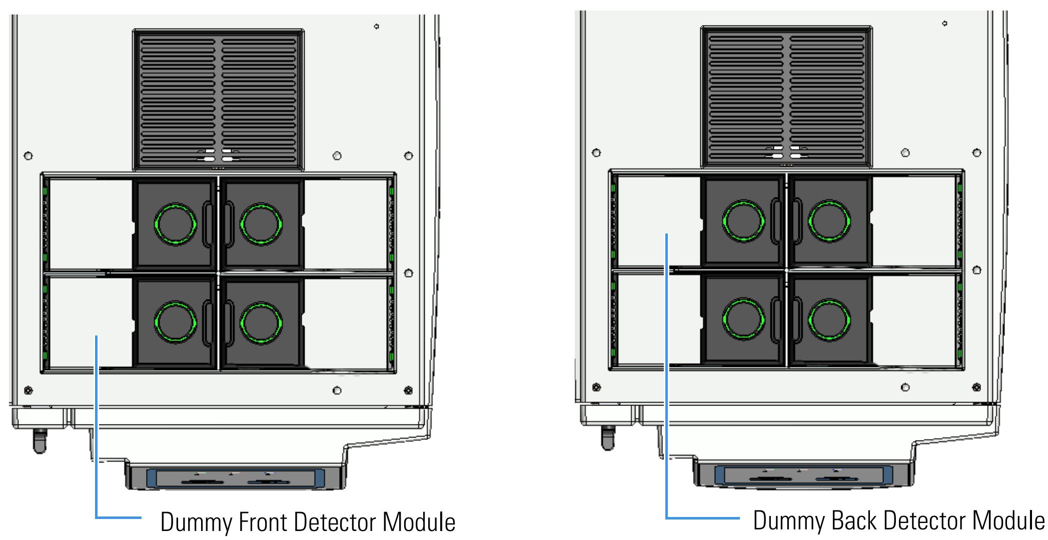
19. Close the module flap cover.

20. If present, move the autosampler towards the to restore the original alignment.

Adding a FID, TCD/TCD In-Series, ECD, or FPD Detector Module

This section provides instructions for adding a front/back FID, TCD/TCD In-Series, ECD, or FPD detector module. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the detector module is not installed. See Figure 480.

Figure 480. Location of Detector Modules on your TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

❖ To add a new FID, TCD/TCD In-Series, ECD, or FPD detector module

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

6. Remove the dummy module from the position where the detector module will be installed.

IMPORTANT The FPD detector should be installed in the **back** site of the detector housing to avoid obstacles with another module. For details about the installation of the FPD detector module, see the section "Installing the FPD Detector" on page 194.

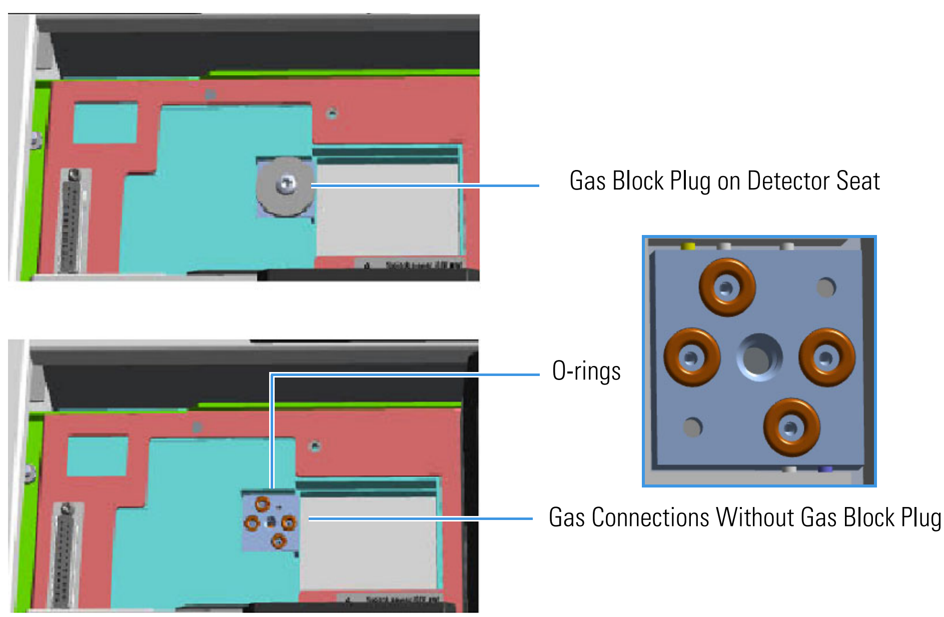
a. Open the module flap cover.

b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.

c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector/detector housing. Place the dummy module on a clean surface.

d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver. See Figure 481.

Figure 481. Detector Gas Block Plug



WARNING Make sure all the four O-rings are placed into their seats on the gas connection. See Figure 481.

Do not install the module if the O-rings are missing.

7. Open the front door of the GC.

8. Plug the detector module into the main frame.
    a. Open the module flap cover.
    b. Keeping the module flap cover open, place the module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the detector seat of the detector housing.
    c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

    d. Close the module flap cover.

9. Remove the plug and connect the analytical column end to the detector.
    a. Position the column so that the end of the column extends the proper distance above the end of the ferrule as reported in Table 19.

Table 19. Column Insertion Depth For FID, NPD, TCD, ECD, and FPD Detectors

FID	NPD	TCD	ECD	FPD
Insert the column as far as goes and withdrawn about 2 -3 mm			23 mm	125 mm

Note If you are installing an **In-Series Connection TCD** module (TCD module modified for the connection in-series with a second detector or with a methanizer), you must connect the vent line metal tubing, that protrudes into the GC oven, to a second detector proceeding as follows:

- Being careful not to create too narrow angles, bend the vent line metal tubing until its end reaches the bottom of the second detector.
- Making sure that the end of the vent line metal tube is perfectly straight, insert it like as an analytical column through the proper detector retaining nut and ferrule.

ATTENTION If you are connecting the In-Series Connection TCD module to a **FID**, **NPD**, or **FPD**, position the vent line metal tubing so that the end of the tubing extends the proper distance above the end of the ferrule as reported in Table 19.
If you are connecting the In-Series Connection TCD module to an **ECD**, the insertion depth of vent line metal tubing must be **21 mm**.

10. Open the gas supplies.
11. Check the gas supply for leaks.

   a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.
   b. If you detect a leak, tighten the connection and retest it.
   c. Repeat this process until all connections are leak free.

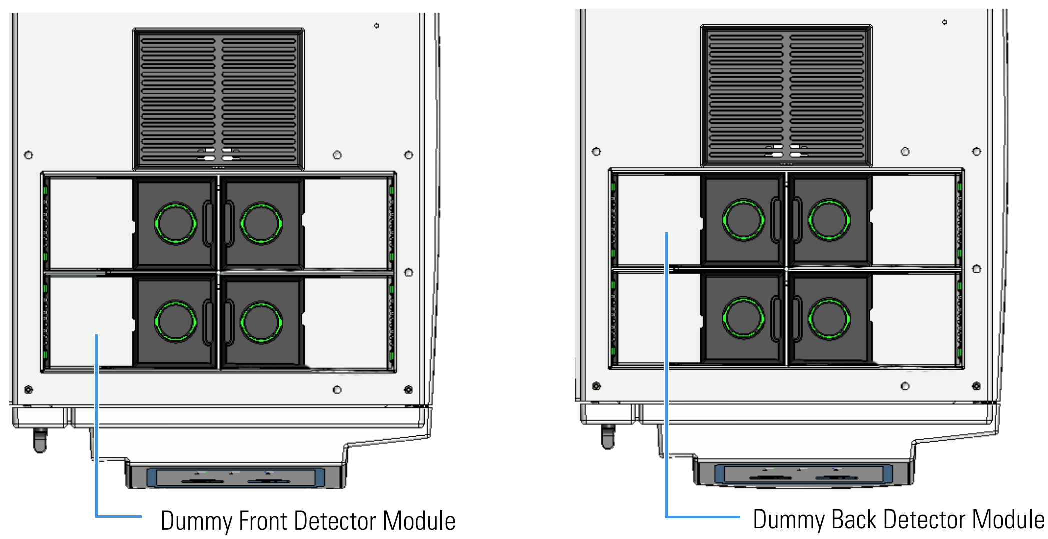
12. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
13. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker) to the position I.
14. Check the module gas connections for leaks.
15. Close the front door of the GC.

Adding a NPD Detector Module

This section provides instructions for adding a front/back NPD detector module. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the detector module is not installed. See Figure 482.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

Figure 482. Location of Detector Modules on your TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

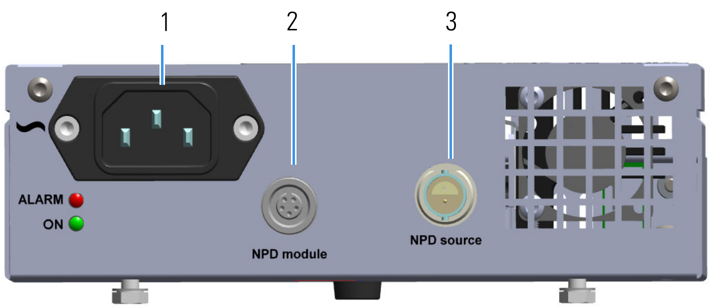
ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

The NPD detector module addition also requires the installation of the NPD Thermionic Source Power Module. See Figure 483.

Figure 483. NPD Thermionic Source Power Module

The module includes the following connections. See Figure 484.

Figure 484. NPD Thermionic Source Power Module Connections



1. AC input connector.
   The module has a power rating of 120/230 Vac; 50/60 Hz; 65VA.
2. A 5-pin connector marked **NPD Module** (**2**) for the connection of the signal cable coming from the NPD detector module.
3. A 2-pin connector marked **NPD Source** (**3**) for the connection of the thermionic source assembly cable coming from the NPD detector module.

One protecting fuse is present inside the module. See Table 20.

Table 20. Aux Temperature/Cryo Module Protecting Fuses

Fuse	Type	Protections
F1	F4A 250 V; (5 x 20 mm)	Circuit for the generation of the current for the thermionic source

❖ To add a new NPD detector module

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

   > **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.

   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

6. Remove the dummy module from the position where the detector module must be installed.

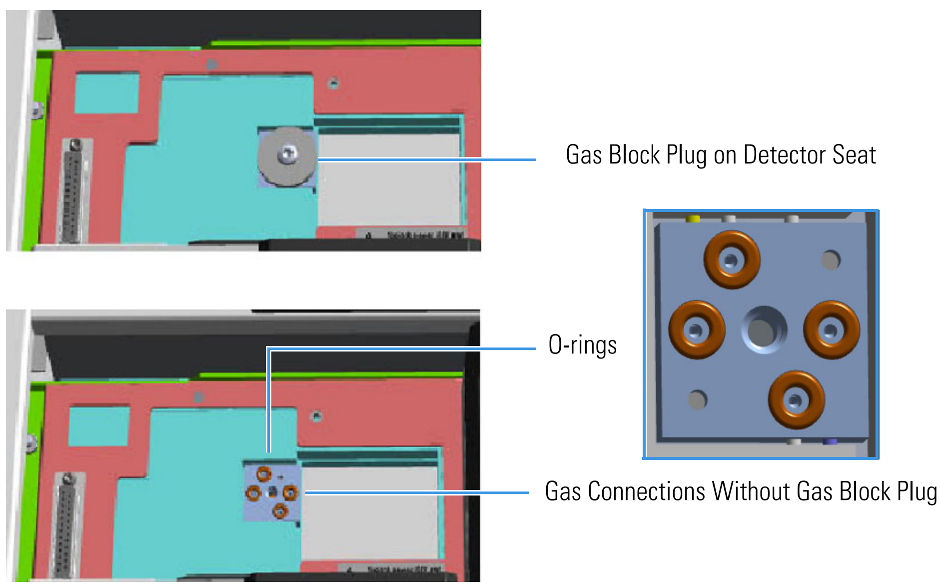
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.

   c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector/detector housing. Place the dummy module on a clean surface.

   d. Remove the gas block plug from the gas connections by unscrewing its fixing screw using a T20 Torxhead screwdriver. See Figure 485.

Figure 485. Detector Gas Block Plug



WARNING Make sure all four O-rings are placed into their seat on the gas connection. See Figure 485.

Do not install the module if the O-rings are missing.

7. Open the front door of the GC.

8. Plug the detector module into the main frame.

   a. Open the module flap cover.

b. Keeping the module flap cover open, place the detector module in its seat. Be sure to insert the 25-pin male connector on the bottom of the module into the 25-pin female connector on the detector seat of the detector housing.

c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

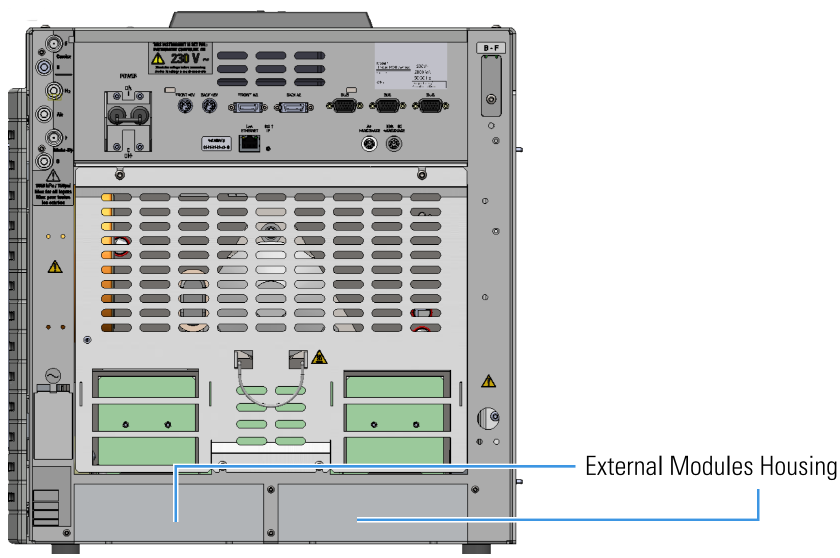
IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

d. Close the module flap cover.

9. Install the NPD Thermionic Source Power Module.

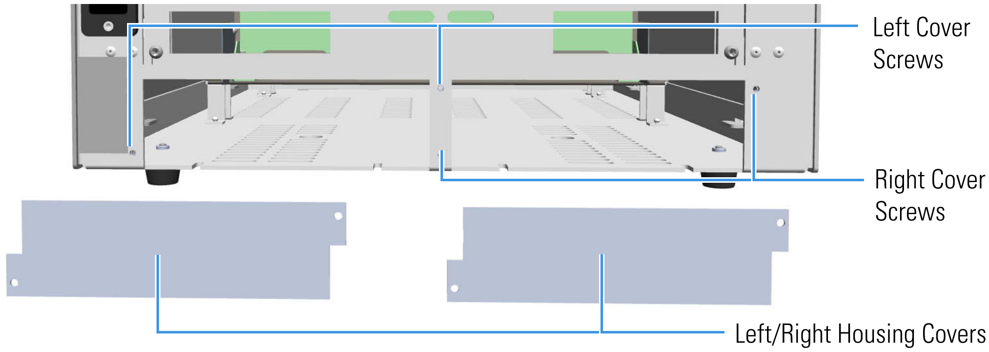
   The module should be installed into an external module housing provided on the back of the GC. See Figure 486.

Figure 486. External Modules Housing



10. Remove the cover of the external module housing where you want to install the module. See Figure 487.

Figure 487. Housing Cover Removal



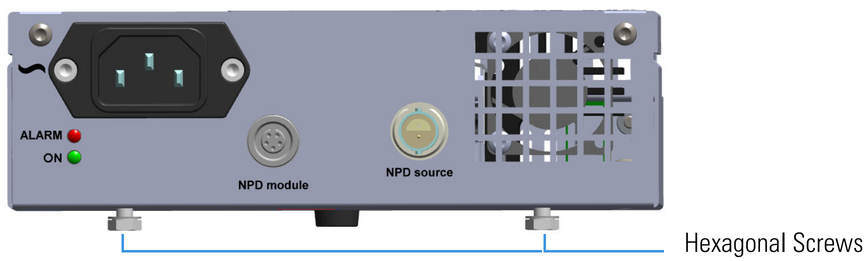
a. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws.

b. Remove the covers from the housing.

11. Install the module into the housing.

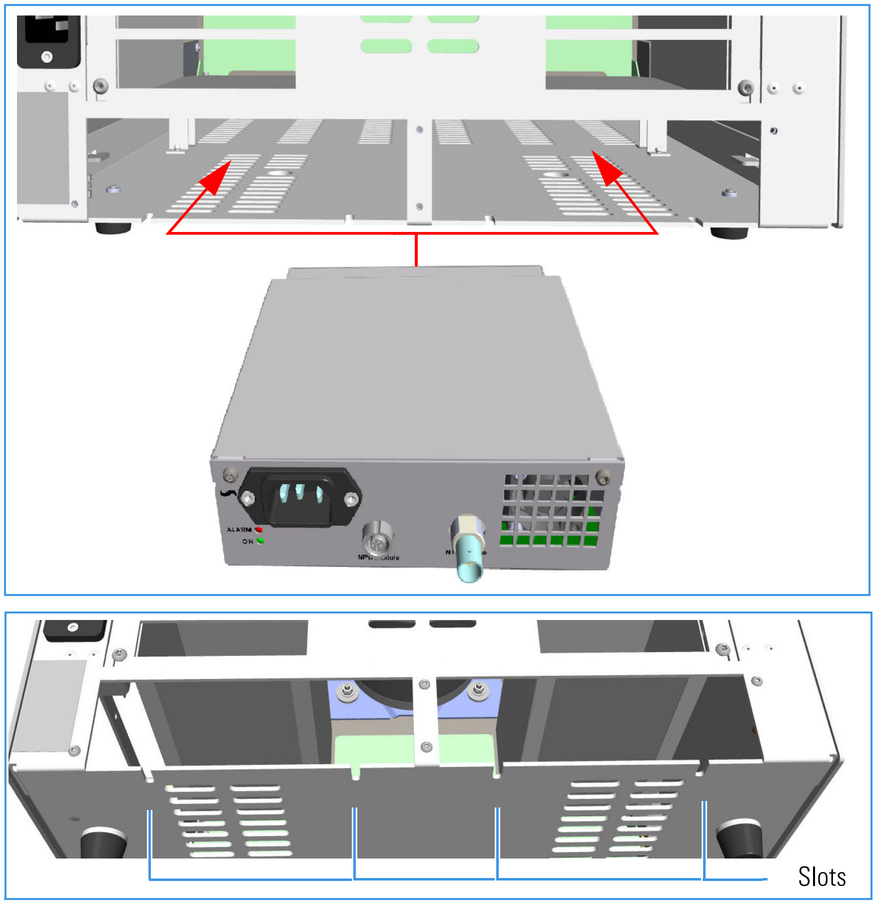
a. Loosen the two hexagonal screws under the module. See Figure 488.

Figure 488. Module Installation (1)



b. Place the module into the left or right housing until the hexagonal screws couple the slots on the floor of the GC. See Figure 489.

Figure 489. Module Installation (2)

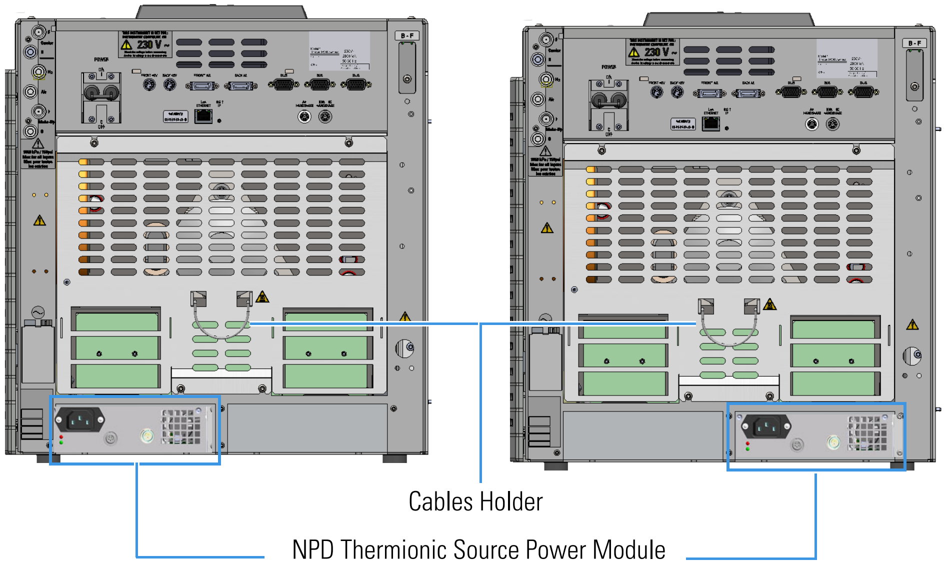


c. Finger tighten the hexagonal screws slightly, or using a 10-mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

The result of the installation is shown in Figure 490.

Figure 490. NPD Thermionic Source Power Module Installed into the GC



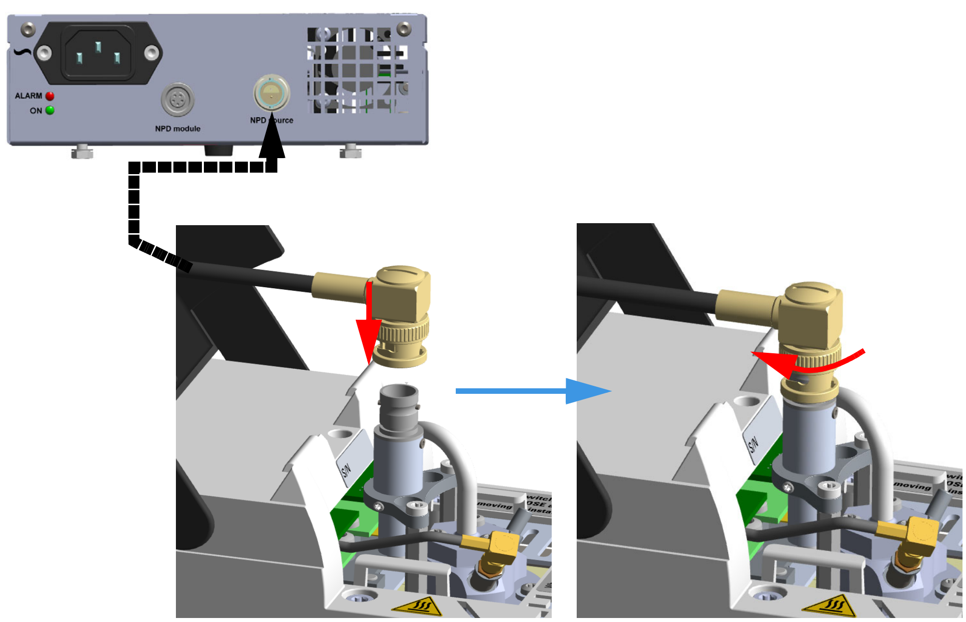
12. Connect the NPD Thermionic Source Power Module.

> **Tip** To avoid the contact with the hot air from the vents, it is suggested to gather the electrical cables into cables holder.

a. Open the module flap cover.

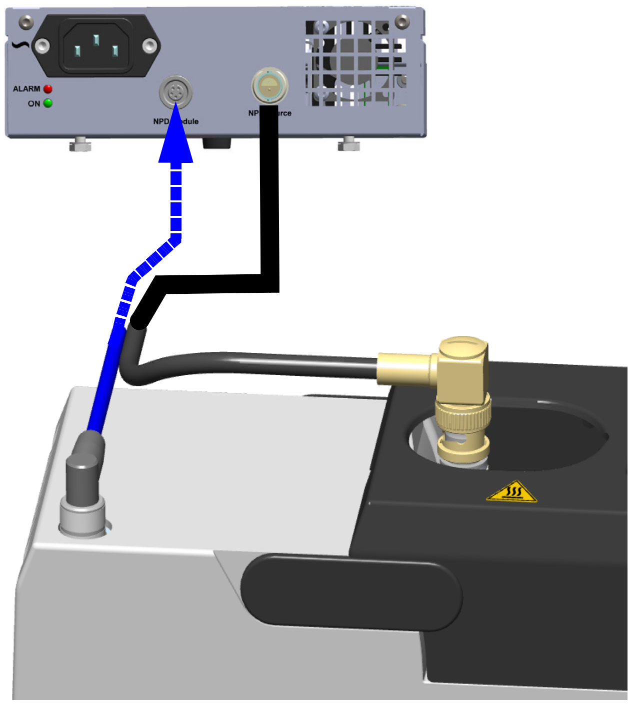
b. Using the cable provided, connect the source assembly connector on the NPD Thermionic Source Power Module to the thermionic source and twist the ring to lock the connection. See Figure 491.

Figure 491. Thermionic Source Assembly Cable Connection



c. Using the cable provided, connect the signal connector on the NPD Thermionic Source Power Module to the connector on the detector module. See Figure 492.

Figure 492. Signal Cable Connection



13. Remove the plug and connect the column end to the detector.

14. Open the gas supplies.

15. Check the gas supply for leaks.

    a. Use a handheld electronic leak detector (Thermo Scientific GLD Pro leak detector or equivalent) to check each fitting for leaks.

    b. If you detect a leak, tighten the connection and retest it.

    c. Repeat this process until all connections are leak free.

16. Plug the power cable to the AC input connector of the NPD Thermionic Source Power Module, and to the wall outlet. The LED marked **On** blinks green.

IMPORTANT The NPD Thermionic Source Power Module must be powered at the same line voltage of the main GC system.

If other external modules are present, plug the power cable to the AC Input connector of each module, and to the wall outlet.

17. Power on the GC.

a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

b. Flip up the power switch (breaker) to the position I.

18. Check the module gas connections for leaks.

19. Close the front door of the GC.

20. Set the make-up gas on.

21. Switch on the thermionic source. Hydrogen and air are automatically opened.
The LED marked **On** of the NPD Thermionic Source Power Module becomes solid green.

22. With all gases on, heat the detector to 150 °C and hold for about 15 minutes, then increase the temperature to 250 °C and hold for 15 minutes.

23. Increase the temperature to operating value (300 °C to 320 °C recommended). Allow 15 minutes for equilibration.

24. Check the NPD leakage current. If > 2.0 pA, verify the installation.

Adding an Aux Temperature/Cryo Module

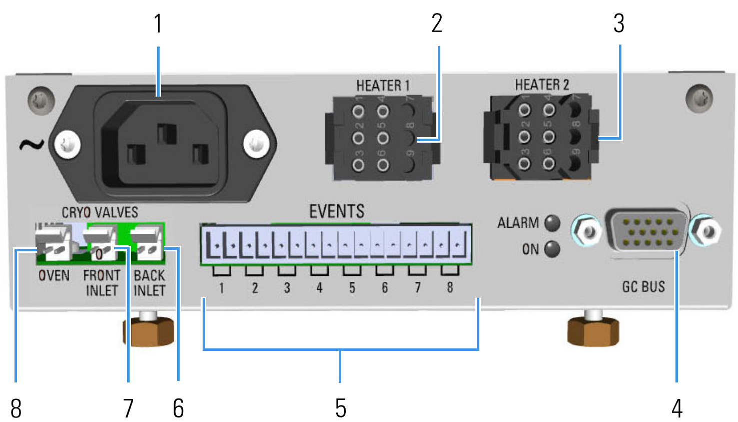
This section provides instructions for updating your TRACE 1600/1610 with the Aux Temperature/Cryo module. See Figure 493.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

Figure 493. Aux Temperature/Cryo Module

The module includes the following connections. See Figure 494.

Figure 494. Aux Temperature/Cryo Module Connections



1. AC input connector.
   The module has a power rating of 120/230 Vac; 50/60 Hz; 355 VA.
2. A 6-pin connector marked **Heater 1** for the connection of the transfer line of a mass spectrometer.
3. A 6-pin connector marked **Heater 2** for the connection of the transfer line of a second mass spectrometer.
4. 15-pin female connectors marked **Bus** for the communication with the GC.
5. A 16-pin connector marked **Events** for the connection of **eight** external solenoid valves (24 V, 2 W max). The valves can be programmed individually during the running of the instrument.

6. A 2-pin connector marked **Back Inlet** for the connection of the solenoid valves for the back PTV/PTVBKF cryogenic system.

7. A 2-pin connector marked **Front Inlet** for the connection of the solenoid valves for the front PTV/PTVBKF cryogenic system.

8. A 2-pin connector marked **Oven** for the connection of the solenoid valves for the Oven cryogenic system.

Four protective fuses are present inside the module. See Table 21.

Table 21. Aux Temperature/Cryo Module Protective Fuses

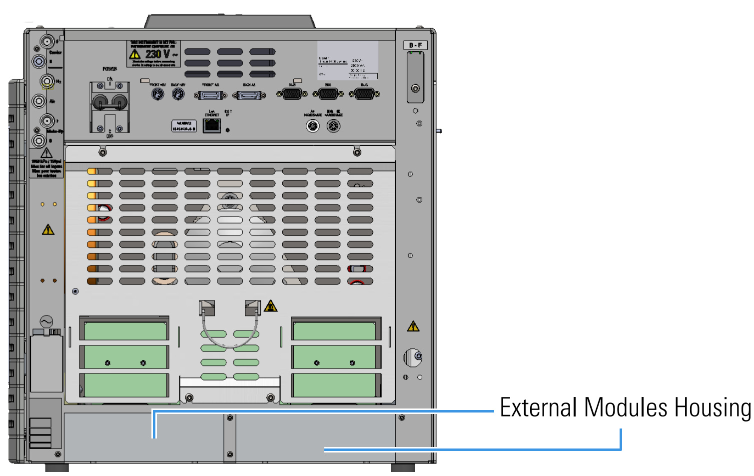
Fuse	Type	Protection
F1	F2A 250 V; (5 x 20 mm)	Heater 1
F2	F2A 250 V; (5 x 20 mm)	Heater 2
F3	T2A 250 V; (5 x 20 mm)	24 V
F4	F1.6A 250 V; (5 x 20 mm)	24 V solenoid valves

The module features the following:

- The valve control of the Oven cryo option.
- The valve control of the front/back PTV cryo option.
- Sixty-three timed events to automatically drive up to eight external on/off solenoid valves.

The module should be installed into a free external module housing provided on the back of the GC. See Figure 495.

Figure 495. External Modules Housing



❖ To add an Aux Temperature/Cryo Module

1. Put the GC in standby condition.

2. Cool the oven, injectors, and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.

4. Power off the GC.

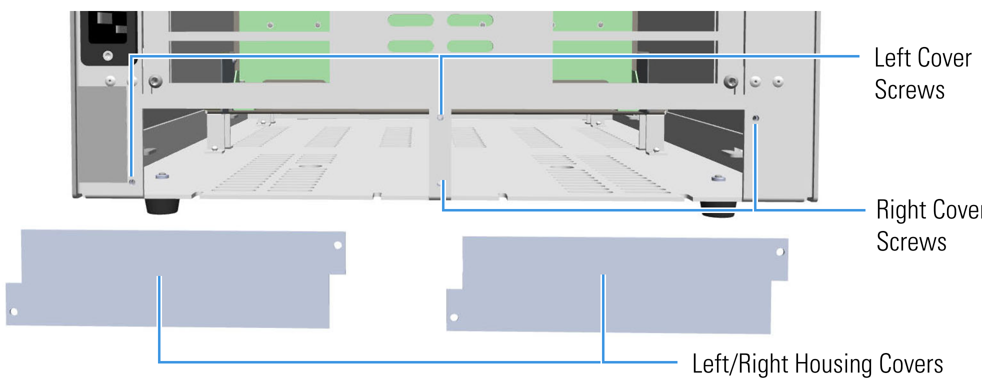
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.

   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

6. Remove the cover of the external modules housing where you want to install the module. See Figure 496.

Figure 496. Housing Cover Removal



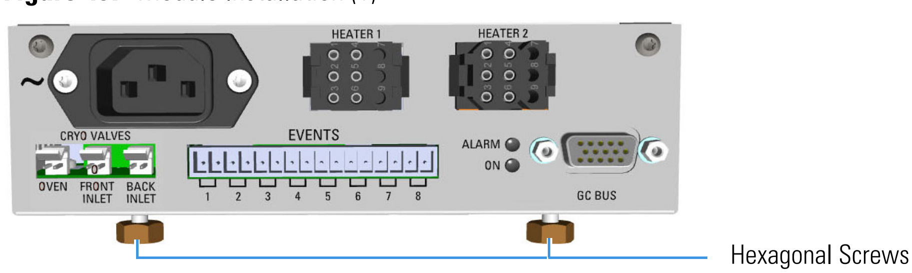
   a. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws.

   b. Remove the covers from the housing.

7. Install the module into the housing

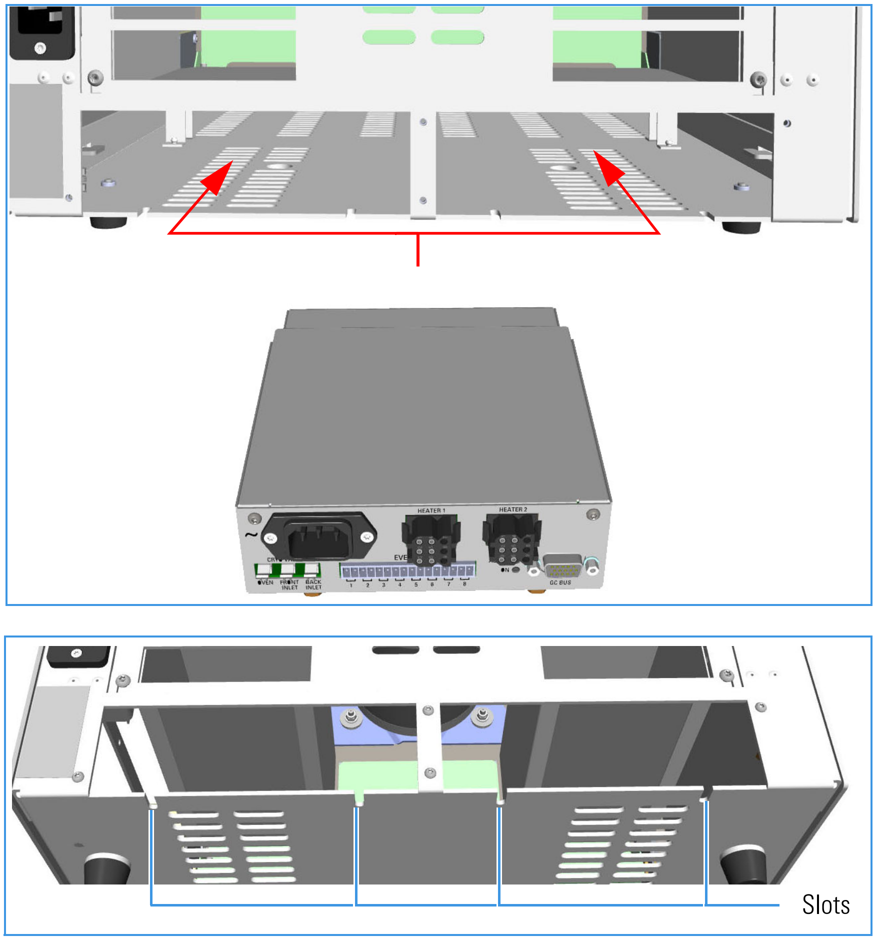
   a. Loosen the two hexagonal screws under the module. See Figure 497.

Figure 497. Module Installation (1)



b. Place the module into the left or right housing until the hexagonal screws couple the slots on the floor of the GC. See Figure 498.

Figure 498. Module Installation (2)

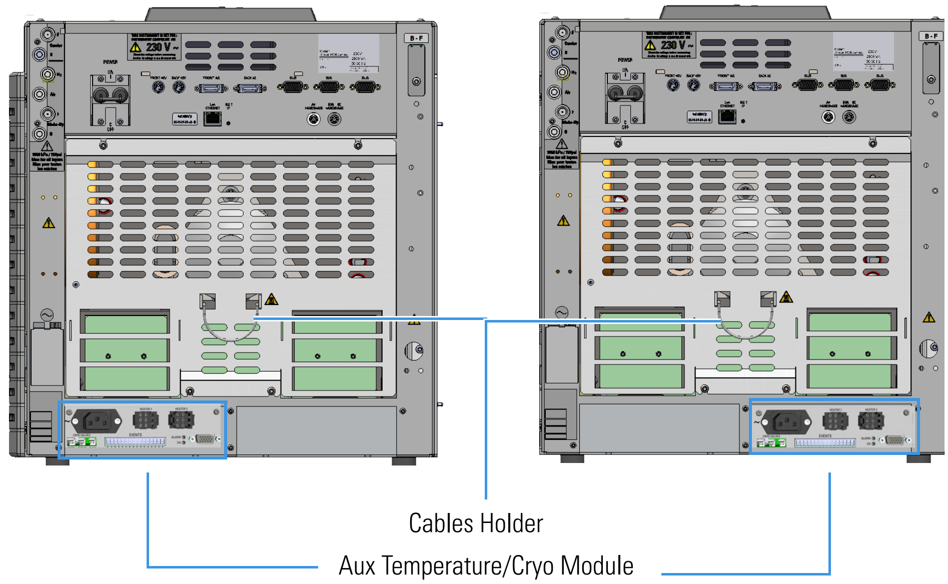


c. Finger-tighten the hexagonal screws slightly, or using a 10-mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

The result of the installation is shown in Figure 499.

Figure 499. Aux Temperature/Cryo Module Installed into the GC



8. Connect the Aux Temperature/Cryo module.

> **Tip** To avoid the contact with the hot air from the vents, it is suggested to gather the electrical cables into cables holder.

   a. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

      – If the cryo option for the Oven is present, connect the 2-pin connector marked **Cryo Valves - Oven** to the cryo solenoid valve using the cable provided.

      – If the cryo option for the front/back PTV/PTVBKF injector is present, connect the 2-pin connector marked **Cryo Valves - Front Inlet** or **Cryo Valves-Back Inlet** to the cryo solenoid valve using the cable provided.

      – If the on/off activation of external solenoid valves (up to eight) is required, connect a 2-pin connector marked **Event 1÷8** to each external solenoid valve.

      – Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights after the GC is powered on.

> **IMPORTANT** The Auxiliary Temperature/Cryo module must be powered at the same power supply voltage required for the GC.

9. Open the gas supplies.

10. If other external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

11. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.
12. Configure and enable the system installed through the user interface of your GC, or through the CDS in use. Refer to the *TRACE 1600/1610 User Guide*.

Adding a Helium Saver Injector Module

The Instant Connect Helium Saver Injector Module (HeS-S/SL) is designed as a “double wide” module that fits into the space provided by one detector module and one injector module on the upper deck of your TRACE 1600/1610 GC.

Installing the Module

The module may be placed in either the Front or Back position on the upper deck.

- If the module is located in the **Front** position, plumb the helium supply to the Front Make Up gas connection on the back panel of the GC.
- If the module is located in the **Back** position, plumb the helium to the Back Make Up gas connection on the back panel of the GC.

Plumb the nitrogen gas to the corresponding Front or Back Carrier gas connections.

IMPORTANT Although nitrogen will not be the actual carrier gas for the analytical separation, it will be the carrier gas during the injection, and it is necessary to plumb the nitrogen to the carrier gas input.

Note For optimal results, use a high capacity oxygen trap on the nitrogen supply, and a heated zirconium alloy gettering trap on the helium supply. These traps can be purchased together as Thermo Scientific part number 1R120577-0001.

Alternatively, you may opt to provide own helium purification. Due to the low flow rate of helium employed, conventional chemical traps (non-heated traps) may actually contaminate the gas supply. Heated zirconium-based traps specifically designed for helium are ideal. These traps can also remove nitrogen, which is difficult to eliminate from conventional traps.

❖ To install the Instant Connect Helium Saver Injector Module

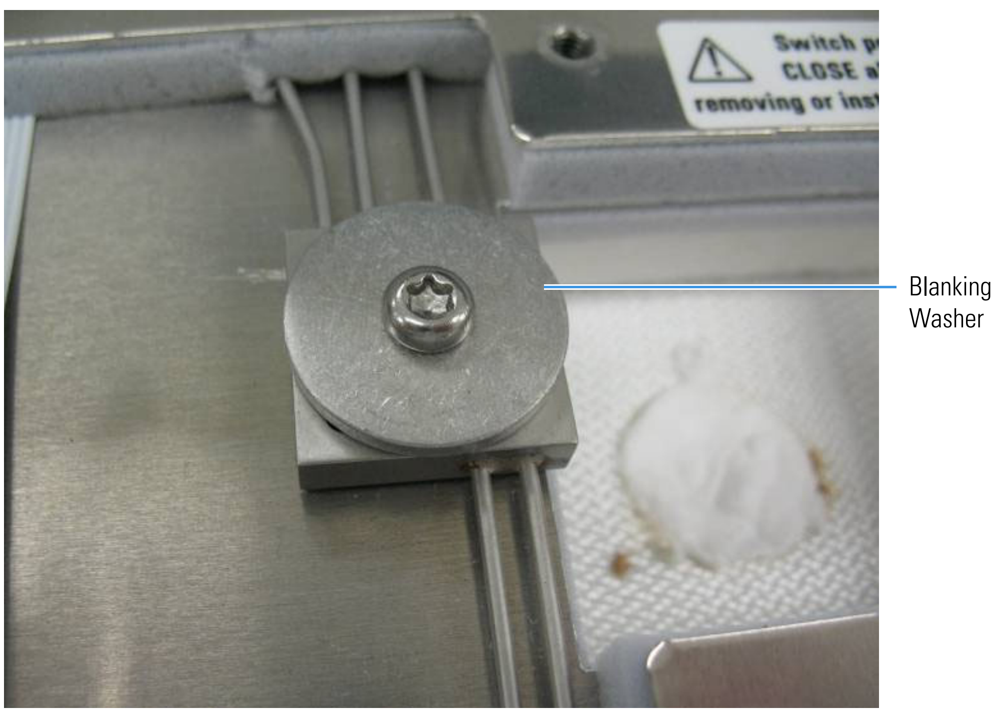
1. Cool the GC and MS heated zones and then shut off all carrier and detector gases on the local GC user interface as well as at the source cylinder.

2. Remove the detector and injector dummy modules from the locations where the Helium Saver S/SL module will be installed by loosening the two captive T20 screws on each module. See Figure 500.

Figure 500. Removing the Dummy Modules

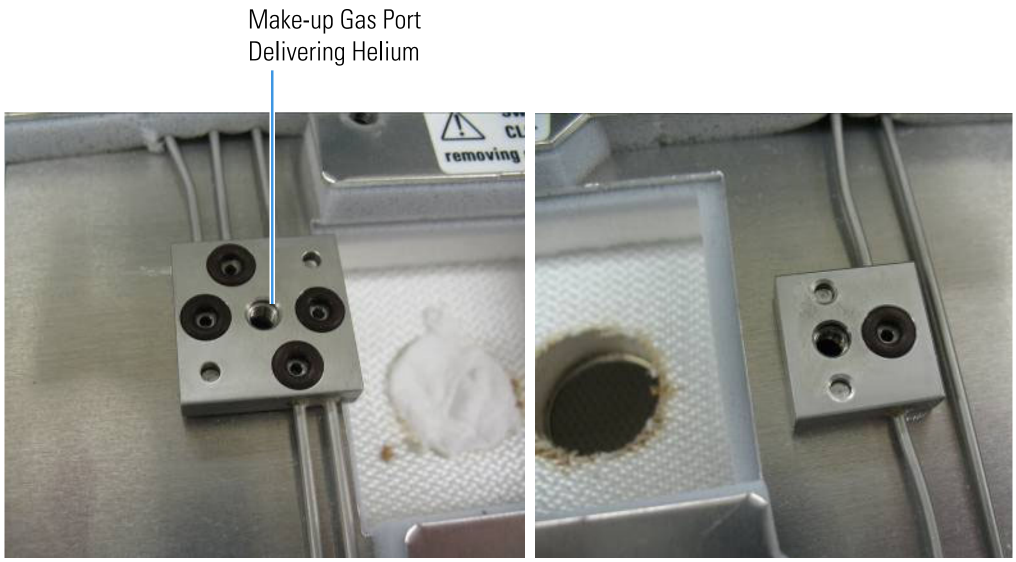
3. Remove the blanking washers from the detector and injector pneumatic network. See Figure 501.

Figure 501. Removing the Blanking Washers



4. Ensure there is an O-ring present in the O-ring seat of each position on the pneumatic network block. See Figure 502.

Figure 502. Confirming Presence of O-rings



5. Plumb a cylinder of high purity helium 99.999% to the appropriate make-up gas connection on the back of the GC using the adapter provided. See Figure 503.
The Thermo Scientific gas purification kit part number 1R120577-0001 contains a heated gettering trap which can be used directly with this fitting.

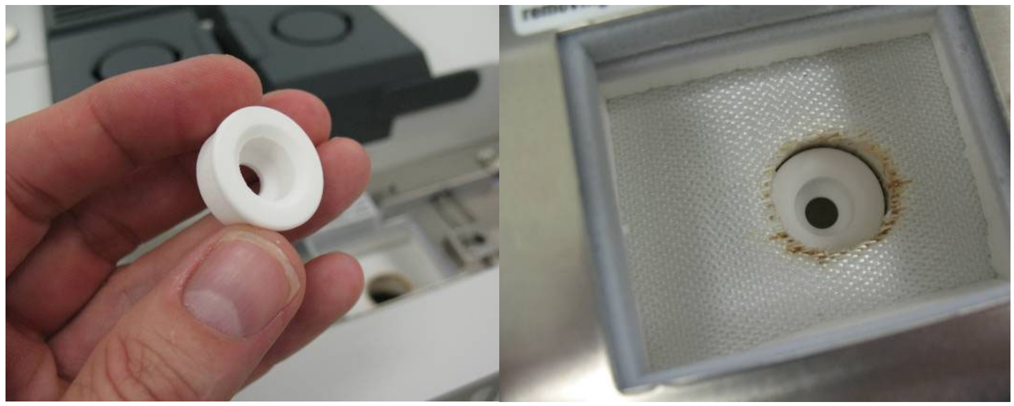
Figure 503. Plumbing the Helium Cylinder

Alternatively, a customer supplied gettering trap can be used along with the provided 1/16 in. stainless steel tubing. Set the regulator pressure such that helium purges the make-up line of the pneumatic network for 15 min at a flow of 20–100 mL/min.

The flow can be measured directly from the detector block at the left most port as shown in Figure 502 on page 493. This will purge the gas line as well as eliminate air from the gettering material of an in-line heated helium purifier. Do this before applying power to the purifier. Ensure the hose leading to the flowmeter is clean and dust free before holding it against the O-ring seat.

6. Carefully insert the Instant Connect Helium Saver Injector Module into position on the GC top deck after first inserting the ceramic insulator shown in Figure 504.

Figure 504. Positioning the Instant Connect Helium Saver Injector Module



Also, be sure to remove the column nut from the injector if it has not already been removed. This prevents damage to the ceramic insulator when the module is inserted.

Note It may be helpful to insert the left side of the module just prior to the right side in order to clear the space properly. The module fits snugly into position but should not require undue force to clear the sheet metal opening.

7. Secure the T20 screws near the center line of the module leading to the injector and detector pneumatic network prior to tightening the captive screws which hold the module. See Figure 505.

Figure 505. Securing the Instant Connect Helium Saver Injector Module in Place

It will be necessary to push down on the right side of the module near the back edge to ensure engagement of the 25 pin D-sub electrical connector. Wiggle the module as necessary to engage the pins and then secure the screws.

8. At this point, the regulator that delivers the helium can be set to the appropriate pressure: typically 110 psig (760 kPa; 7.6 bar) will suffice for 0.25 mm i.d. columns of 30 m length.
   Dial the pressure up slowly while tapping the pressure gauge in order to set the appropriate pressure. Table 22 serves as a guide for setting the correct helium regulator pressure.

Table 22. Determining Correct Helium Regulator Pressure for Column Type (Sheet 1 of 2)

Column Length	Column i.d.	Desired Flow *	Required helium regulator pressure psig (kPa; bar) **
5 m/10 m	0.10 mm	0.4 mL/min	110 psig (760 kPa; 7.6 bar)
		0.5 mL/min	120 psig (830 kPa; 8.3 bar)
		0.6 mL/min	130 psig (900 kPa; 9 bar)
10 m/20 m	0.18 mm	0.8 mL/min	100 psig (690 kPa; 6.9 bar)
		1.0 mL/min	110 psig (760 kPa; 7.6 bar)
		1.2 mL/min	120 psig (830 kPa; 8.3 bar)
		1.5 mL/min	130 psig (900 kPa; 9 bar)
		2.0 mL/min	140 psig (970 kPa; 9.7 bar)
15 m	0.25 mm	1.0 mL/min	100 psig (690 kPa; 6.9 bar)
		1.2 mL/min	110 psig (760 kPa; 7.6 bar)
		1.7 mL/min	120 psig (830 kPa; 8.3 bar)
		2.2 mL/min	130 psig (900 kPa; 9 bar)
		2.7 mL/min	140 psig (970 kPa; 9.7 bar)
30 m	0.25 mm	1.0 mL/min	100 psig (690 kPa; 6.9 bar)
		1.2 mL/min	110 psig (760 kPa; 7.6 bar)
		1.7 mL/min	120 psig (830 kPa; 8.3 bar)
		2.2 mL/min	130 psig (900 kPa; 9 bar)
		2.7 mL/min	140 psig (970 kPa; 9.7 bar)
		3.2 mL/min	150 psig (1030 kPa; 10.3 bar)
60 m	0.25 mm	1.0 mL/min	120 psig (830 kPa; 8.3 bar)
		1.2 mL/min	130 psig (900 kPa; 9 bar)
		1.7 mL/min	140 psig (970 kPa; 9.7 bar)
		2.2 mL/min	150 psig (1030 kPa; 10.3 bar)
100 m	0.25 mm	1.0 mL/min	130 psig (900 kPa; 9 bar)

Table 22. Determining Correct Helium Regulator Pressure for Column Type (Sheet 2 of 2)

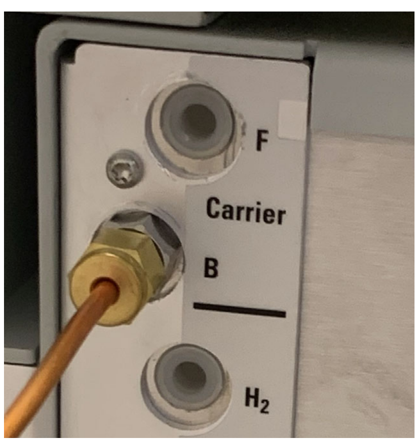
Column Length	Column i.d.	Desired Flow *	Required helium regulator pressure psig (kPa; bar) **
		1.2 mL/min	140 psig (970 kPa; 9.7 bar)
		1.7 mL/min	150 psig (1030 kPa; 10.3 bar)
30 m	0.32 mm	1.5 mL/min	100 psig (690 kPa; 6.9 bar)
		2.0 mL/min	110 psig (760 kPa; 7.6 bar)
		2.5 mL/min	120 psig (830 kPa; 8.3 bar)
		3.0 mL/min	130 psig (900 kPa; 9 bar)
		3.5 mL/min	140 psig (970 kPa; 9.7 bar)
60 m	0.32 mm	1.5 mL/min	110 psig (760 kPa; 7.6 bar)
		2.0 mL/min	120 psig (830 kPa; 8.3 bar)
		2.5 mL/min	130 psig (900 kPa; 9 bar)
		3.0 mL/min	140 psig (970 kPa; 9.7 bar)
		3.5 mL/min	150 psig (1030 kPa; 10.3 bar)
100 m	0.32 mm	1.5 mL/min	130 psig (900 kPa; 9 bar)
		2.0 mL/min	140 psig (970 kPa; 9.7 bar)
		2.5 mL/min	150 psig (1030 kPa; 10.3 bar)

* For flow rates not specifically listed, round up in pressure to the next highest value. For example, if 1.5 mL/min is desired using a 0.25 mm ID column of 15 m length, use a helium regulator pressure of 110 psig (760 kPa; 7.6 bar).

** Minimum pressure required to avoid nitrogen back diffusion into the helium carrier gas. Higher pressure will result in a slightly higher (than minimum) consumption of helium, but will not result in adverse analytical performance.

9. Plumb a nitrogen supply to the appropriate Carrier input at the back of the GC as shown in Figure 506.

Figure 506. Plumbing the Nitrogen Supply to the GC



10. The Thermo Scientific gas purification kit contains a high capacity oxygen trap that should be placed in the nitrogen line. Be sure to purge the regulator and gas line before attaching the oxygen filter.
11. Keep nitrogen flowing through the trap while attaching the filter to the back of the GC in order to prevent oxygen from entering the trap.
12. Adjust the pressure regulator to supply a pressure sufficient for the analytical method in use. In general, 75 psig (517 kPa; 5.17 bar) is more than sufficient for most applications. Very small bore capillaries may require higher pressures.

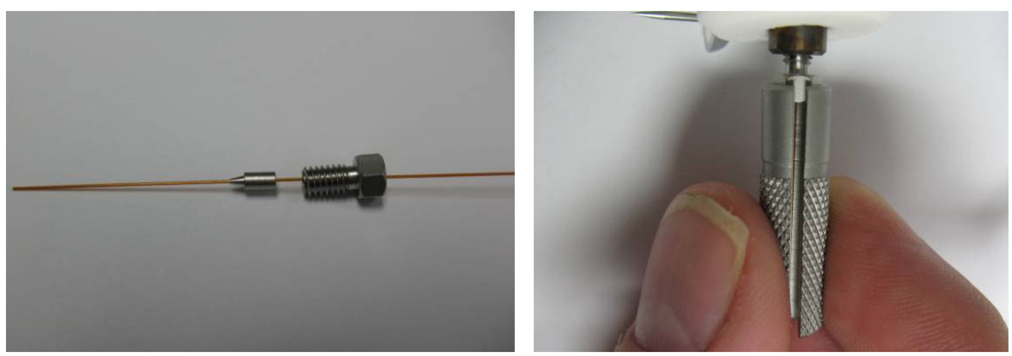
Installing the Column

The Instant Connect Helium Saver Injector Module is designed to be used with Silflow™ metallic ferrules. This allows for very accurate trimming of the column following compression of the ferrule onto the column. It is important that only 5 mm of column protrudes past the tip of the ferrule for proper operation. The inlet has been designed to work optimally with 0.25 mm i.d. columns, although larger (up to 0.32 mm i.d.) or smaller i.d. can be used successfully.

❖ To install the column

1. Insert the column through the SilFlow™ nut and ferrule as shown in Figure 507.

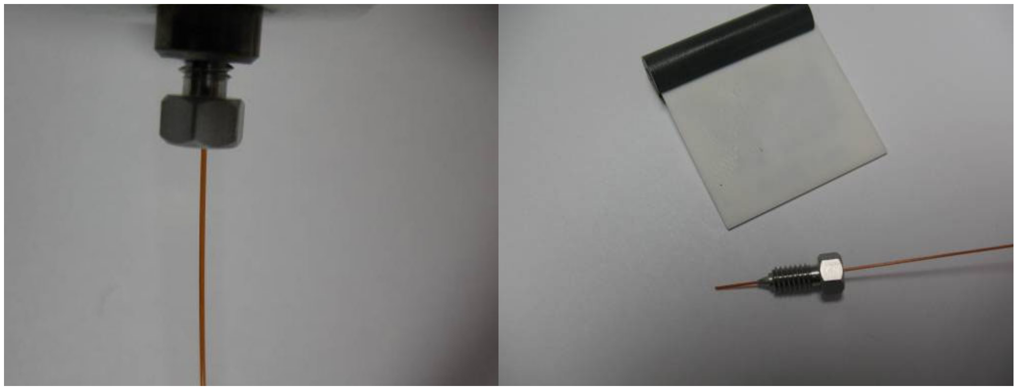
Figure 507. Installing the Column Nut and Ferrule



2. Allow a few centimeters of column to extend past the tip of the ferrule and insert it into the base of the inlet. It will be necessary to gently poke around in order to find the small bore cone that serves as a column guide and ferrule seat.
3. Use the knurled tool to tighten the nut by finger force only, until the ferrule grabs the column, and the column no longer slides in the bore of the ferrule.

   The column connection should appear as shown in Figure 508.

Figure 508. Installing the Column in the Injector

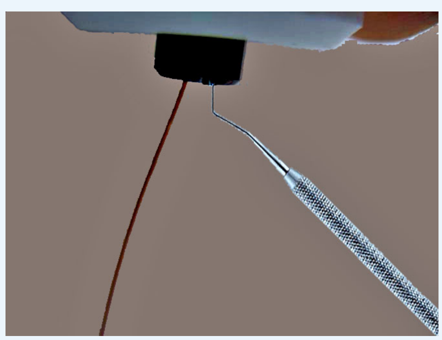


The column should be fully captured by the ferrule without the ability to slide it up or down.

4. At this point, remove the nut and ferrule assembly and confirm the column will not slide in the ferrule (See first **Tip** on page 498). Trim the column such that only 5 mm extends past the tip of the ferrule.

5. Carefully reinstall the column and again tighten the ferrule. The column is now installed in the injector.

Tip An indispensable tool for removal of the column from the inlet is a dental pick or thumbtack. When the SilFlow ferrule engages the inlet on tightening, it is slightly deformed at the tip in order for the sealing to occur. This causes the ferrule to become "stuck," which is a normal occurrence. The ferrule can easily be removed by inserting the pointed tip of the dental pick gently along the side of the ferrule and pressing vertically to cause the ferrule to be displaced to the side. Gently pulling on the column at the same time will dislodge the ferrule.

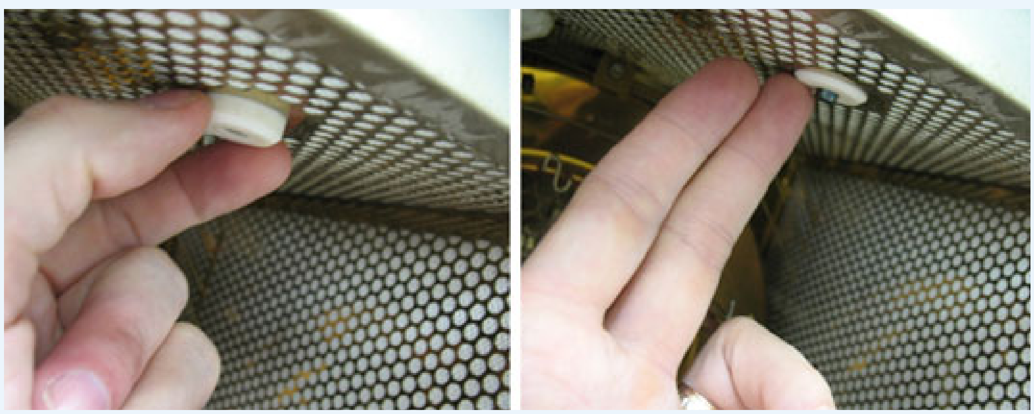


Note The standard outfit kit for the Instant Connect Helium Saver Injector Module is equipped with SilFlow ferrules having internal diameters of 0.50, 0.40, and 0.35 mm.

If you are using a 0.32 mm id column, use the 0.50 mm i.d. ferrules supplied.
If you are using a 0.25 mm id column or smaller, use the 0.35 mm id ferrule if the column will pass through it.
This will allow easy finger tightening of the ferrule using the hand tool without undue torque. In other words, use the smallest ferrule that will fit your columns.
The ideal situation is when the column passes through the hole with slight pressure.
The replacement Thermo part numbers are as follows:

- 0.50 mm ferrule **10ea**. 29063467 (for 0.32 columns)
- 0.40 mm ferrule **10ea**. 29063466 (for 0.25 columns and smaller on the high end of the o.d. tolerance)
- 0.35 mm ferrule **10ea**. 29063465 (for 0.25 columns and smaller on the low end of the o.d. tolerance).

Tip When installing the column, nut and ferrule, lift up slightly on the ceramic insulator surrounding the base of the injector insert as shown in figure.



This will expose the end of the insert and make it easier to locate the column in the central hole.
After the final trimming and installation of the column, make sure to pull the insulator back to its lowest position.

Checking for Leaks

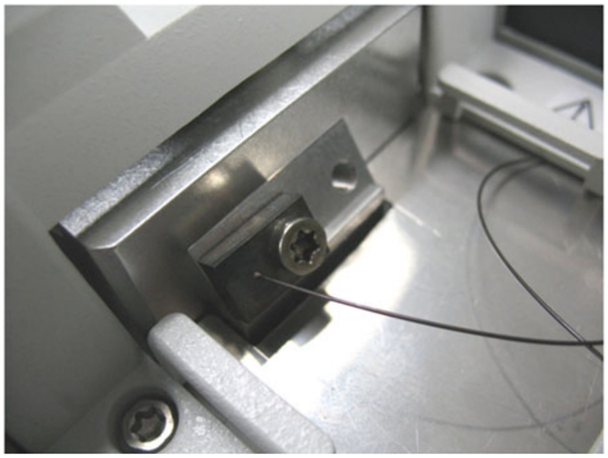
A hand held helium leak detector may be used to check for helium leaks around the inlet and column connection. With the helium conservation enabled, approximately 4 mL/min of helium will enter the injection port.

For maximum sensitivity of the leak detector, set the split flow to **Off** during leak check. This results only in column and septum purge flows.

The composition of the gas mixture in the inlet will be mostly helium and allow good sensitivity. For bulk nitrogen leak detection, the GC column exit can be plugged, and the automated pressure drop leak detection of the GC used for determining the pressure drop.

The helium delivery block should be parked in the rear “blocked” position of Figure 509 if leak checking is done based on pressure drop. The block must be replaced in the front position to resume operation.

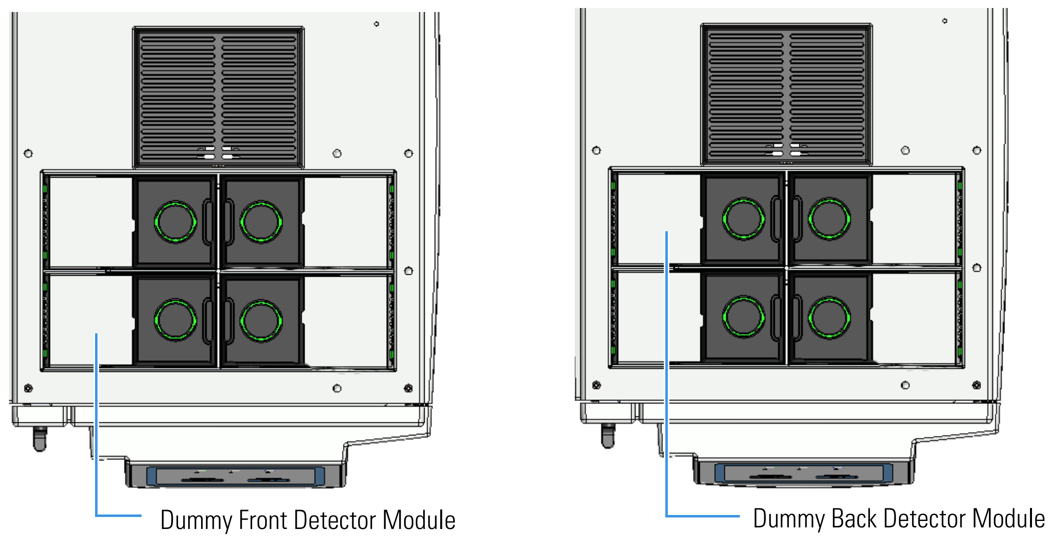
Figure 509. Removing the Helium Tube from the Gas Delivery Block



Adding a PDD Module

This section provides instructions for adding a front/back PDD detector module. According to the configuration of your TRACE 1600/1610, a dummy module is present into the free site where the detector module is not installed. See Figure 510.

Figure 510. Location of Detector Modules on the TRACE 1600/1610 GC



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

Getting Started

To properly installing and connecting the PDD module see sequentially the following sections:

- "Installing a PDD Module" on page 502
- "Plumbing the Gas Lines" on page 506
  - "Installing and Purging the Gas Regulator" on page 507
  - "Installing and Purging the Helium Purifier" on page 507
  - "Connecting the Discharge Gas Supply" on page 508
- "Connecting the High Voltage and Pulses Cables" on page 508
- "Installing the Capillary Column" on page 513

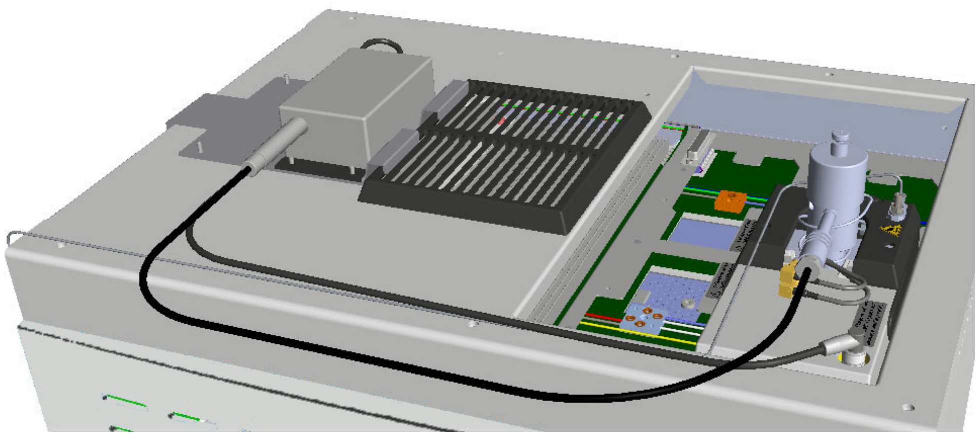
- “Installing the Packed Column” on page 513
- “Testing for Leaks” on page 513
- “Performing Initial Power Up” on page 514

Installing a PDD Module

❖ To install a PDD detector module

The result of the operation is shown in Figure 511.

Figure 511. Result of the PDD Installation



Note The installation of a single PDD detector is considered. The injector modules are deliberately missing for convenience.

1. Put the GC in standby condition.
2. Cool the oven, injector, and detector to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

6. Remove the dummy module from the position where the detector module will be installed.

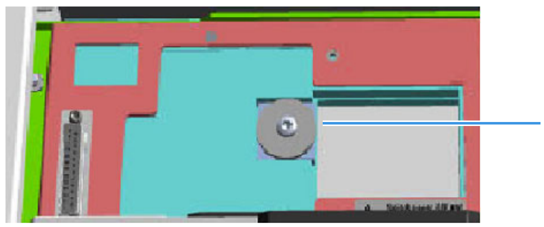
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.

   c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector/detector housing. Place the dummy module on a clean surface.

   d. Keep the gas block plug of the gas connections installed. See Figure 481.

   Figure 512. Detector Gas Block Plug

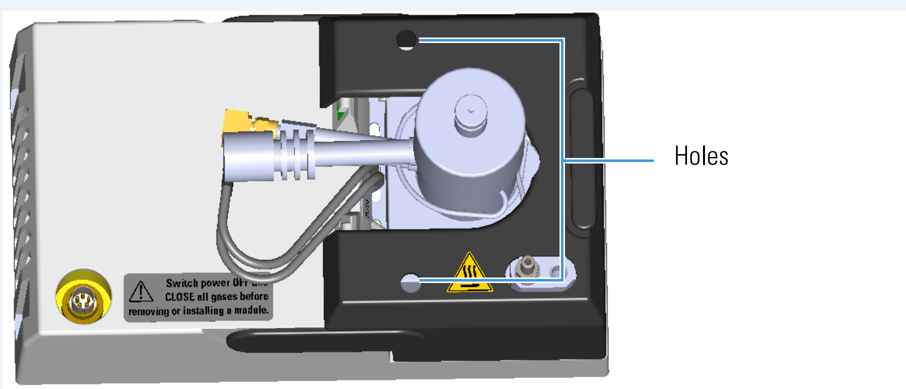
7. Open the front door of the GC.

8. Plug and fix the detector module into the main frame.

   a. Place the module in its seat. Be sure to insert the 25-pin male connector, on the bottom of the module, into the 25-pin female connector on the detector seat of the detector housing.

   Note Because the module flap cover of the PDD detector cannot be opened, two holes are provided on the module flap cover for accessing the captive fixing screws. See Figure 513.

   Figure 513. Holes on the Module Flap Cover

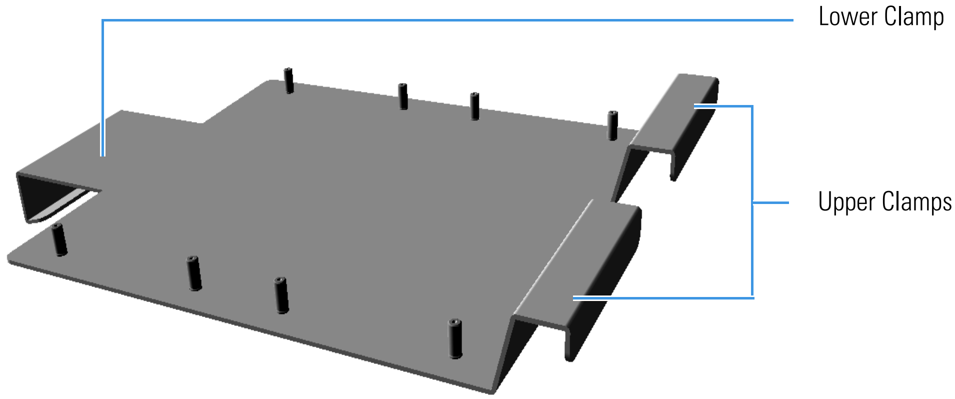
   b. Insert a T20 Torxhead screwdriver into the holes provided on the module flap cover and tighten the captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

9. Mount the support bracket of the pulse generator. See Figure 514.

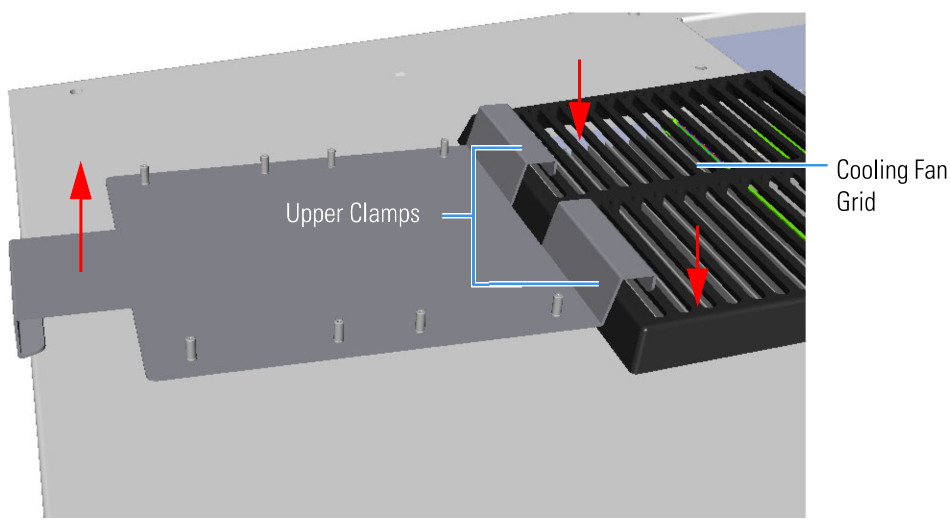
Note The support bracket can hold two pulse generators for supplying two PDD detectors on the GC.

Figure 514. Support Bracket



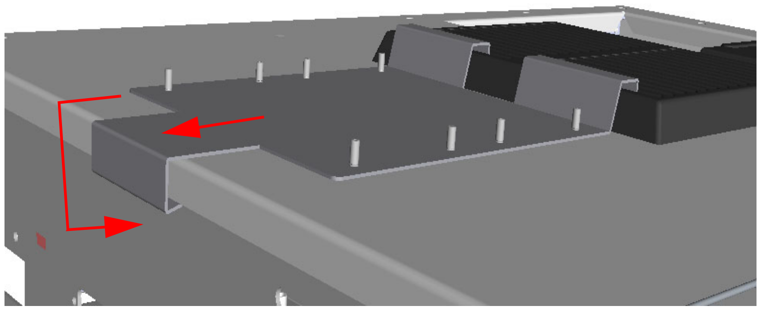
a. Insert the upper clamps of the support bracket into the last slots of the cooling fan grid. See Figure 515.

Figure 515. Support Bracket Installation (1)



b. Lift the bottom part of the support bracket and push it back until the lower lamp hooks the rear of the GC top cover. See Figure 516.

Figure 516. Support Bracket Installation (1)



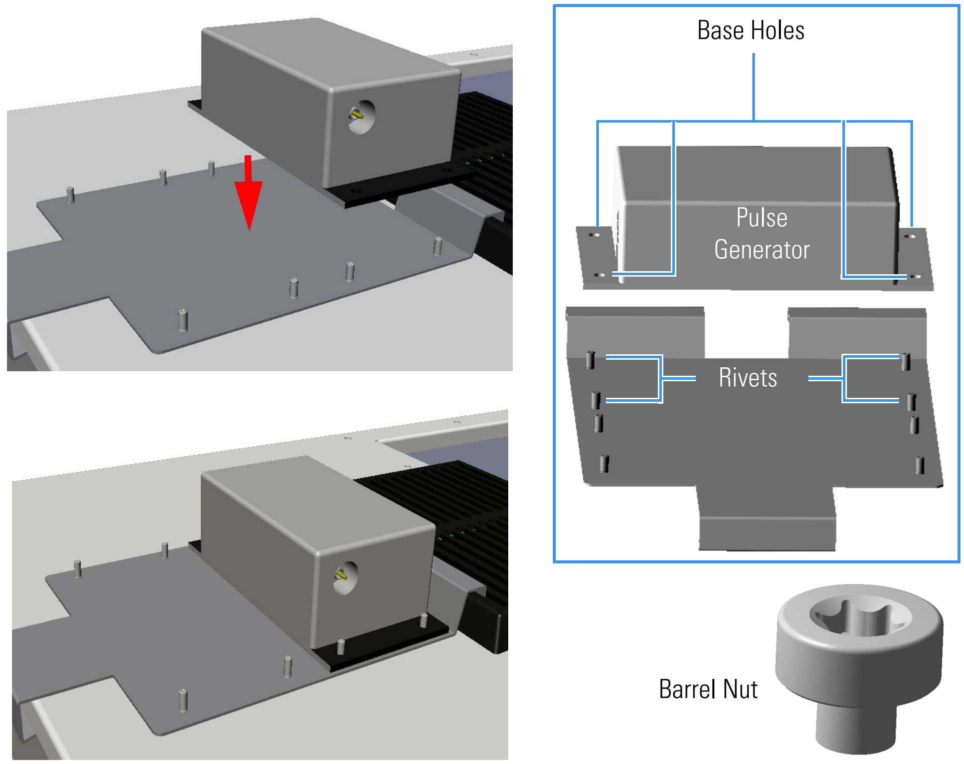
Note Two support brackets can be installed for a maximum of four PDD detectors, two installed on the GC and two installed on the TRACE 1600 Auxiliary Oven. See Figure 517.

Figure 517. Installation of two Support Bracket

10. Place the pulse generator on the support bracket.

    a. Place the pulse generator on a convenient position of the support bracket by aligning the four holes on the base of the generator with the corresponding four rivets on the support bracket as shown in the example of Figure 518.

Figure 518. Pulse Generator Installation

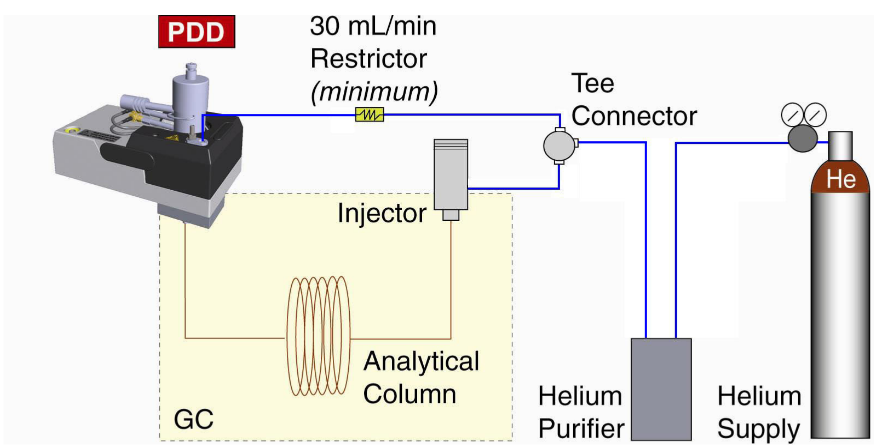


b. Fix the pulse generator using the four barrel nuts provided. Tighten the nuts using a T30 Torxhead screwdriver.

Plumbing the Gas Lines

Figure 519 shows the diagram of the gas lines connections of the detector system.

Figure 519. Gas Line Connections



Before connecting the gas lines verify that:

- The pressure regulators are commercial ultra-pure grade regulators with stainless steel diaphragms. Regulators with diaphragms made of neoprene or other elastomers should never be used.
- The connecting tubes are thoroughly cleaned and baked before use.
- The gas regulator and the helium purifier must be properly purged. See the following sections for further details: "Installing and Purging the Gas Regulator" on page 507, "Installing and Purging the Helium Purifier" on page 507, and "Connecting the Discharge Gas Supply" on page 508.

WARNING Never use leak detecting fluids on any part of the system.

Installing and Purging the Gas Regulator

WARNING To avoid injury, before starting make sure to strictly respect all the Regulations concerning the manual handling of gas cylinders under pressure.

❖ To install and purge the gas regulator

1. Install the pressure regulator on the cylinder.
2. Making sure the regulator is closed, open the cylinder allowing the regulator to pressurize.
3. Close the cylinder and check the regulator for pressure leaks. Observe the needle of the regulator output pressure gauge for 15 minutes.
4. Open the regulator allowing the pressure to relief.
5. Repeat five times from step 2.

Installing and Purging the Helium Purifier

❖ To install and purge the helium purifier

Before starting, make sure the helium purifier outlet tube is capped.

1. Connect the helium cylinder pressure regulator to the inlet port of the helium purifier by using the appropriate connecting tube and fittings.
2. Turn the output pressure regulating knob clockwise until the gauge registers 345 kPa (50 psig).
3. Wait five minutes for equilibrium, then turn the regulating knob all the way counterclockwise.

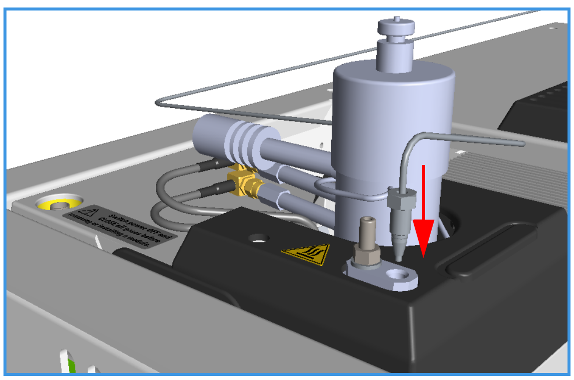
4. Observe the needle of the output pressure gauge for 15 minutes. There will be a slight initial drop. If it does not move after that, consider all the connections are tight.
5. If necessary, use an electronic leak detector to locate any leaks. If a leak detector is not available, tighten all the fitting and repressurize the system for another test.
6. Uncap the outlet tube of the helium purifier and purge the system for 15 to 30 minutes at 60 - 80 mL/min to eliminate air from the purifier getting material.

Connecting the Discharge Gas Supply

❖ **To connect the discharge gas supply**

1. Connect the helium purifier outlet port to a port of the Tee connector provided by using the 1/16-in. o.d. connecting tube provided.
2. Connect the second port of the Tee connector to the carrier gas inlet port, located on the rear panel of the GC, by using a sufficient piece of the stainless steel connecting tube provided and the appropriate fitting.
3. Connect the last port of the Tee connector to the inlet of the discharge gas restrictor.
4. Connect the outlet tube of the restrictor to a flow measuring device and adjust the helium pressure to obtain a flow of about 30 mL/min.
5. After setting the flow rate, connect the outlet of the restrictor to the discharge gas inlet on the PDD module. See Figure 520.

Figure 520. Gas Supply Connections



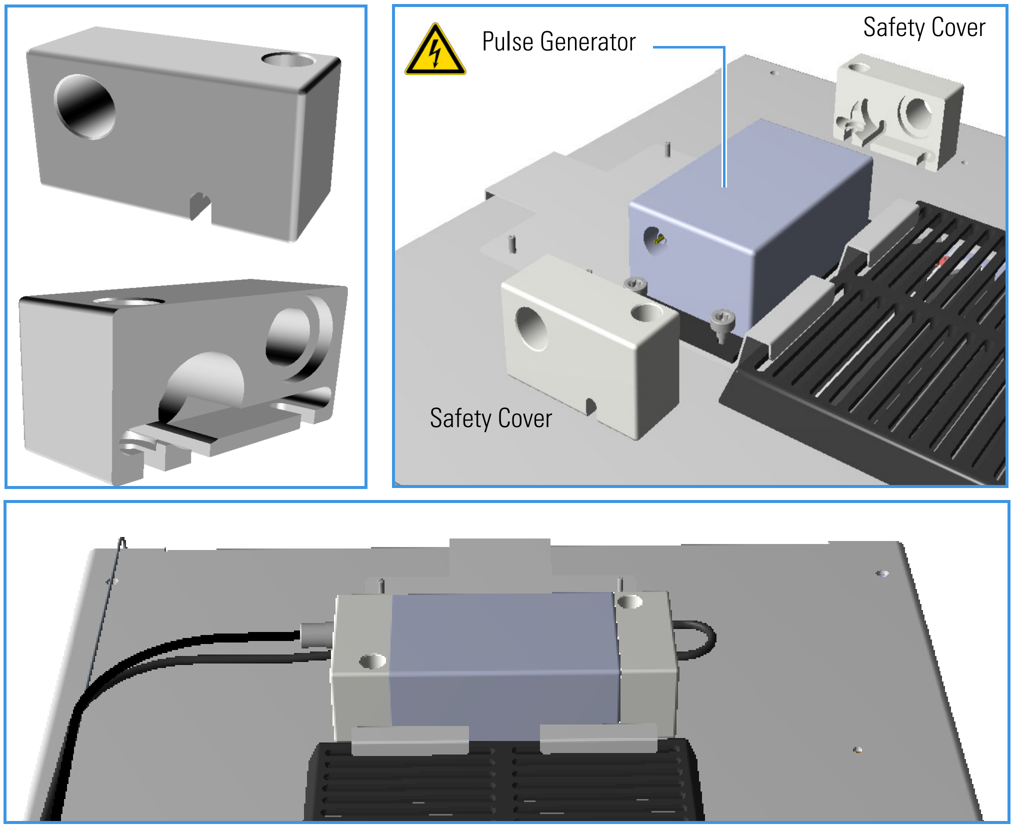
Connecting the High Voltage and Pulses Cables

❖ **To connect the cables from the pulse generator to the PDD module**

WARNING Never the high voltage discharge cable must be disconnected when the pulse generator is turned on. Dangerous high voltage is present: 3700 V Peak; 170 mA Peak.

To avoid accidental disconnection of the high voltage discharge cable (mainly) and the pulses cable from the pulse generator, the safety covers must be installed. See Figure 521.

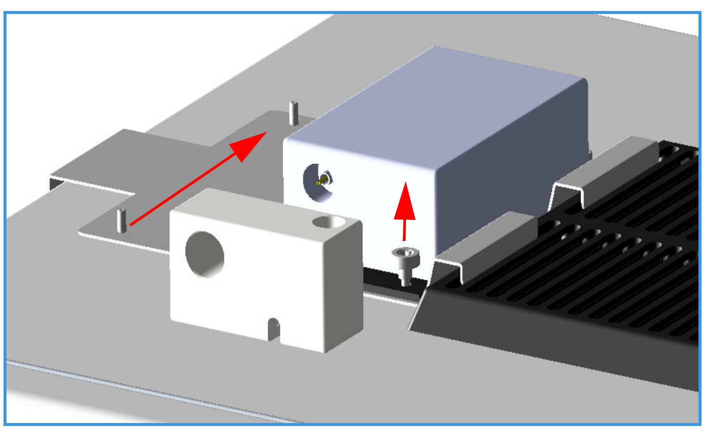
Figure 521. Pulse Generator Safety Covers



1. Connect the high voltage discharge cable.

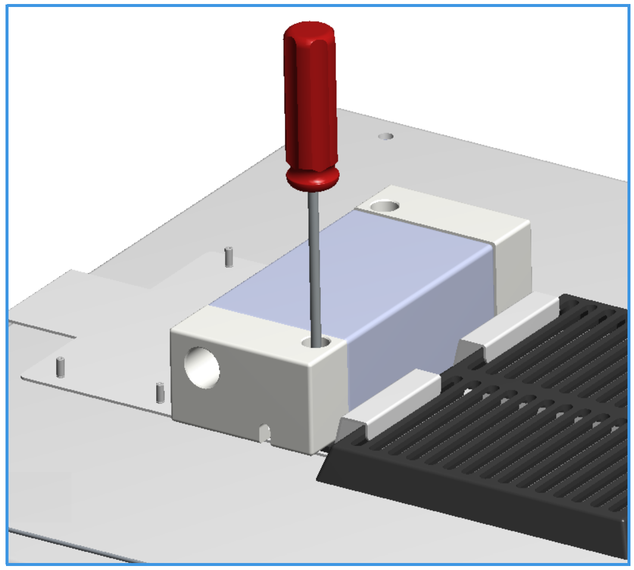
   a. On the high voltage side, loosen the right nut that fix the pulse generator to the bracket. Do not loosen the left nut, keep it tightened. Place the safety cover until the nuts couple the slots on the bottom of the safety cover. See Figure 522.

   Figure 522. High Voltage Discharge Cable Connection (1)

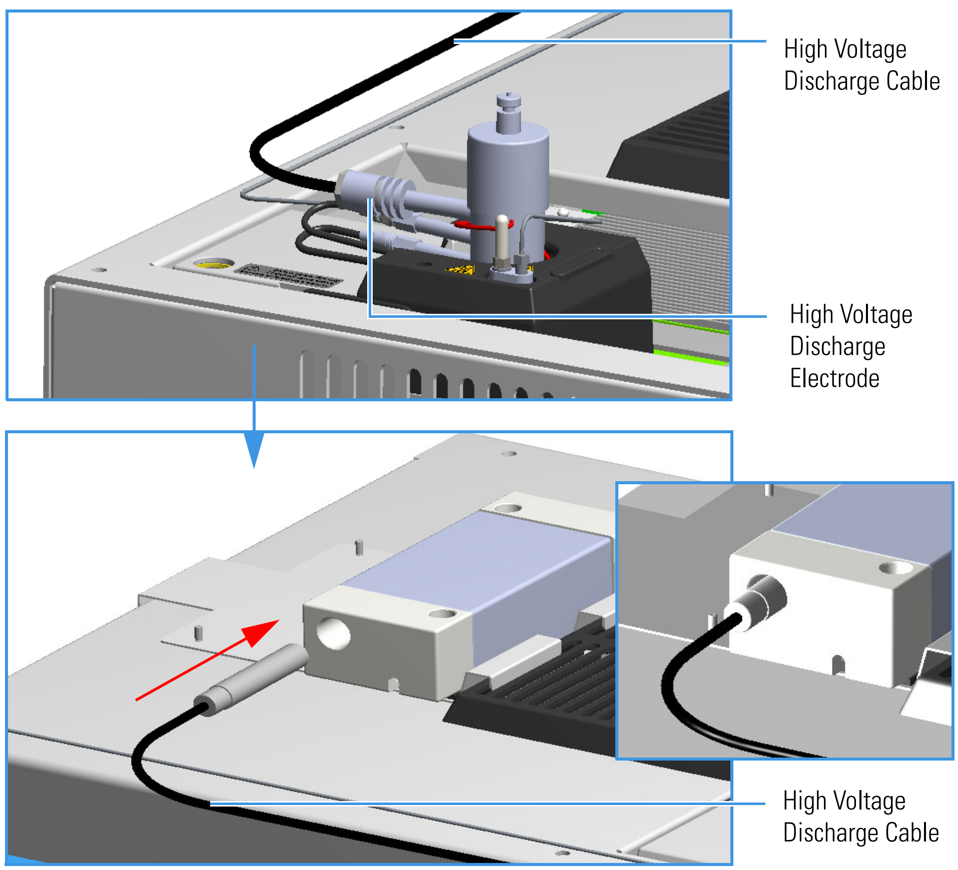
   b. Tighten the right nut using a T30 Torxhead screwdriver. See Figure 523.

Figure 523. High Voltage Discharge Cable Connection (2)



c. Insert the connector of the high voltage discharge cable, coming from the high voltage discharge electrode on the PDD module, into the connection provided in the pulse generator passing through the hole on the safety cover. See Figure 524.

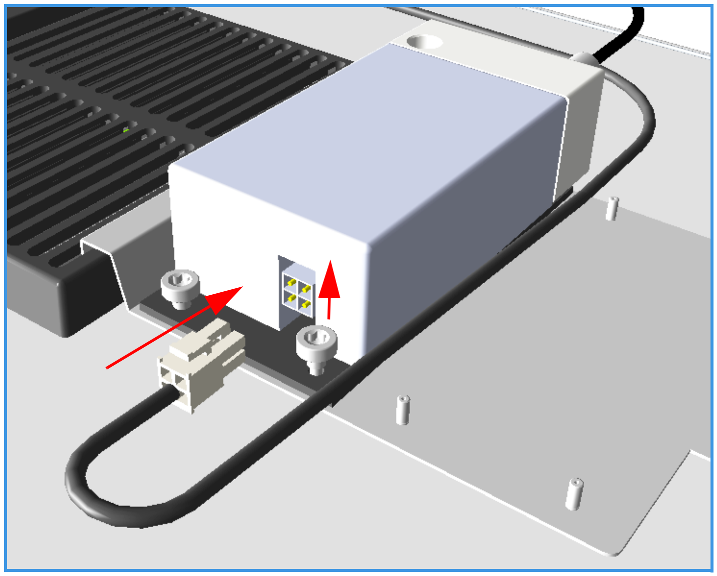
Figure 524. High Voltage Discharge Cable Connection (3)



2. Connect the pulses cable.

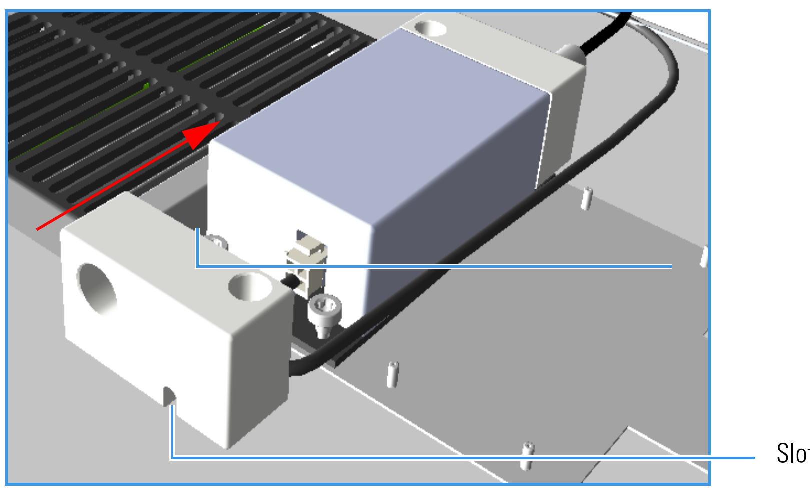
   a. Plug the 4-pin pulses cable connect into the 4-pin connector on the pulse generator See Figure 525.

Figure 525. Pulses Cable Connection (1)



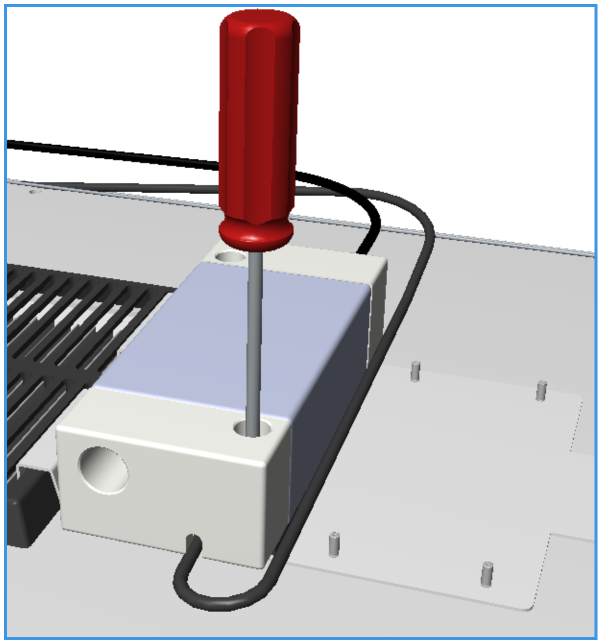
   b. On the pulse generator control side, loosen the right nut that fix the pulse generator to the bracket. Do not loosen the left nut, keep it tightened. Place the safety cover until the nuts couple the slots on the bottom of the safety cover; paying attention to guide the cable into the slot located on the bottom of the safety cover. See Figure 526.

Figure 526. Pulses Cable Connection (2)



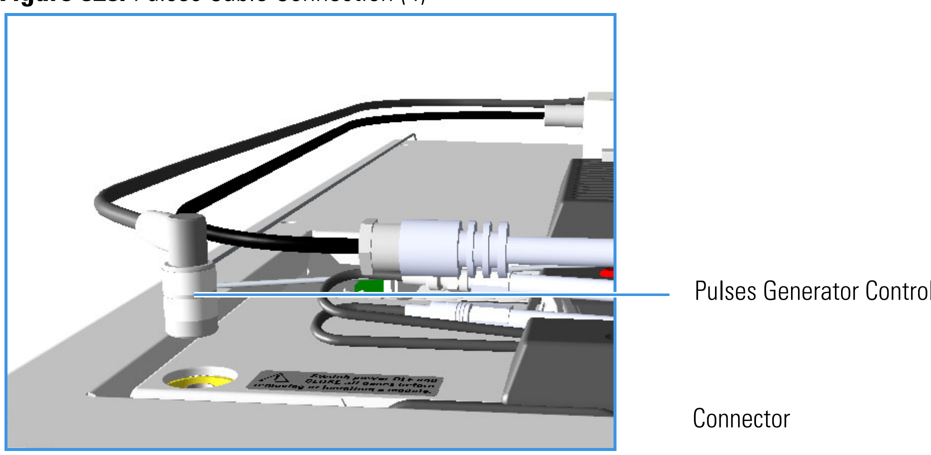
   c. Tighten the right nut using a T30 Torxhead screwdriver. See Figure 527.

Figure 527. Pulses Cable Connection (3)



d. Connect the cable between the pulse generator and the pulse generator control on the PDD module. See Figure 528.

Figure 528. Pulses Cable Connection (4)



WARNING If for any reasons it is necessary to disconnect the cables from the pulse generator, the safety covers must be removed proceeding in the reverse order in which they was installed. Before starting, make sure that the GC is powered Off.

Installing the Capillary Column

For PDD, the column must penetrate **136 mm** inside the pre-installed capillary column adapter.

❖ To install the capillary column

1. Make a mark on the column 136 mm from the end.
2. Remove the knurled nut column inlet at the bottom of the detector. Slide the nut overt the end of the column, followed by the appropriate column ferrule.
3. Seat the ferrule in the detail of the column adapter and begin sliding the column through the capillary column adapter and into the column inlet.
4. Get the nut started on the threads and tighten it until you feel it contact the ferrule, then back off half a turn.
5. Slide the column into the column inlet until the mark is flush with the surface of the knurled nut, and secure the column in the adapter by tightening the knurled nut finger tight only.

Installing the Packed Column

❖ To install the packed column

1. Remove the pre-installed capillary column adapter.
2. Replace pre-installed capillary column adapter with the **packed columns adapter** that penetrates into the PDD cell for the correct length.
3. Connect the packed column to the packed column adapter.

Testing for Leaks

It is critical for the system to be leak-tight. Leak test is strongly recommended before operating with PDD.

❖ To test for leaks

1. Open the discharge gas supply.
2. Cap the tube and pressurize the entire system with helium to 138 kPa (20 psi).
3. If the system does not hold pressure, check all the fittings with an electronic helium leak detector. DO NOT use leak detecting liquids.
4. Tighten fittings as required.

Performing Initial Power Up

❖ **To perform the initial power up**

WARNING During normal operation, the detector produce ultraviolet energy (UVA, UVB), some of which may be emitted. Do not watch the arc without eye protection.

1. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
2. Power on the GC.
   a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
   b. Flip up the power switch (breaker) to the position I.
3. Close the front door of the GC.
4. Set the detector temperature to 100 °C and allow time for the detector to reach the set temperature, and for the helium purifier to reach the optimum working condition.
5. Turn on the pulse generator.
6. Check the standing/background current. Optimum range is 600 - 2000 pA at 100 °C. Lower current indicates a clean, leak-free system.
7. The recommended detector temperature is 20 °C above the column temperature, with a minimum of 100 °C. Set the detector to the operating temperature required for the intended analysis. When the detector has reached the set temperature, read and record the standing current.
8. Start carrier flow, then read the standing current. The difference between this reading and the one previous is the ionization of the combined impurities in and eluting with the carrier gas. The smaller the difference, the better the quality of the gas exiting the column.
9. Set the column oven to the temperature required for the intended analysis. When the oven reaches the set temperature, read the standing current. The difference with the previous reading is the ionization of the column bleed. The smaller the difference, the better the column is conditioned.

   From this point, the standing current should be observed and logged after any system change. In addition, logging the standing current (with and without the column) on a regular basis is an effective monitor of system integrity (leak tightness and cleanliness).

   We also recommend tracking the internal standard (quantity on column/area count) for sensitivity continuity.

Adding a Generic Detector Interface

This section provides instructions for installing the detector and control modules of the Generic Detector Interface on your TRACE 1600/1610 GC or TRACE 1600 Auxiliary Oven.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

Preliminary Operations

Before starting, the following preliminary operation must be carried out.

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.

CAUTION If the GC is coupled to a TRACE 1600 Auxiliary Oven, unplug the power cable from the AC Input connector into the back of the TRACE 1600 Auxiliary Oven and from the wall outlet.

ATTENTION Si le GC est couplé à un four auxiliaire TRACE 1600, débranchez le câble d’alimentation du connecteur d’alimentation CA à l’arrière du four auxiliaire TRACE 1600 et de la prise murale.

4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

Getting Started

For properly installing the Generic Detector Interface see the following sections:

- “Removing the GC Back Cover” on page 516
- “Assembling the GDI Electrical Interface” on page 517
- “Replacing the Encapsulated Flow Restrictors” on page 519

- "Installing and Connecting the GDI Electrical Interface" on page 520
- "Connecting a GDI Interface to the TRACE 1600 Auxiliary Oven" on page 525
- "Installing a GDI Mechanical Module" on page 526
- "Connecting the Detector Gas Tubing to the Manifolds" on page 528
- "Connecting Heater and Signal Cables" on page 533
- "Restarting the GC" on page 534
- "Performing the Third-party Detector Start-up and Optimization" on page 534
- "Configuring and Setting GDI Detector" on page 534

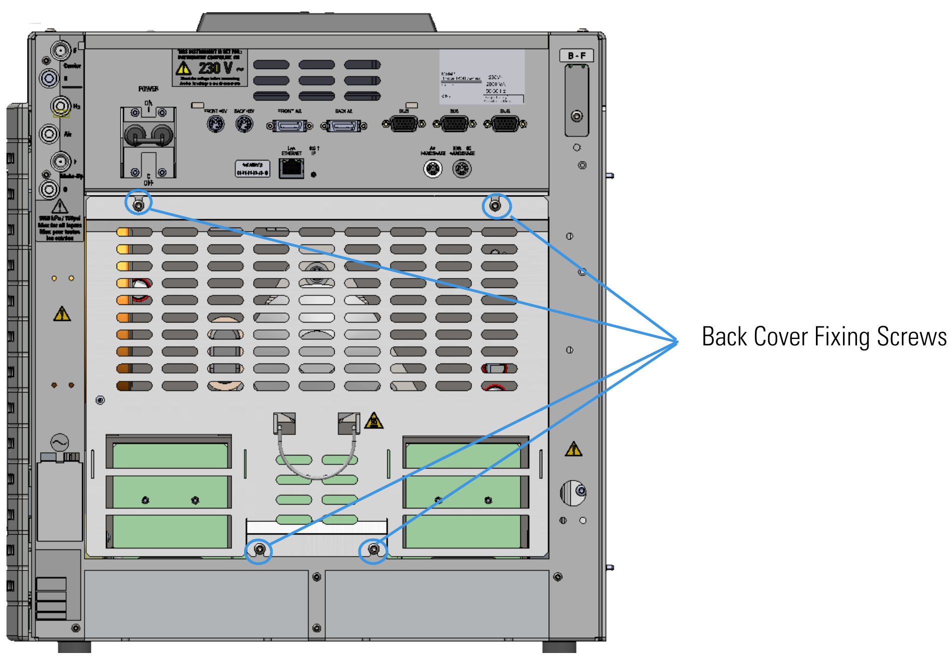
Removing the GC Back Cover

Remove the back cover for accessing the compartment on the back of the GC.

❖ To remove the back cover

1. Remove the cover.
   a. Using a T20 Torxhead screwdriver, unscrew the four screws that secure the back cover to the GC. See Figure 529.

Figure 529. Back Cover Removal



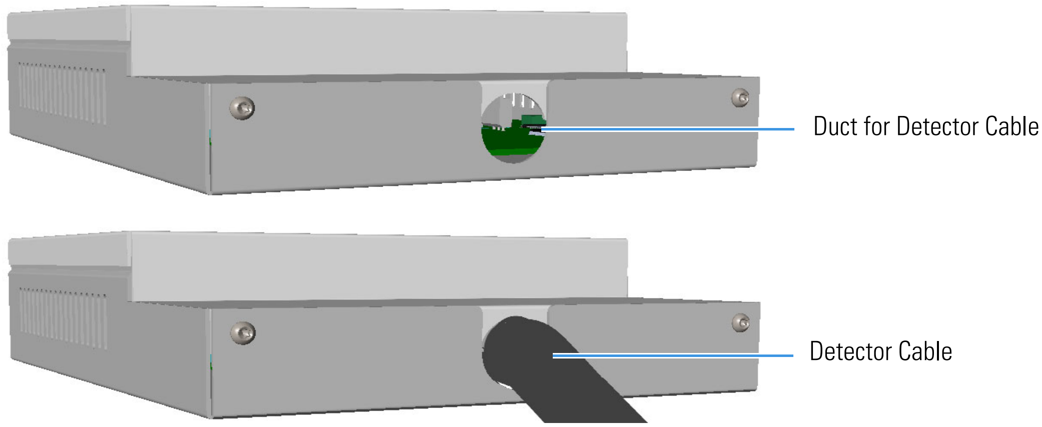
   b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back cover.

Note Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

Assembling the GDI Electrical Interface

If not already done, you must connect the detector cable and its cable grommet into the GDI electrical interface. See Figure 530.

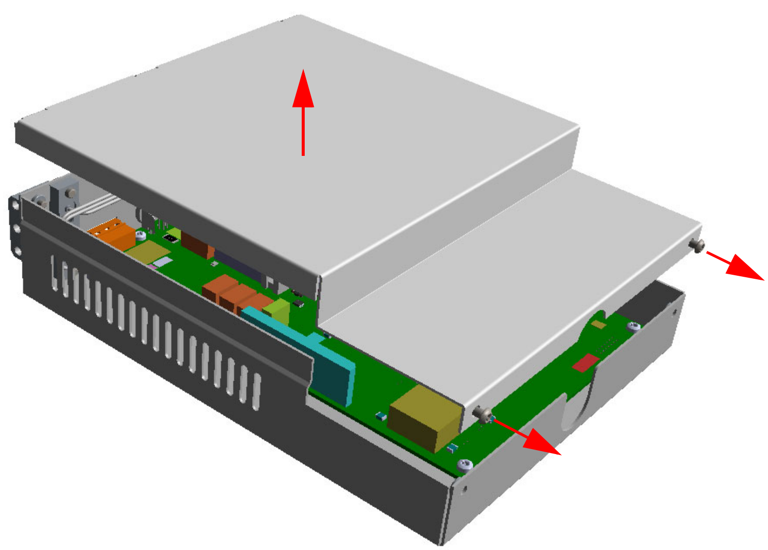
Figure 530. GDI Electrical Interface Back View



❖ **To assemble the GDI electrical interface**

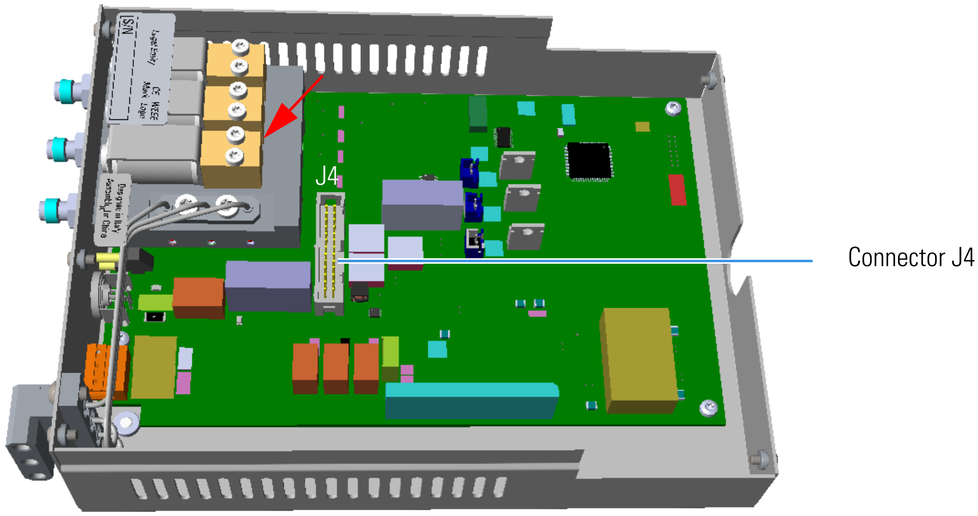
1. Unscrew the fixing screws of the GDI electrical interface using a T10 Torxhead screwdriver, and remove the top cover. See Figure 531.

   Figure 531. Assemble GDI Electrical Interface (1)

2. On the board inside the control module look for the 26-pin male connector marked **J4**. See Figure 532.

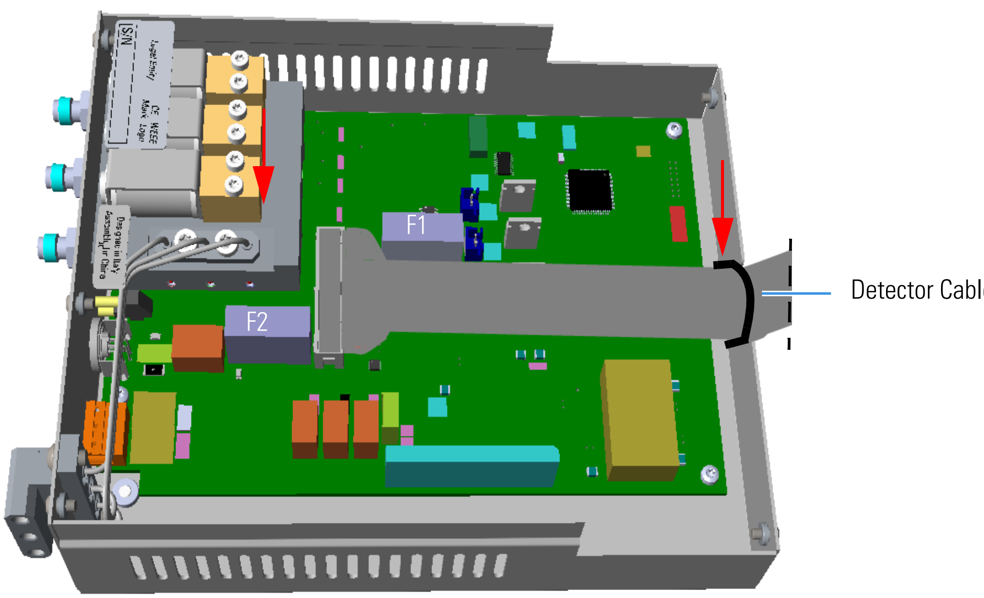
Figure 532. Assemble GDI Electrical Interface (2)



3. Connect the 26-pin female connector of the detector cable to the 26-pin male connector marked **J4** on the board.

4. Guide the detector cable and its cable grommet out of the control module through the duct. See Figure 533.

Figure 533. Assemble GDI Electrical Interface (3)



IMPORTANT Two protecting fuses **F1** and **F2** are present on the electronic board of the GDI electrical interface for the protection of the **24 Vdc** and **48 Vac** respectively:

- **F1** = T300mA 250V; (5 x 20 mm)
- **F2** = T2A 250V; (5 x 20 mm)

5. Remount and fix the top cover by using the fixing screws.

Replacing the Encapsulated Flow Restrictors

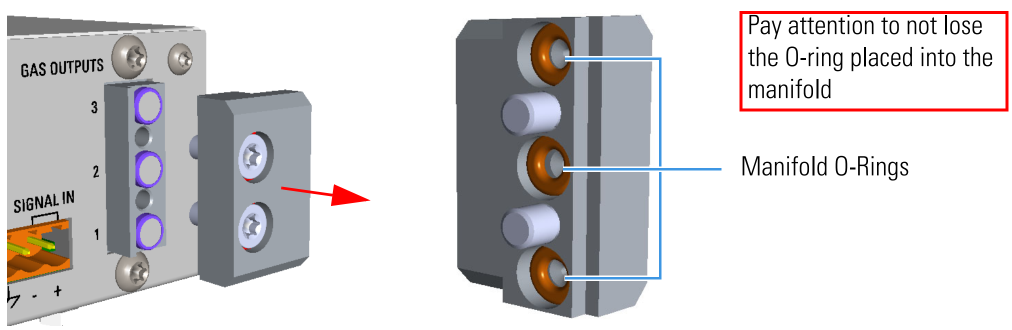
This section provides instruction for replacing the 1/4-in. OD x 1/4-in. length encapsulated flow restrictors. The flow restrictors are located inside the manifold marked **Gas Outputs** on the GDI electrical interface. See Figure 534.

Figure 534. Gas Outputs Manifold

❖ To replace an encapsulated flow restrictor

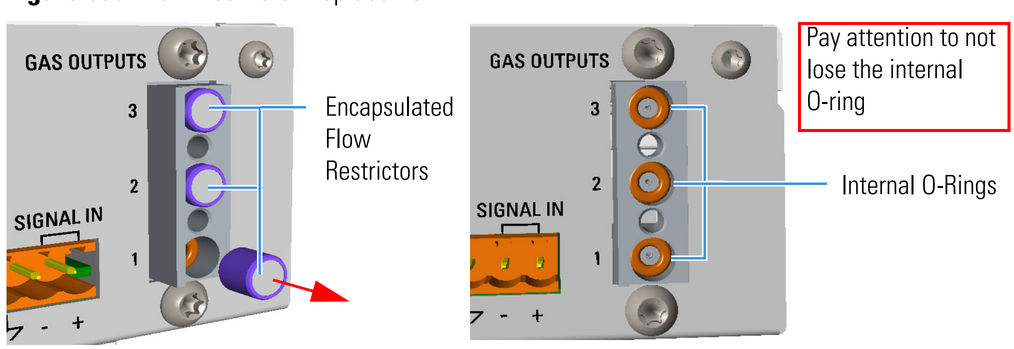
1. Remove the Gas Outputs manifold from the GDI electrical interface by unscrewing its fixing screws using a T20 Torxhead screwdriver. See Figure 535.

Figure 535. Gas Outputs Manifold



2. Remove the encapsulated flow restrictor of interest from its seat using tweezers. See Figure 536.

Figure 536. Flow Restrictor Replacement



3. Replace the encapsulated flow restrictor with the ones required by the third-party detector, then reinstall the manifold proceeding in the reverse order in which it was removed.

4. Calibrate the new full scale of the flow restrictor.

   a. In the **GDI Configuration** page, set gas type to the real gas in use and full scale to 100 mL/min whatever restrictor is installed.

      See the section "Configuring and Setting GDI Detector" on page 534, and refer to Chapter 2 and Chapter 4 of the *TRACE 1600/1610 User Guide*.

   b. Set relevant channel flow rate in the **Method/Instrument Control** page to the full scale value (100 mL/min). Make sure the gas input pressure is at least 60 psig (414 kPa), and verify that the actual flow displayed by the GC reaches 100 mL/min as set.

      See the section "Configuring and Setting GDI Detector" on page 534, and refer to Chapter 2 and Chapter 4 of the *TRACE 1600/1610 User Guide*.

   c. Check the real flow rate with an external flowmeter.

   d. Use the real reading of the flowmeter as the new full scale, and set it in the **GDI Configuration** page.

Installing and Connecting the GDI Electrical Interface

This section provides the instruction for installing and connecting the GDI electrical interface.

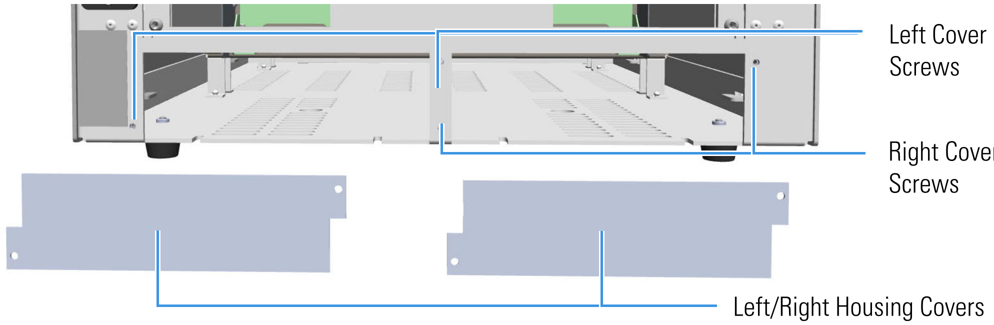
CAUTION It is mandatory that the GDI electrical interface must be placed into an housing on the back of the GC. If both the housings are already occupied by other external modules, one of these must be removed and placed beside the GC, and in the most comfortable position for the user to have free access to the connections.

ATTENTION L'interface électrique GDI doit être obligatoirement placée dans un boîtier à l'arrière du GC. Si les deux boîtiers sont déjà occupés par d'autres modules externes, l'un d'eux doit être retiré et placé à côté du GC de manière à ce que l'utilisateur puisse accéder facilement aux branchements.

❖ To install and connect the GDI electrical interface

1. Remove the cover of the external modules housing where you want to installthe module. See Figure 537.

Figure 537. Housing Cover Removal

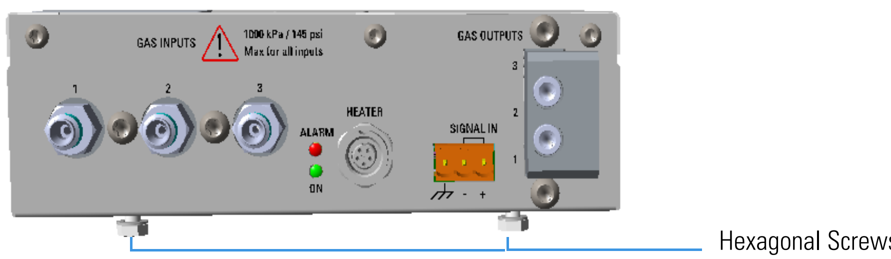


a. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws, then remove the cover from the housing.

2. Install the GDI electrical interface into the housing

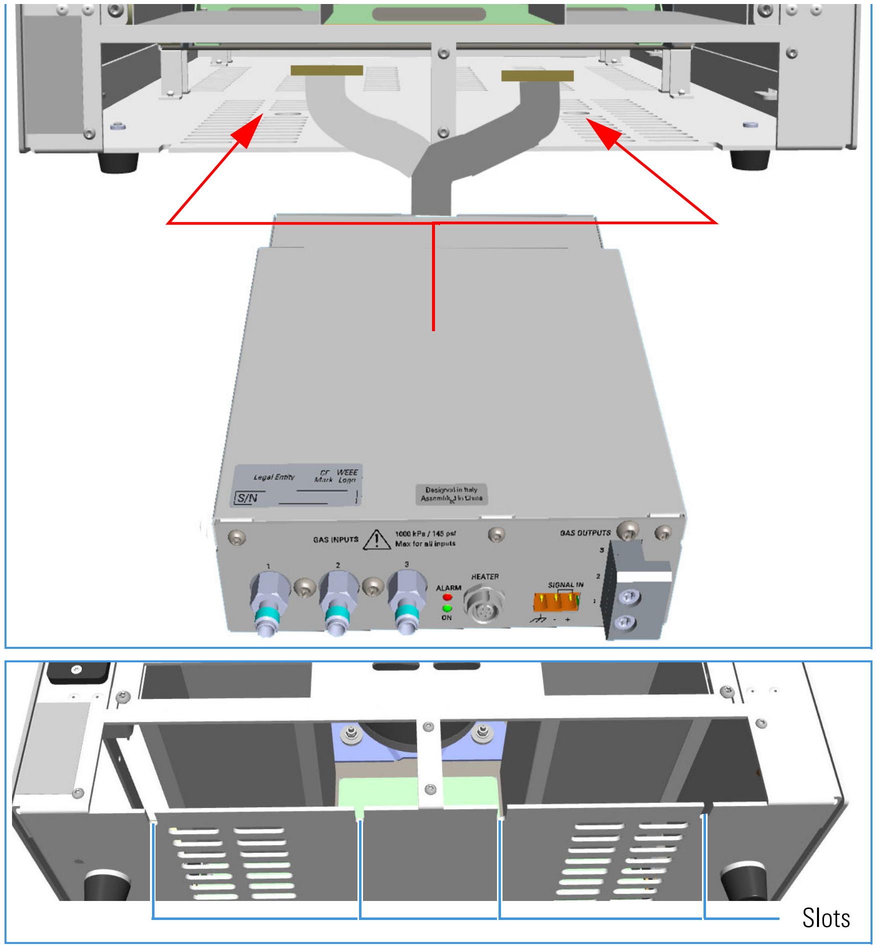
a. Loosen the two hexagonal screws under the module. See Figure 538.

Figure 538. GDI Module Installation (1)



b. Carefully place the GDI electrical interface into the left or right housing. Guide the detector cable into the electronic compartment of the GC, next push the module until the hexagonal screws couple with the slots on the floor of the GC. See Figure 539.

Figure 539. GDI Module Installation (2)



c. Finger-tighten the hexagonal screws slightly, or use a 10-mm wrench.

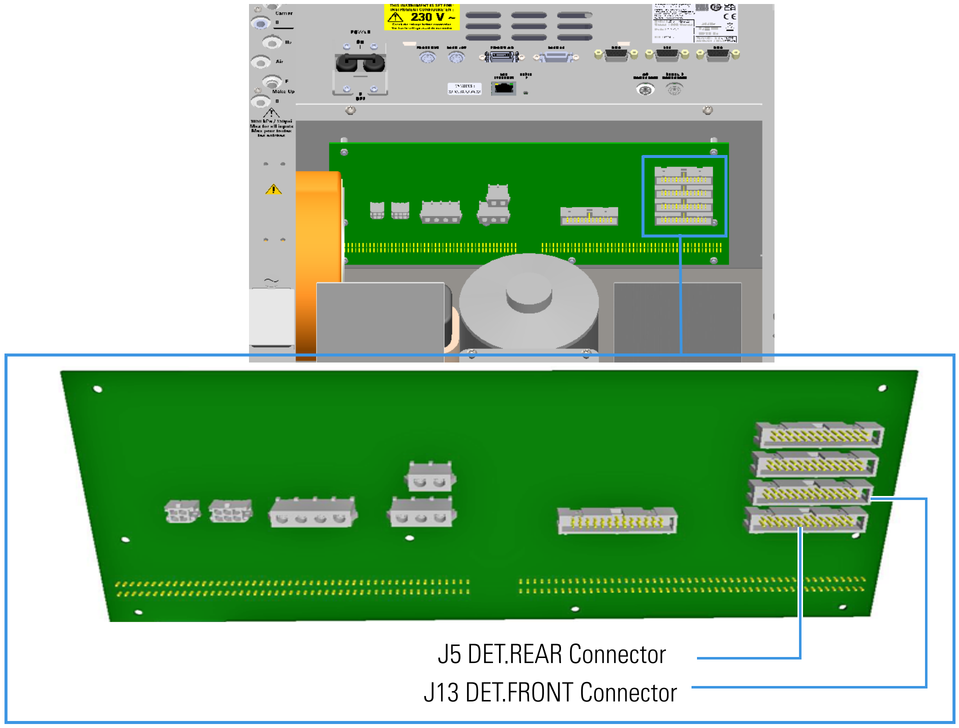
> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the GDI electrical interface when necessary.

> **IMPORTANT** If an GDI mechanical module will be installed on the TRACE 1600/1610 GC, continue the procedure from the step 3. If an GDI mechanical module will be installed on the TRACE 1600 Auxiliary Oven, jump to the section "Connecting a GDI Interface to the TRACE 1600 Auxiliary Oven" on page 525.

3. Connect the 26-pin connector of the detector cable coming from the GDI electrical interface to the backplane board in the electronic compartment.

   a. On the backplane board disconnect the flat cable from the connector marked **J13 DET.FRONT** if the GDI mechanical module is installed in the **Front** site, or from the connector marked **J5 DET.REAR** if the GDI mechanical module is installed in the **Back** site. See Figure 540.

Figure 540. GC Backplane Board Layout



b. Connect the detector cable to the connector **J13 DET.FRONT**, or **J5 DET.BACK** accordingly.

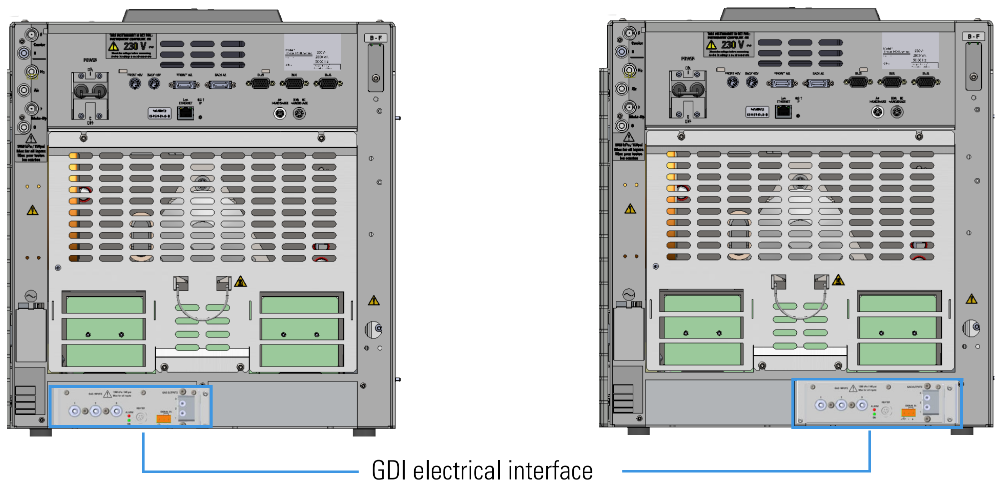
ATTENTION **TRACE 1600/1610 coupled with a TRACE 1600 Auxiliary Oven**

If you are installing the GDI mechanical module in the **Front** or **Back** site of a TRACE 1600/1610 GC coupled with a TRACE 1600 Auxiliary Oven, the detector cable of the GDI electrical interface must be connected as follows:

- **Mechanical module installed in the Front site**: On the backplane board disconnect the flat cable from the connector marked **J13 DET.FRONT**. Connect the detector cable to the connector **J13 DET.FRONT**.
- **Mechanical module installed in the Back site**: Do NOT DISCONNECT the flat cable from connector marked **J5 DET.REAR**. Connect the detector cable directly to the additional connector on the flat cable.

4. Reconnect the ground wire to the back cover terminal.
5. Replace the back cover of the GC proceeding in the reverse order in which it was removed.
   The result of the installation is shown in Figure 541.

Figure 541. GDI Electrical Interface Installed into the GC



Note Continue the installation process by following the instructions listed in the section "Installing a GDI Mechanical Module" on page 526.

Connecting a GDI Interface to the TRACE 1600 Auxiliary Oven

The GDI mechanical module can be installed as auxiliary detector into the position **Aux L** or **Aux R** of the auxiliary detector assembly.

The detector cable of the GDI electrical interface, installed into an external module housing on the back of the GC, must be connected to the VOBP-HRM board located into the electronic compartment of the TRACE 1600 Auxiliary Oven. See the following procedure.

❖ To connect the GDI electrical interface to the TRACE 1600 auxiliary oven

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

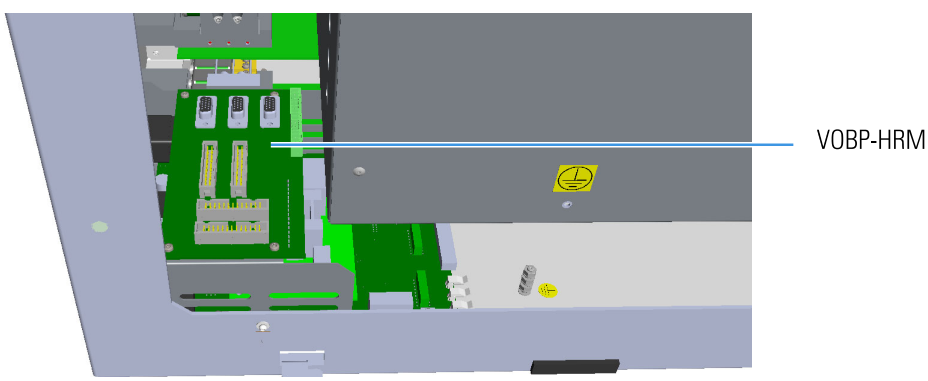
Before starting make sure that the TRACE 1600/1610 GC and the TRACE 1600 Auxiliary Oven are powered off and the power cables disconnected.

1. Carefully decouple the TRACE 1600 Auxiliary Oven from the GC for creating enough operating space for guiding the detector cable from the GDI electrical interface through the GC into the electronic compartment of the TRACE 1600 Auxiliary Oven.

WARNING Before proceeding this operation make sure to disconnect properly the inner tube. Refer to the section Coupling the TRACE 1600 Auxiliary Oven to the GC on the TRACE 1600 Auxiliary Oven Instruction Manual, and operating in the reverse order in which it was mounted.

2. In the electronic compartment look for the VOBP-HRM board. It is located over the power section of the TRACE 1600 Auxiliary Oven. See Figure 542.

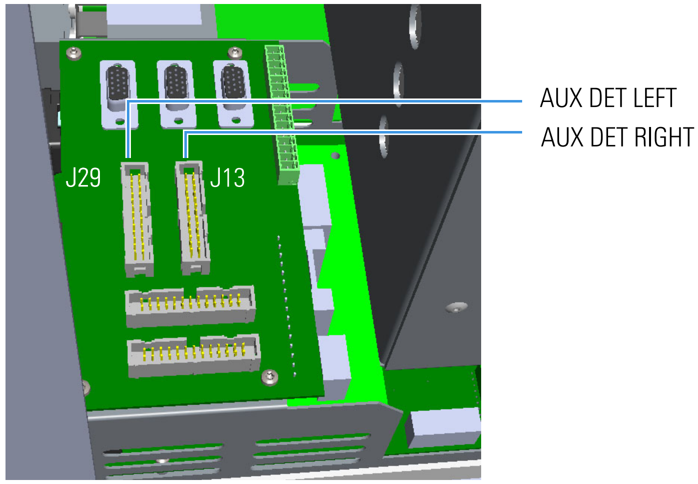
Figure 542. TRACE 1600 Auxiliary Oven: VOBP-HRM Board



3. Connect the 26-pin connector of the detector cable coming from the GDI electrical interface to the VOBP-HRM board in the electronic compartment.

   a. On the board VOBP-HRM disconnect the flat cable from the connector marked **J29 AUX DET LEFT** if the GDI mechanical module is installed in the **Left** site, or from the connector marked **J13 AUX DET RIGHT** if the GDI mechanical module is installed in the **Right** site. See Figure 543.

Figure 543. VOBO-HRM Board Layout



b. Connect the detector cable to the connector **J29 AUX DET LEFT**, or **J13 AUX DET RIGHT** accordingly.

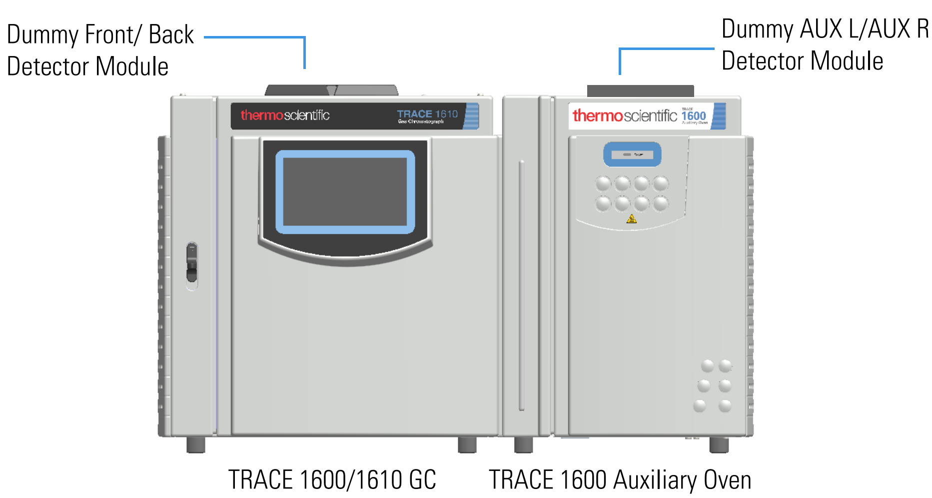
4. Re-couple the TRACE 1600 Auxiliary Oven to the GC.

> **Note** Continue the procedure of installation following the instruction reported in the section "Installing a GDI Mechanical Module" on page 526.

Installing a GDI Mechanical Module

This section provides instructions for adding a **Front/Back/Aux L/Aux R** GDI mechanical module. According to the configuration of your TRACE 1600/1610 GC, a dummy module is present into the free site where a detector module is not installed. See Figure 544.

Figure 544. Add a Front/Back/Aux L/Aux R Detector Module



CAUTION The gas connection for a dummy module is blocked by a plug.

ATTENTION Le raccordement au gaz d'un module factice est obturé par un bouchon.

❖ To install a GDI mechanical module

1. Remove the dummy module from the position where the detector module will be installed.

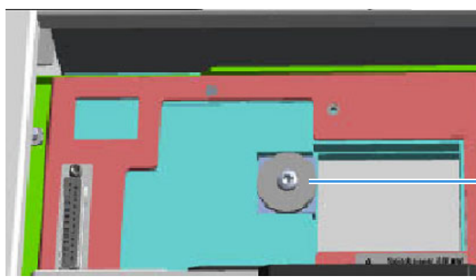
   a. Open the module flap cover.

   b. Using a T20 Torxhead screwdriver, unscrew and remove the two captive fixing screws.

   c. Keeping the dummy module flap cover open, lift up the module from its seat in the injector/detector housing. Place the dummy module on a clean surface.

   d. DO NOT REMOVE the gas block plug from the gas connections. See Figure 545. The gas supply is done through the GDI electrical interface.

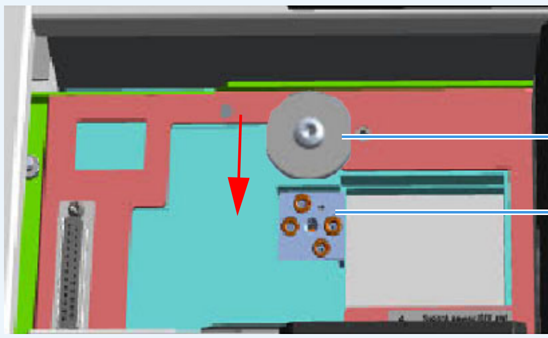
Figure 545. Detector Gas Block Plug (1)



CAUTION If you are removing a real detector module instead of a dummy module, you must place and fix the gas block plug on the gas connections using a T20 Torxhead screwdriver. See Figure 546.

ATTENTION Si vous retirez un véritable module de détecteur au lieu d'un module factice, vous devez placer et serrer le bouchon de blocage de gaz sur les raccordements de gaz avec un tournevis Torx T20.

Figure 546. Detector Gas Block Plug (2)



2. Plug the GDI mechanical module into the main frame.
   a. Open the module flap cover.
   b. Keeping the module flap cover open, place the module in its seat. Note that the 25-pin female connector on the detector seat of the detector housing is not used.
   c. Use a T20 Torxhead screwdriver to tighten the three captive fixing screws without overtightening.

IMPORTANT To maintain the correct alignment the screws must be tightened in turn. Tighten each screw only a small amount before moving to the next screw. Repeat until all are secure.

   d. Close the module flap cover.

Connecting the Detector Gas Tubing to the Manifolds

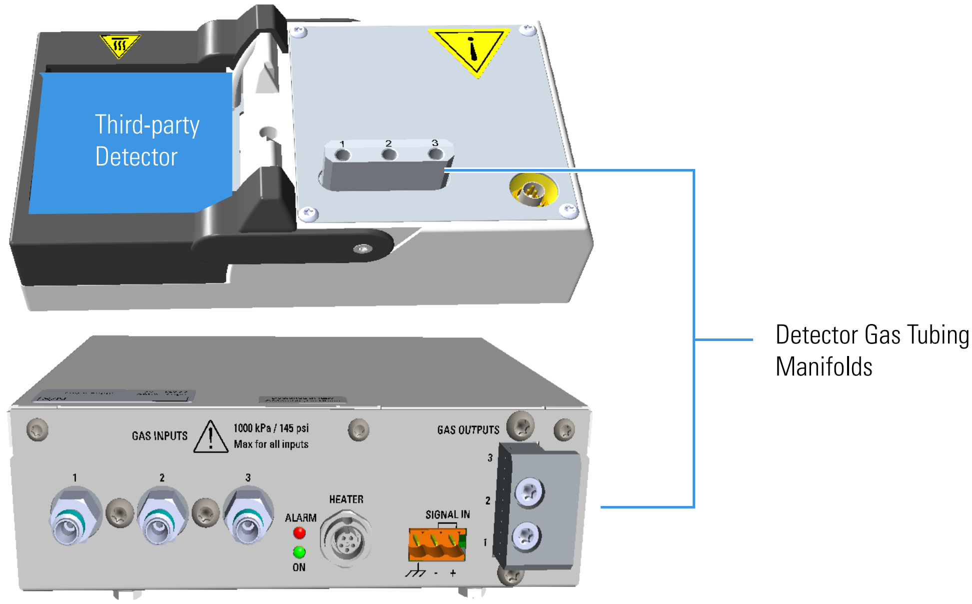
This sections provides instruction for connecting the detector gas tubing to the manifolds of the GDI mechanical module and GDI electrical interface.

❖ To connect the gas tubing block to the manifolds

Figure 547 shows manifolds of the GDI mechanical module and GDI electrical interface.

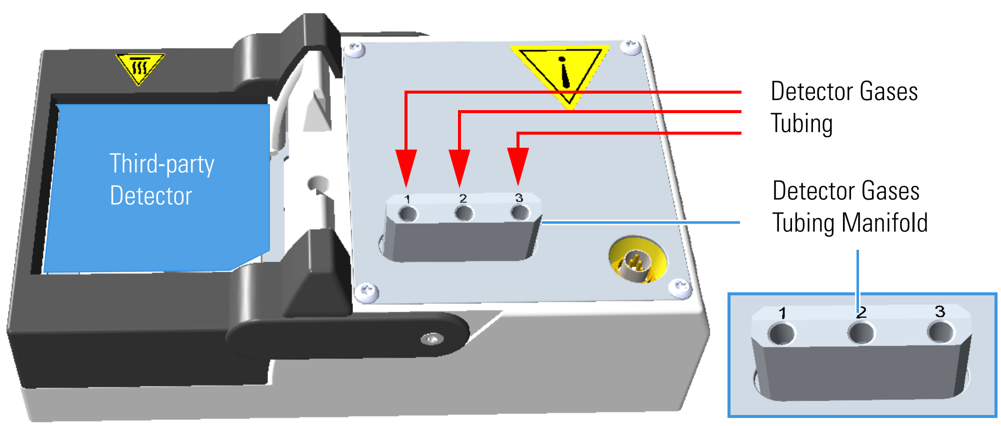
Note Figure 547, Figure 548, Figure 549, Figure 550, and Figure 555 do not show the third-party detector for graphic convenience. Suppose that it is installed in the detector module GDI.

Figure 547. Detector Gas Tubing Manifolds (1)



1. Take one, two, or three segments of the 1/16-in. stainless steel tubing (provided) according to the detector gases required and long enough to properly connect both the detector gas tubing manifolds.
2. Connect the detector gas tubing to the manifold of the GDI mechanical module. See Figure 548.

Figure 548. Detector Gas Tubing Connections



   a. Connect the detector gas tubing to the numbered inlet ports using the appropriate Swagelok® 1/16-in. nut and ferrules. Use a 1/4-in. wrench to tighten the fittings.

IMPORTANT The inlet ports of the manifold on the GDI mechanical module are numbered **1**, **2**, and **3** respectively. Pay attention to the correct order when you connect each detector gas tubing to the corresponding outlet ports marked **Gas 1**, **Gas 2**, and **Gas 3** on the GDI electrical interface.

Connect the detector gas tubing for the third-party detector as follows:

- Outlet port **Gas 1** to inlet port **1**
- Outlet port **Gas 2** to inlet port **2**
- Outlet port **Gas 3** = Air (Wall) to inlet port **3**

b. Repeat step a until all the required detector gas tubing are connected to the GDI mechanical module.

c. Bend and run the detector gas tubing along the top cover.

Note The bending of the detector gas tubing shown in Figure 549 and Figure 550 is indicative.

Figure 549. Bending of the Detector Gas Tubing on the TRACE 1600/1610 GC

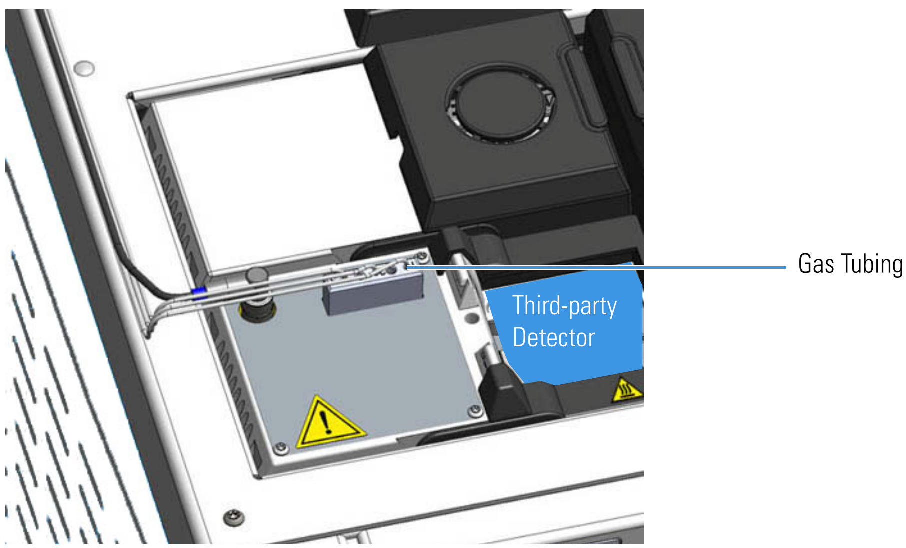
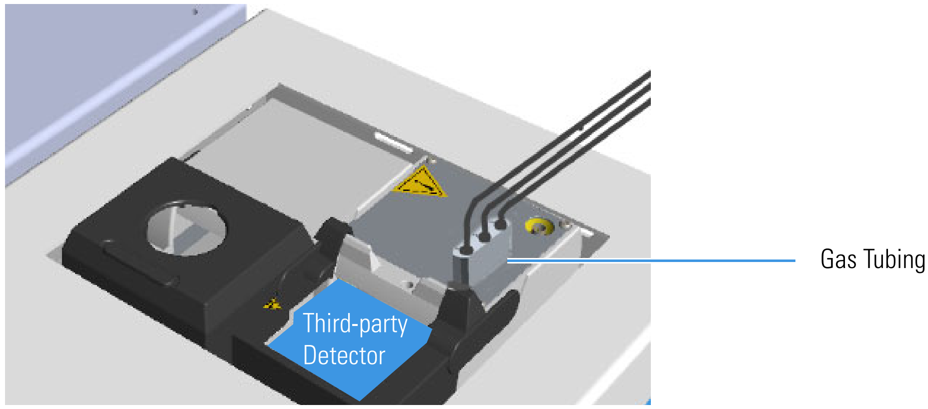
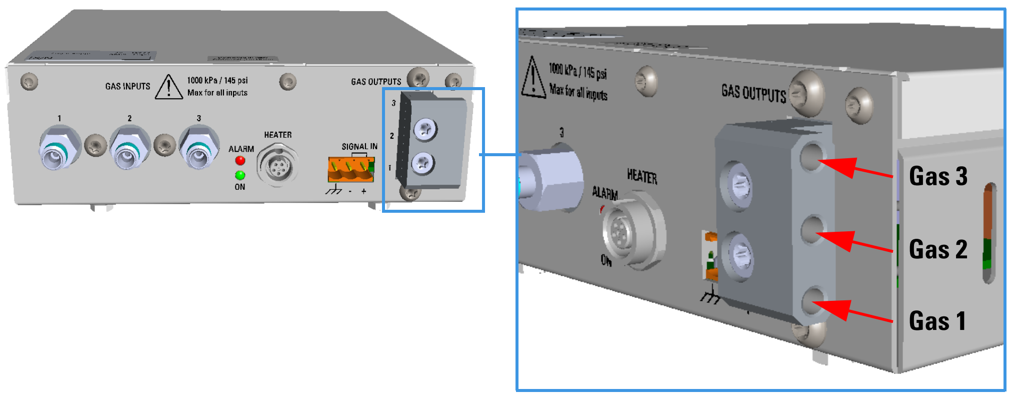


Figure 550. Bending of the Detector Gas Tubing on the TRACE 1600 Auxiliary Oven



3. Connect the relevant detector gas tubing to the manifold of the GDI electrical interface. See Figure 551.

Figure 551. Detector Gas Tubing Connection to the GDI Electrical Interface - External View (1)



a. Guide the detector gas tubing up to reach the GDI electrical interface.

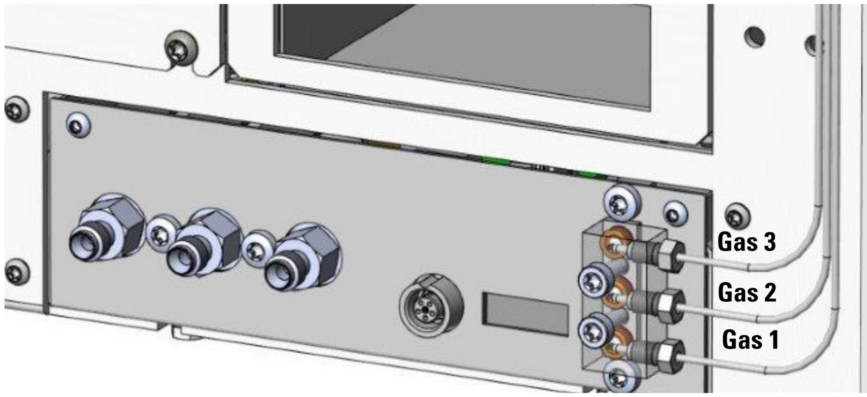
b. Bend and run the detector gas tubing along the back panel of the GC (or TRACE 1600 Auxiliary Oven) until its end reaches the corresponding numbered gas outlet port on the GDI electrical interface.

c. Connect the detector gas tubing to the corresponding numbered outlet port using the appropriate Swagelok® 1/16-in. nut and ferrules. Use a 1/4-in. wrench to tighten the fittings.

d. Repeat step b and step c until all the required detector gas tubing are connected to the GDI electrical interface.

The result of the operation is shown in Figure 552.

Figure 552. Detector Gas Tubing Connection to the GDI Electrical Interface - External View (2)



> **Note** The bending of the gas tubing is indicative.

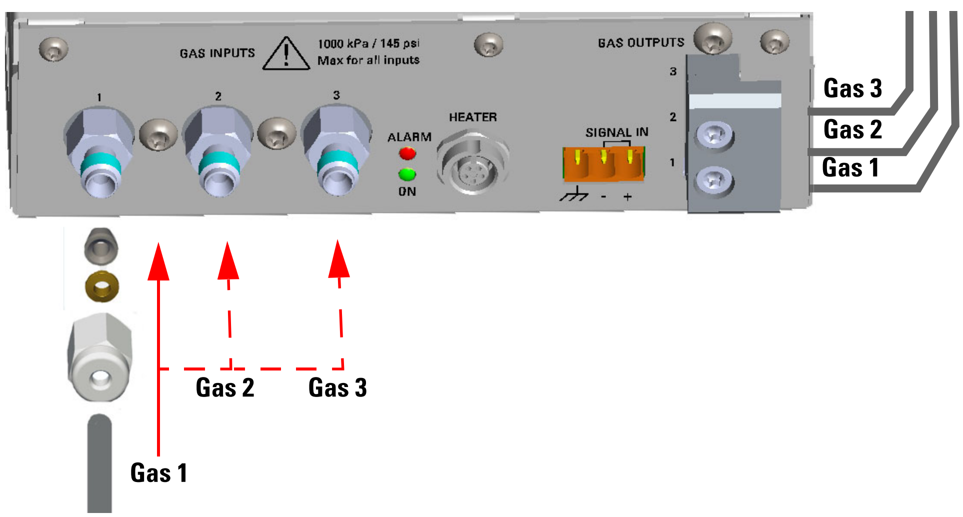
4. Connect the supply gas to the GDI electrical interface.

> **Note** Use the 1/8-in. Swagelok fittings provided on the gas inlet ports to connect the gas lines.

a. Connect the gas line to the corresponding inlet port using the appropriate nut and ferrules. Use a 7/16-in. wrench for tightening the fittings.

b. Repeat step a until all the gas lines are connected to the corresponding inlet port on the GDI electrical interface. See Figure 553.

Figure 553. Gas Lines Connection to the GDI Electrical Interface



> **IMPORTANT** The maximum nominal inlet pressure for all the inputs is 1050 kPa (152 psig), as indicated on the label under the gas inlets ports on the back of the GC. The working inlet pressure range is from 400 kPa (58 psig) to 1050 kPa (152 psig).

Connecting Heater and Signal Cables

If required by the third-party detector, connect the heater cable, the signal cable, or both.

❖ To connect the heater and signal cables

1. Using the cable provided connect the 5-pin connector marked **Heater** on the GDI electrical interface to the detector connector on the GDI mechanical module. See Figure 554 and Figure 555.

Figure 554. Heater and Signal Connectors

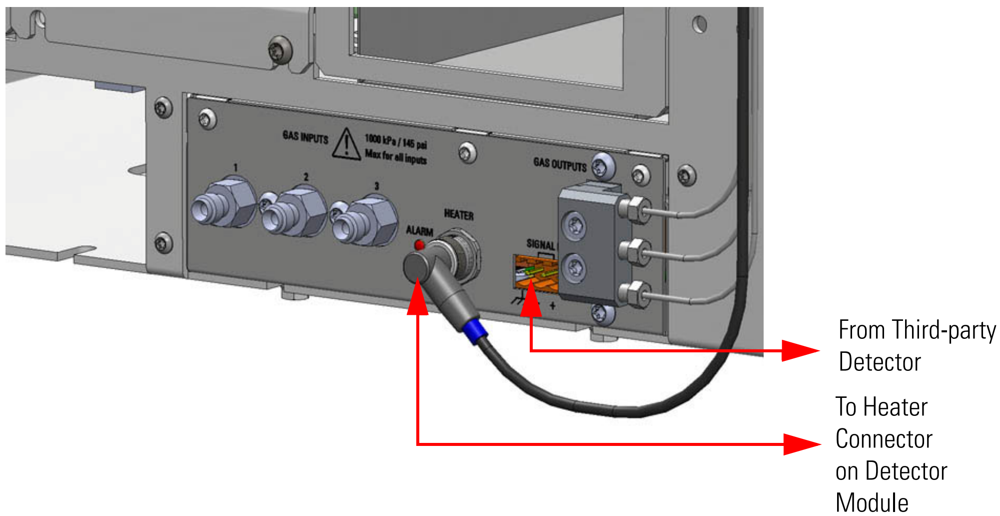
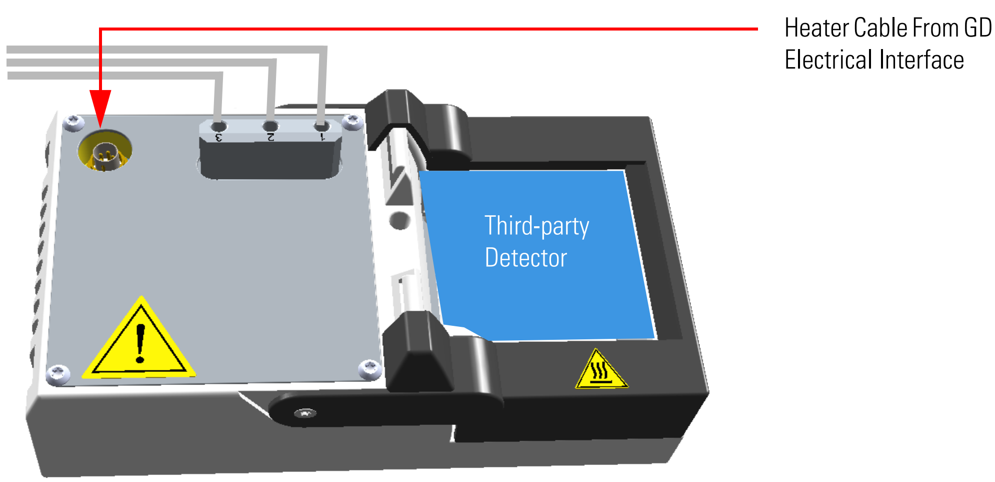
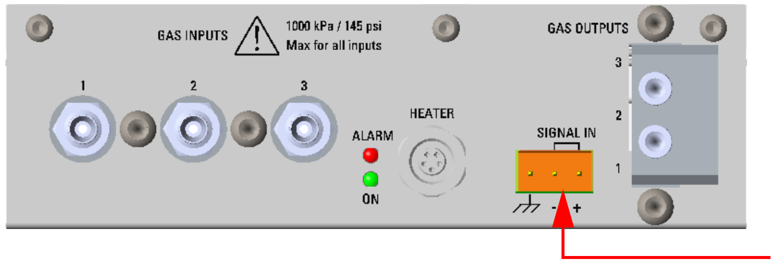


Figure 555. Heater Cable Connection



2. Connect the signals cable from the third-party detector to the connector marked Signal IN on the GDI electrical interface. See Figure 556.

Figure 556. Signal Connection



Restarting the GC

❖ **To restart the GC**

1. Open the gas supplies.
2. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
3. Power on the GC.
   a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
   b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

Performing the Third-party Detector Start-up and Optimization

Refer to the third-party detector manual.

Configuring and Setting GDI Detector

Configure and enable the GDI mechanical module through the user interface of your GC, or through the CDS in use. Refer to the *TRACE 1600/1610 User Guide*.

See the following sequences:

- "Configure and set GDI Detector through the touch screen" on page 534
- "Configure and set GDI Detector through the chromatography data system (CDS)" on page 535

❖ **Configure and set GDI Detector through the touch screen**

1. In the main menu select the Configuration icon, the Configuration menu appears. Select the Front/Back/Aux L/Aux R **GDI** detector icon to open the relevant sub-menu.

2. In the main menu select the **Instrument control** icon. The Instrument Control menu appears. In the Instrument Control menu, select the Front/Back/Aux L/Aux R GDI detector icon to open the relevant sub-menu.

3. Set the **parameters** values as required, then return to main menu.

> **Note** For details refer to **Chapter 2** in the *TRACE 1600/REACE 1610 User Guide.*

❖ Configure and set GDI Detector through the chromatography data system (CDS)

1. In the **Configuration** window select the **Detectors** tab.

2. Select the **Detector Type**: choose **GDI**.

3. Click **GDI Config...**; the GDI Configuration page is visualized.

4. Select the **Gas Type** used for the detector gases **Gas 1**, **Gas 2**, and **Gas 3**.
   Choose one: Air, Hydrogen, Nitrogen, Helium, Argon, or Argon/Methane. Nitrogen is the default gas.

5. Set the **Full-scale flow** of the restriction installed for each detector gas. Set a value in the range 1-1000 mL/min. Default value is 50 mL/min.

6. Select the **Max. detector temperature** in the range from 0 °C to 450 °C.
   The default temperature is 400 °C.

7. Select the **ADC full-scale voltage**. Choose one: 1 V, 5 V, or 10 V. The default value is 1 V.

8. Open the **GDI Method Page** and set the required parameters.

> **Note** For details refer to **Chapter 4** in the *TRACE 1600/REACE 1610 User Guide.*

> **Note** If the heater is installed but the actual Temperature read back is 0 °C, check the integrity of the heater and the temperature probe.

Adding an Analog Output Interface

This section provides instructions for installing the Analog Output Interface (AOI) on your TRACE 1600/1610 GC.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

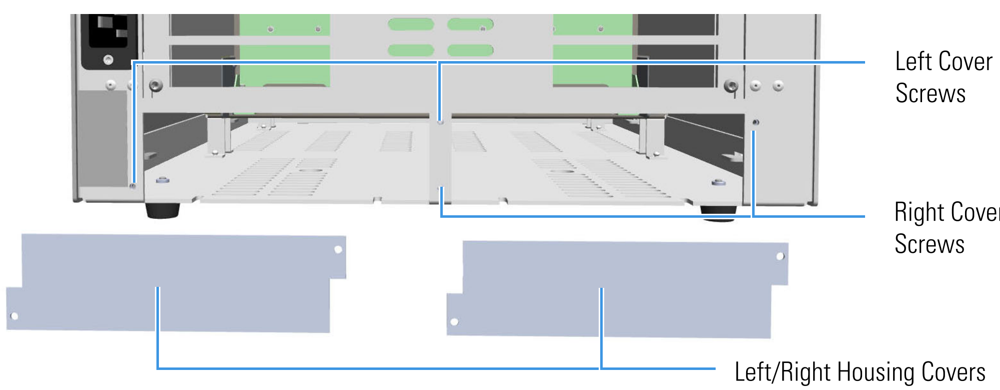
❖ To install an analog output interface

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

   Note By pressing the **Maintenance** button, the GC cool down is automatically carried out.

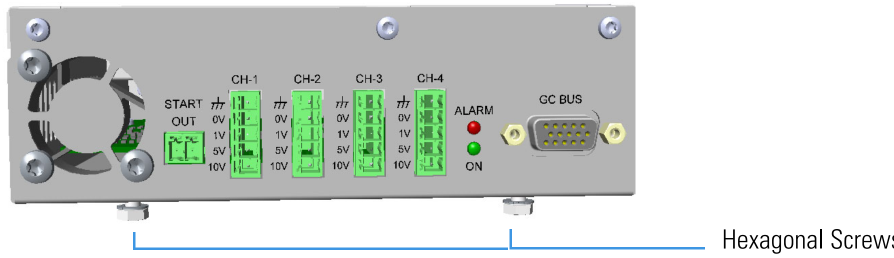
3. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
4. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
5. Remove the cover of the external modules housing where you want to install the Analog Output Interface module. See Figure 557.

   Figure 557. Housing Cover Removal

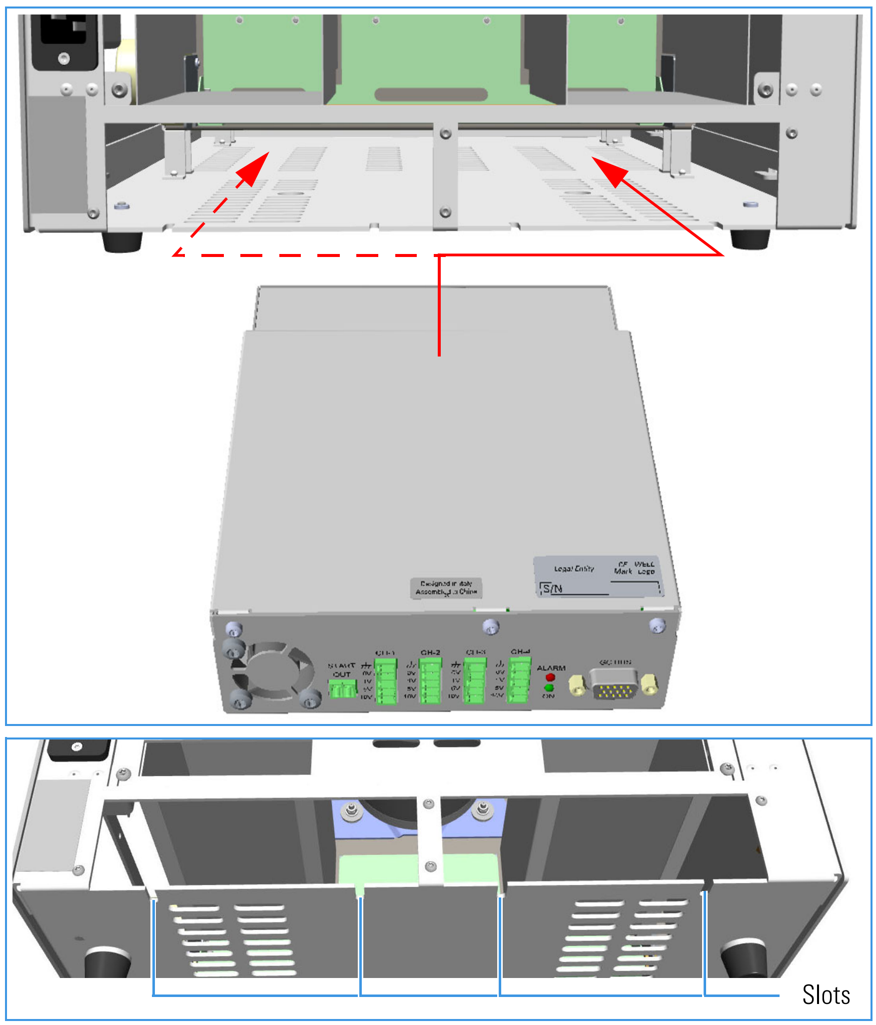
   a. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws, then remove the cover from the housing.
6. Install the Analog Output Interface into the housing.
   a. Loosen the two hexagonal screws under the module. See Figure 558.

Figure 558. AOI Installation (1)



b. Carefully place the Analog Output Interface into the left or right housing until the hexagonal screws couple with the slots on the floor of the GC. See Figure 559.

Figure 559. AOI Installation (2)

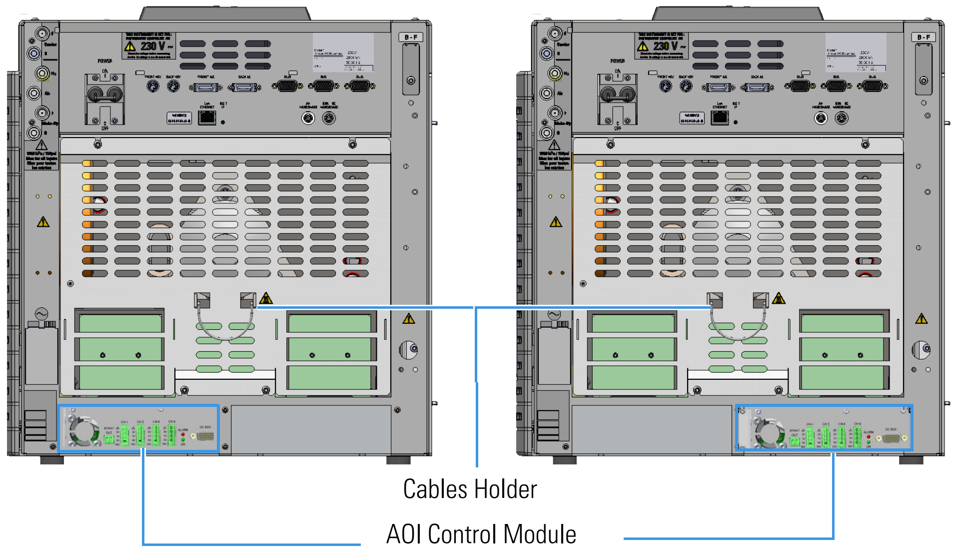


c. Finger-tighten the hexagonal screws slightly, or use a 10 mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

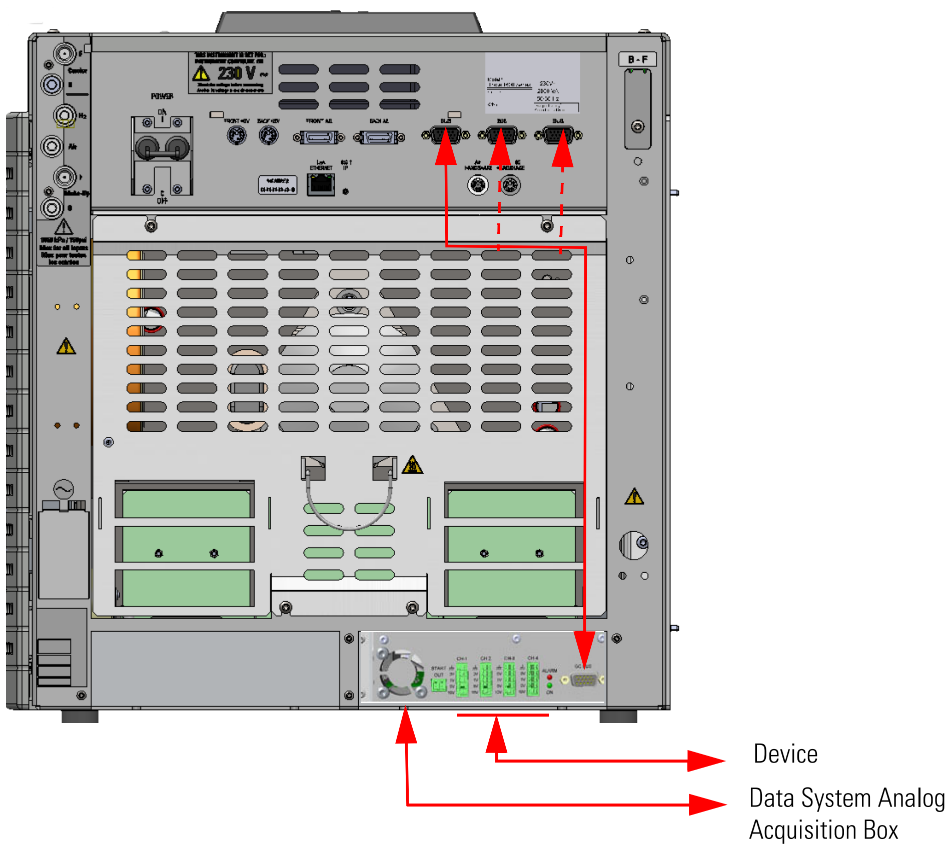
The result of the installation is shown in Figure 541.

Figure 560. Analog Output Interface Module Installed into the GC



7. Connect the analog output interface module. See Figure 561.

Figure 561. AOI Connections



Tip To avoid the contact with the hot air from the vents, it is suggested to gather the electrical cables into cables holder.

a. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

b. Connect up to four channels **CH-1**, **CH-2**, **CH-3**, **CH-4** to your device selecting the full scale of each analogue signal from **1 V** to **10 V** according to your needs.

IMPORTANT Only connect the Ground wire to the GND contact of the AOI module or of the your device. Do not connect the Ground cable to both the devices.

c. Connect the **Start OUT** contact closure to **Start IN** TTL line of the Data system analog acquisition box.

8. Open the gas supplies.
9. If other external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
10. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

11. Configure and enable the system installed through the touch screen of your GC. Refer to the TRACE 1600/1610 *User Guide*.

10

Adding Systems

This chapter describes how to install any added system that is available for the TRACE 1600/1610. See the *TRACE 1600/1610 Spare Parts Guide* for information about ordering the equipment in this chapter.

Contents

Adding the Oven Cryo System

This section provides instructions for installing and configuring the Oven Cryo system on your TRACE 1600/1610 using the dedicated kit.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

The cryo system requires liquid nitrogen or carbon dioxide as coolant. Before using liquid nitrogen or carbon dioxide, read the indications of hazards, and the instructions in the Safety sheet supplied by the manufacturer with reference to the CAS number (Chemical Abstract Service). See also “Liquid Nitrogen Safety Precautions” on page xxxi and “Carbon Dioxide Safety Precautions” on page xxxi.

Oven Cryo System Overview

Two Oven Cryo Upgrade Kits are available:

- Oven Cryo with Liquid Nitrogen (LN_2) as coolant.
- Oven Cryo with Carbon Dioxide (CO_2) as coolant.

Each upgrade kit contains all the material required to install the Oven Cryo system on your GC. See Figure 562 and Figure 563.

Figure 562. Oven Cryo Kit for Carbon Dioxide

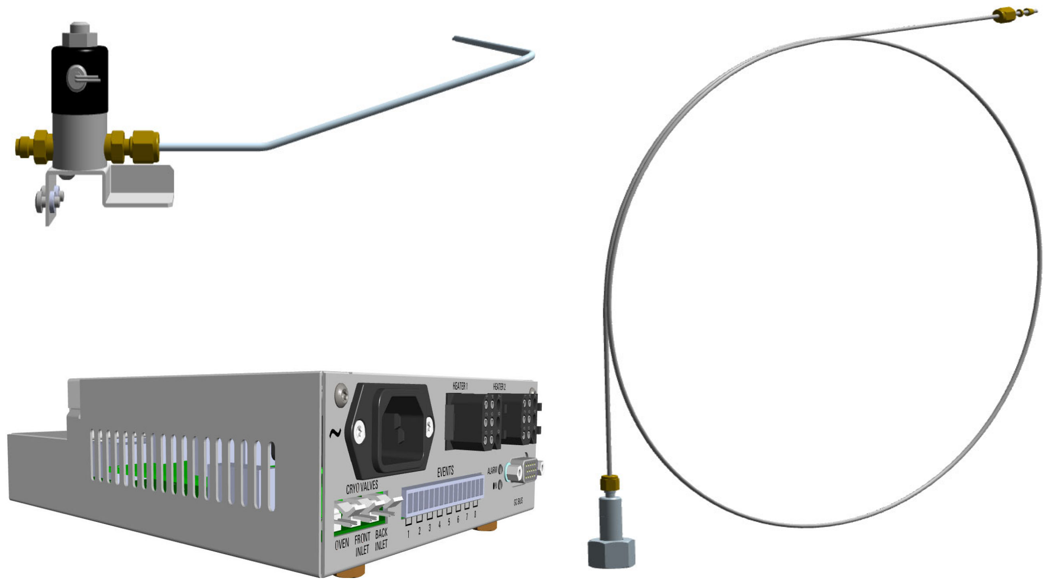
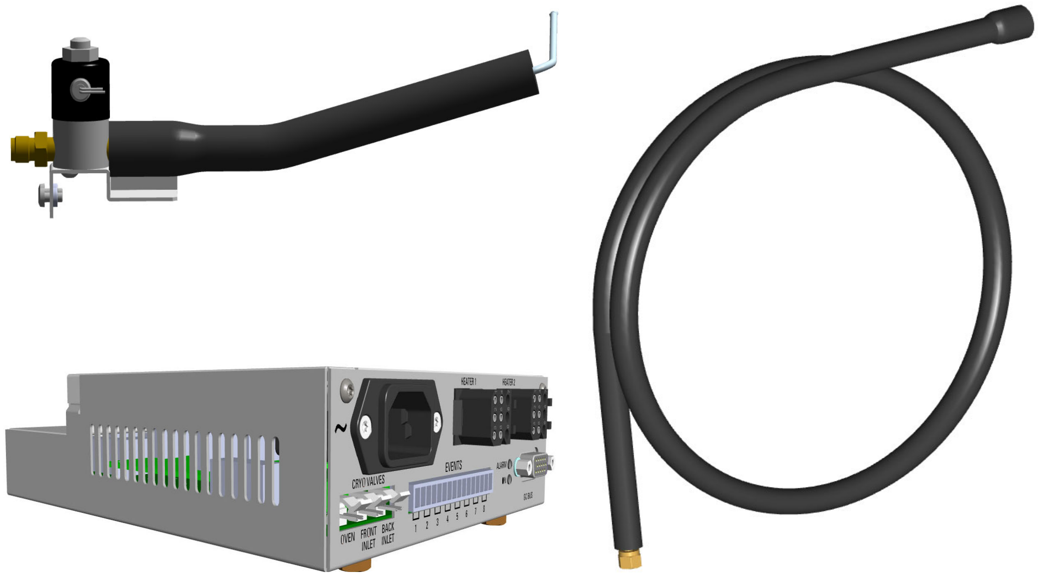


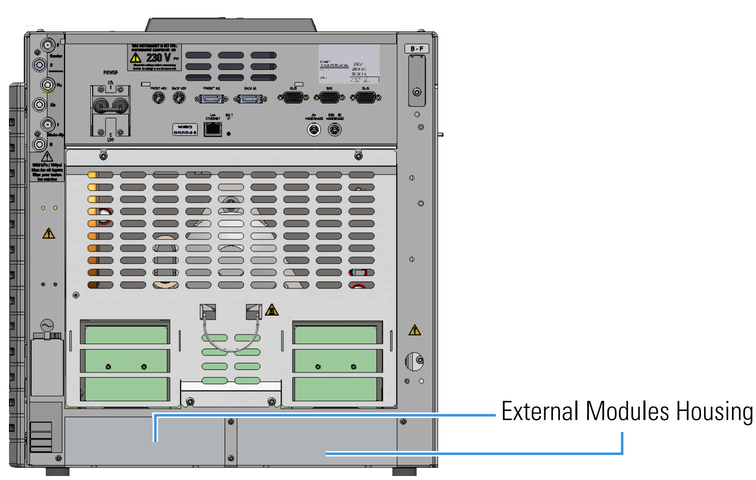
Figure 563. Oven Cryo Kit for Liquid Nitrogen



Each upgrade kit contains all the material required to install the Oven Cryo system on your GC:

- Dedicated solenoid valve mounted on a support bracket.
- Tube for the coolant into the oven.
- Coolant tank tube with connection fittings.
- Aux Temperature/Cryo Module that should be installed into a free external module housing provided on the back of the GC. See Figure 564.

Figure 564. External Modules Housing



Installing the Oven Cryo System

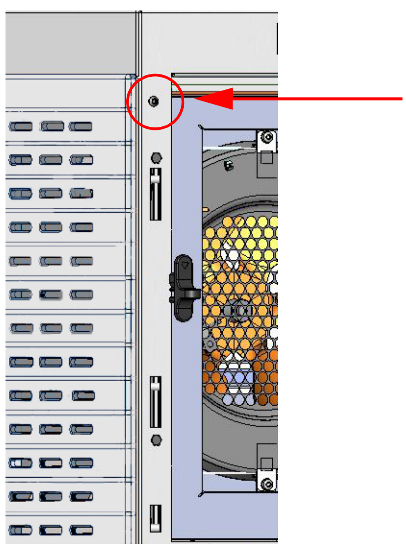
❖ To install the Oven Cryo System

1. Put the GC in standby condition.
2. Cool the oven, injectors, and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

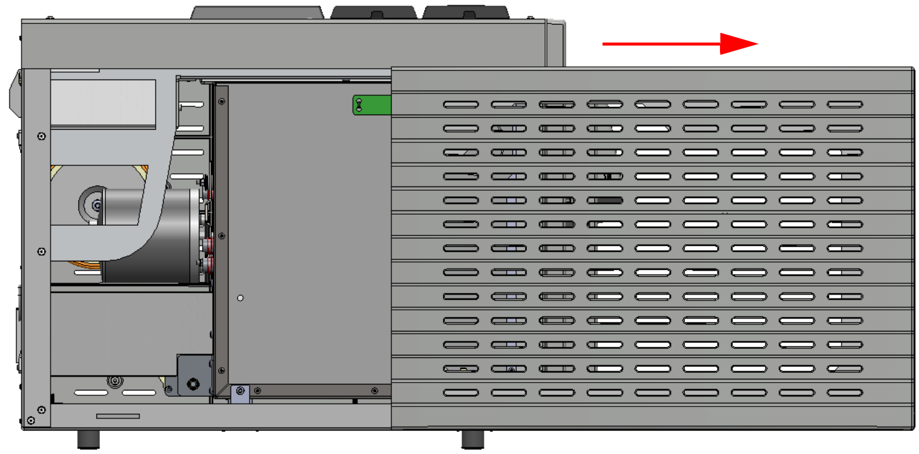
3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, in the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Remove the Left Side panel.
   a. Open the front door of the GC. Using a T20 Torxhead screwdriver, unscrew the left side panel screw from the interior front panel. See Figure 565.

   Figure 565. Left Side Panel Fixing Screw

   b. Slide the panel towards the back of the instrument up to the stop.
   c. Remove the panel by pulling it outwards. Be aware that the ground wire is attached to the panel. See Figure 566.

Figure 566. Left Panel Removal

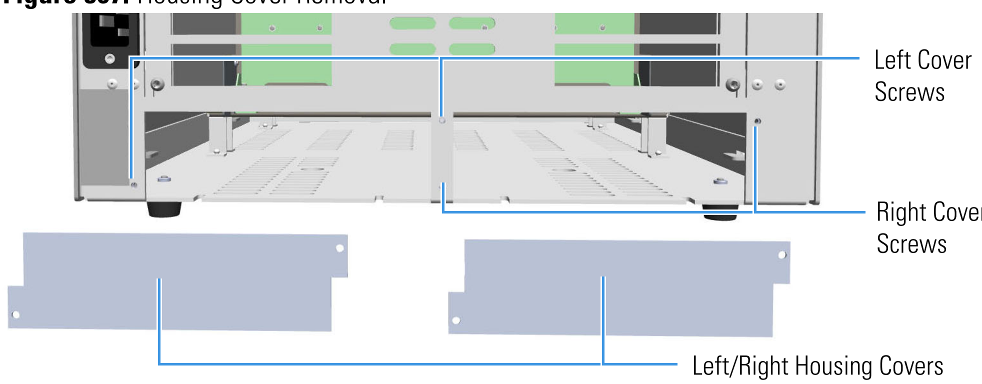


d. Unplug the ground wire from the panel.

> **Note** Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

7. Install the Aux Temperature/Cryo Module. See Figure 567

Figure 567. Housing Cover Removal



a. Remove the cover of the external modules housing where you want to install the module.

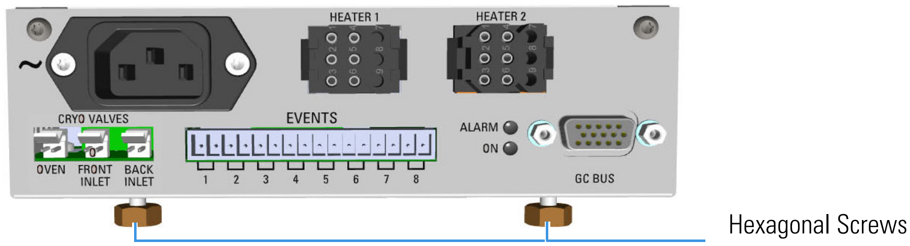
b. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws.

c. Remove the covers from the housing.

8. Install the module into the housing

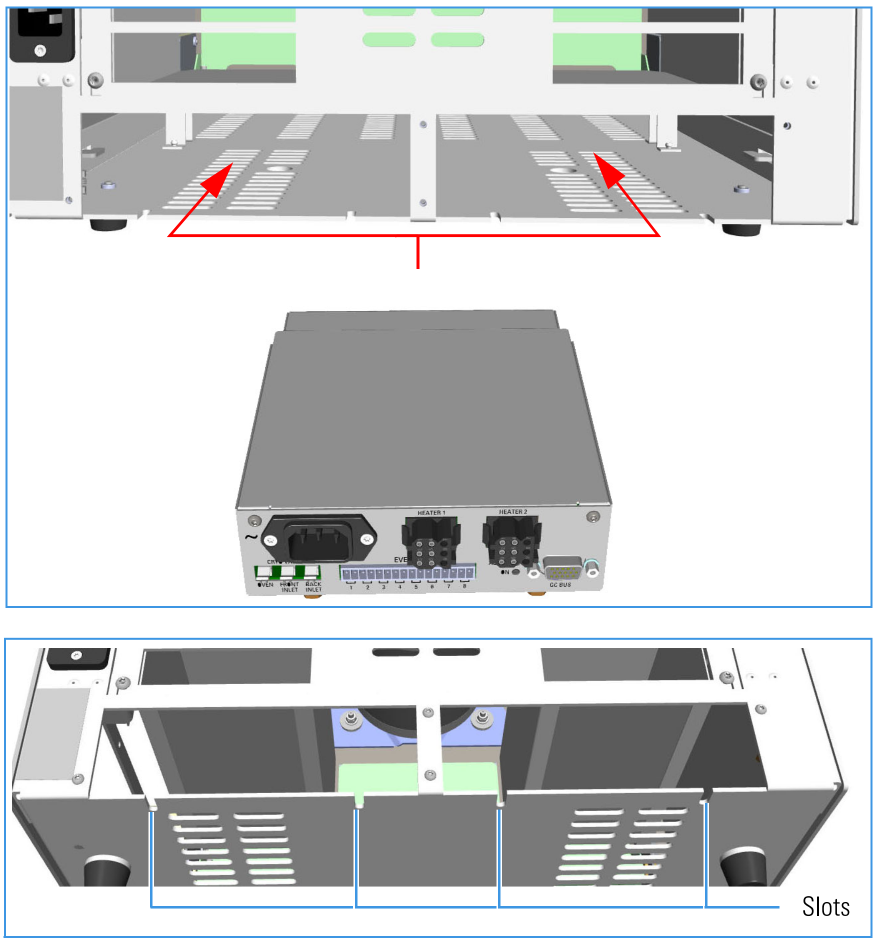
a. Loosen the two hexagonal screws under the module. See Figure 568.

Figure 568. Module Installation (1)



b. Place the module into the left or right housing until the hexagonal screws couple the slots on the floor of the GC. See Figure 569.

Figure 569. Module Installation (2)

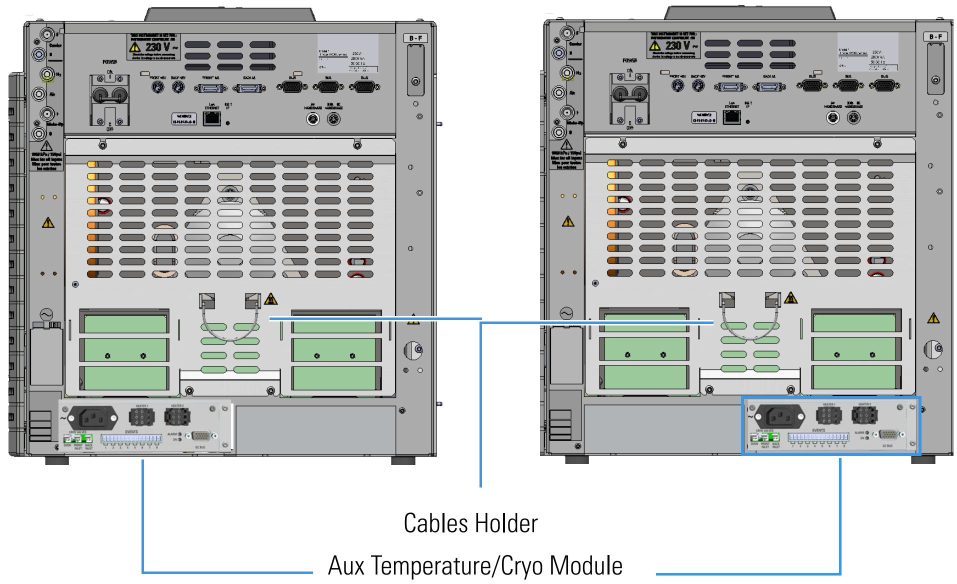


c. Finger-tighten the hexagonal screws slightly, or use a 10-mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

The result of the installation is shown in Figure 570.

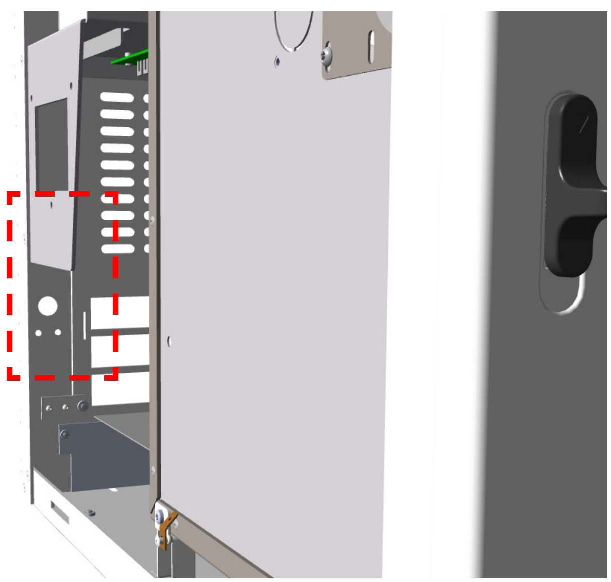
Figure 570. Aux Temperature/Cryo Module Installed into the GC



9. Install the solenoid valve.

   The solenoid valve must be installed in the proper seat on the back of the GC. See Figure 571.

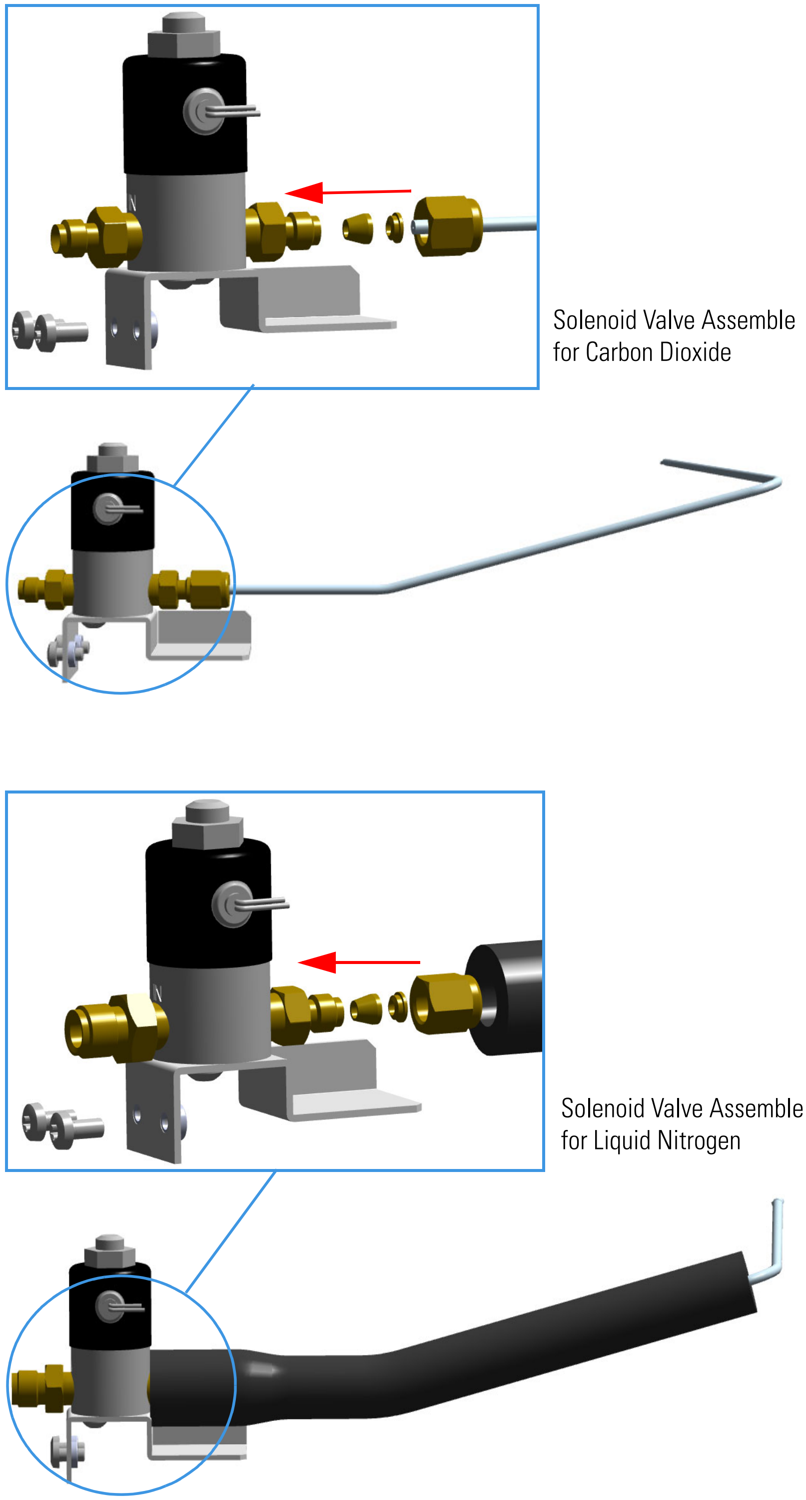
   Figure 571. Solenoid Valve Assembly Seat

   a. With care, take the solenoid valve assembly and remove the two screws from the brackets using a T15 Torxhead screwdriver. These screws are used to fix the bracket on the GC.

      If not already done, connect the coolant tube to the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench for tightening the fittings. See Figure 572.

Figure 572. Solenoid Valve Assembly



b. Guide the solenoid valve assembly into its seat on the back of the GC, and the tube for the coolant into the oven through the holes provided. See Figure 573 and Figure 574.

Figure 573. Installation of the Solenoid Valve Assembly for Carbon Dioxide

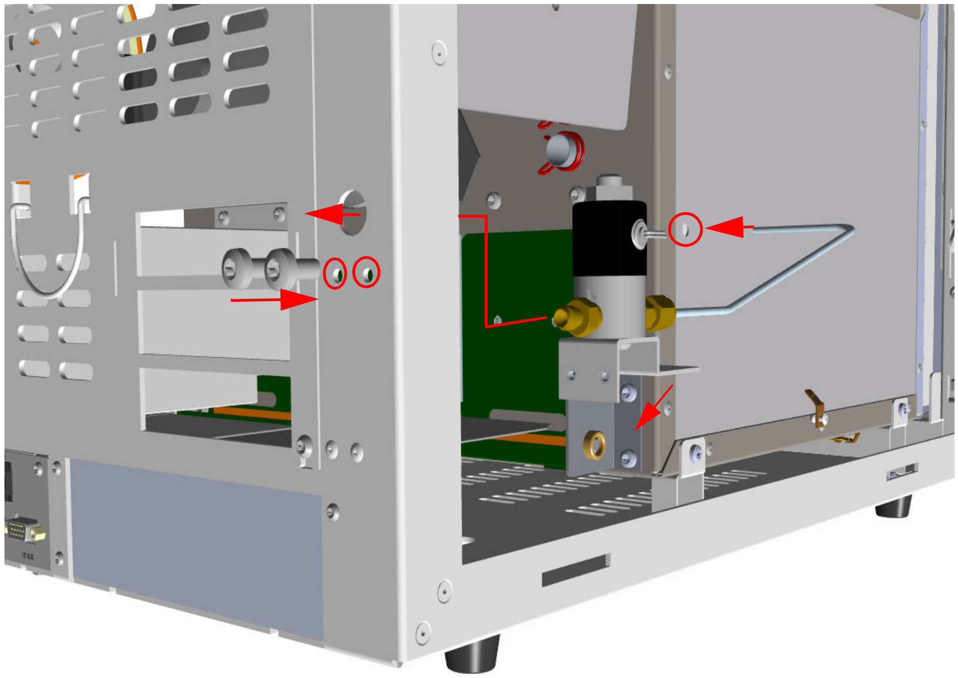
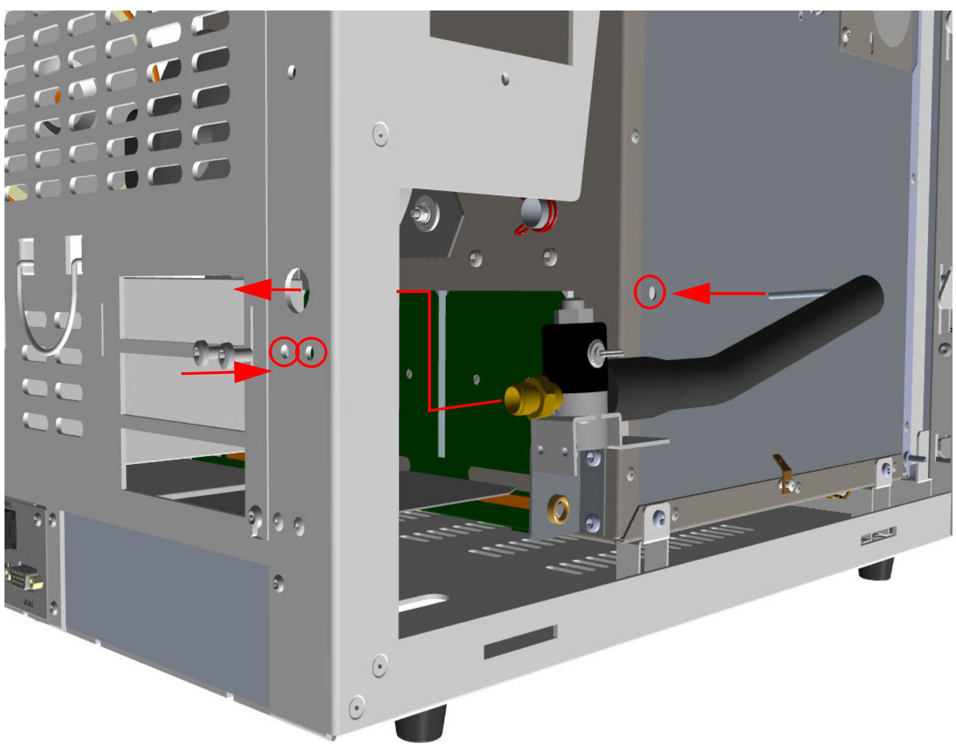


Figure 574. Installation of Solenoid Valve Assembly for Liquid Nitrogen



c. Fix the solenoid valve assembly to the back of the GC using the two fixing screws previously removed. See Figure 575.

Figure 575. Solenoid Valve Assemble Fixing

10. Connect the cryogenic tank tube to the solenoid valve assembly.

    a. Connect the proper end of the cryo supply tube to the 1/8-in. NPT connection of the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench for tightening the fittings. See Figure 576 and Figure 577.

Figure 576. Oven Cryo Supply Tube for Carbon Dioxide Connection

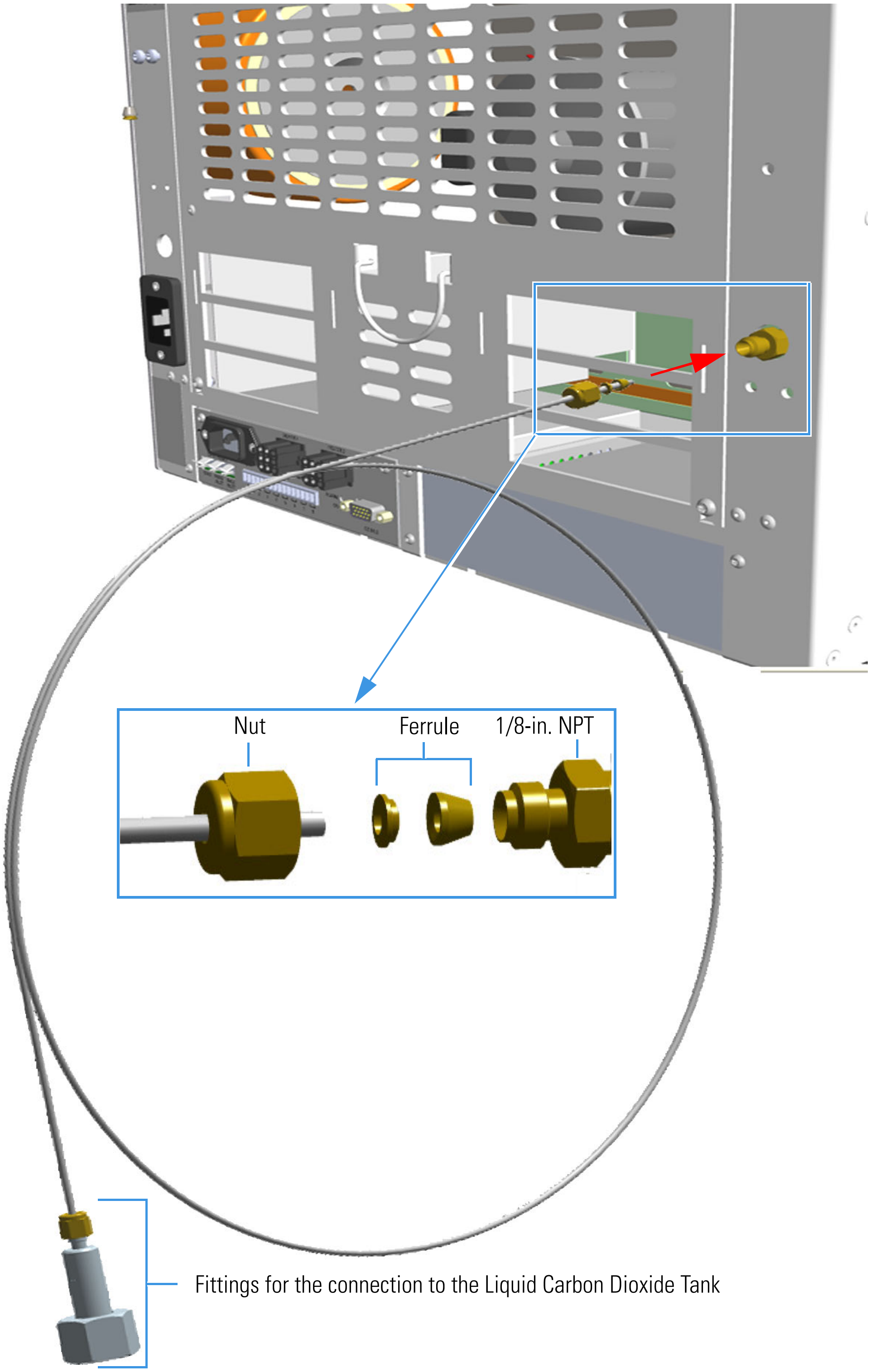
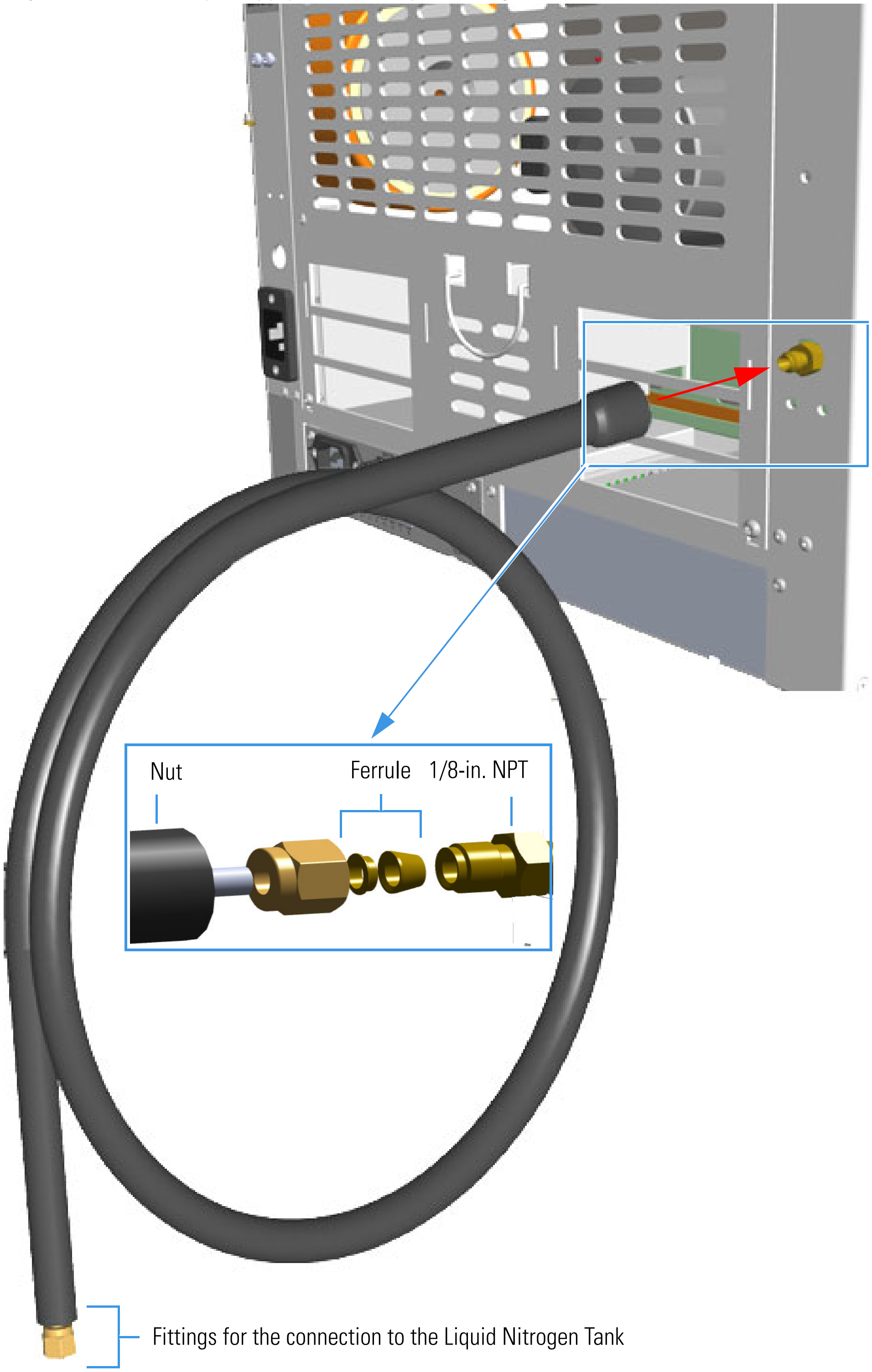


Figure 577. Oven Cryo Supply Tube for Liquid Nitrogen Connection

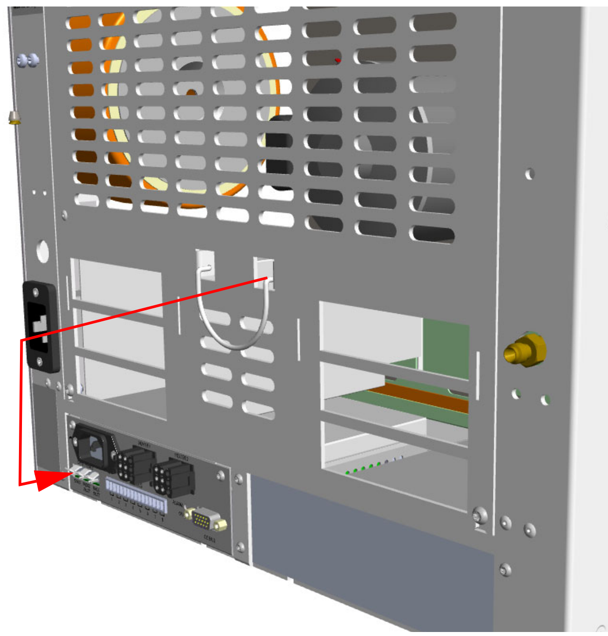


b. Connect the other end to the coolant container using the appropriate nuts and ferrules.

11. Connect the cryo valve to the Aux Temperature/Cryo Module.

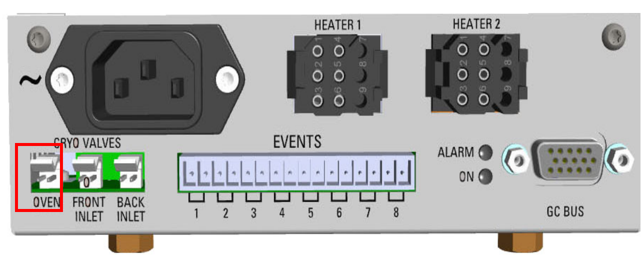
    a. Connect the cable provided to the solenoid valve connector, and guide the cable through the slot in the center of the back panel. See Figure 578.

    Figure 578. Solenoid Valve Cable Connection

    b. Connect the cryo solenoid valve to the 2-pin connector marked **Cryo Valves - Oven** using the cable provided. See Figure 579.

    Figure 579. Cryo Valves: Oven

    c. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

    d. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights after the GC is powered on.

    Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section "Adding an Aux Temperature/Cryo Module" on page 486.

    e. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

12. Mount the left side panel proceeding in the reverse order in which the left side panel was removed.

13. Open the gas supplies.

14. If other external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

15. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

16. Configure and enable the cryogenic system through the user interface of your GC, or through the CDS in use. Refer to the *TRACE 1600/1610 User Guide*.

    a. **Configuration and enabling through the touch screen**.

        i. In the main menu select the **Configuration** icon. The Configuration menu appears.

        ii. In the Configuration menu, select the **Oven** icon to open the relevant submenu.

        iii. Set the **Cryogenic** parameters.

        – **Cryogenic Type** — Enable or disable the cryogenic system when it is installed and configured with Carbon Dioxide or Liquid Nitrogen as a coolant. Select between LN_2, CO_2, or none.

        – **Cryo timeout** — Enter the time at which the cryo system will be disabled. Enter a value from 0–30 min.

        – **Cryo Threshold** — Specify the temperature at which the cryo system begins to supply the coolant. Enter a value from 40-200 °C.

        iv. Return to main menu.

    b. **Configuration and enabling through the Chromatography Data System**.

        i. In the **Configuration** window select the **Auxiliary** tab.

        ii. Select the **Auxiliary control module** check box to enable the setting for the auxiliary control of the module option installed on your GC.

        iii. Select the **Oven cryogenics** check box.

        iv. Select the **Cryo type** used by your cryogenic option. Choose one: Liquid Nitrogen or Carbon Dioxide.

        v. Open the **Oven** page. Select the **Cryogenics enable** check box to enable the cryogenic system.

        vi. In **Cryo threshold** text box specify the temperature at which the cryo system begins to supply the coolant. Enter a value from 40-200 °C.

17. Set the normal detector, injector, and GC working conditions.

Adding the PTV and PTVBKF Cryo System

This section provides instructions for installing and configuring the PTV and PTVBKF Cryo system on your TRACE 1600/1610 using the dedicated kit. See Figure 580 and Figure 581.

Figure 580. PTV and PTVBKF Double Cryo System for Carbon Dioxide

Figure 581. PTV and PTVBKF Double Cryo System for Liquid Nitrogen

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.
The cryo system requires the use of liquid nitrogen or carbon dioxide as coolant. Before using liquid nitrogen or carbon dioxide, read the hazard indications and the instructions reported in the Safety sheet supplied by the manufacturer with reference to the CAS number (Chemical Abstract Service). See also "Liquid Nitrogen Safety Precautions" on page xxxi and "Carbon Dioxide Safety Precautions" on page xxxi.

PTV/PTVBKF Cryo System Overview

Two PTV/PTVBKF Cryo Upgrade Kits are available:

- PTV/PTVBKF Cryo with Liquid Nitrogen (LN_2) as coolant.
- PTV/PTVBKF Cryo with Carbon Dioxide (CO_2) as coolant.

Each upgrade kit contains all the material required to install the PTV/PTVBKF Cryo system on your GC. See Figure 582 and Figure 583.

Figure 582. PTV/PTVBKF Cryo Kit for Carbon Dioxide

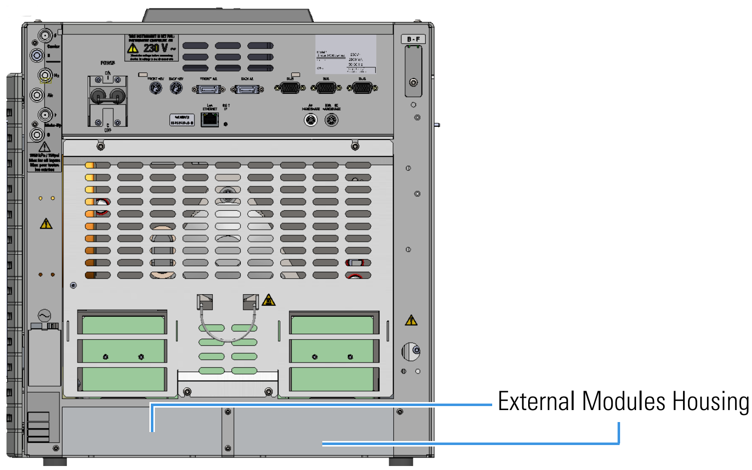
Figure 583. PTV/PTVBKF Cryo Kit for Liquid Nitrogen

Each upgrade kit contains all the material required to install the PTV/PTVBKF Cryo system on your GC:

- Dedicated solenoid valve mounted on a support bracket.

- Tube for the coolant into the PTV/PTVBKF injector module.
- Coolant tank tube with connection fittings.
- Aux Temperature/Cryo Module that should be installed into a free external module housing provided on the back of the GC. See Figure 584.

Figure 584. External Modules Housing



Installing the PTV/PTVBKF Cryo System

❖ **To install the PTV/PTVBKF Cryo System**

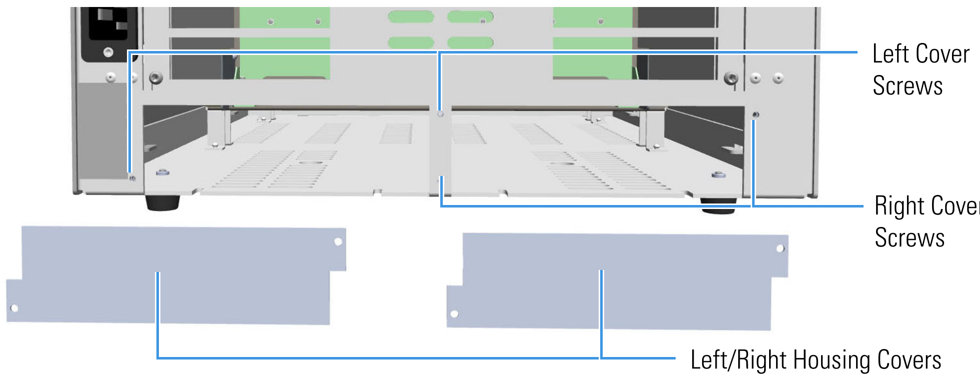
1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Put the autosampler away if present.
7. Install the Aux Temperature/Cryo Module.

a. Remove the cover of the external modules housing where you want to install the module. See Figure 585.

Figure 585. Housing Cover Removal



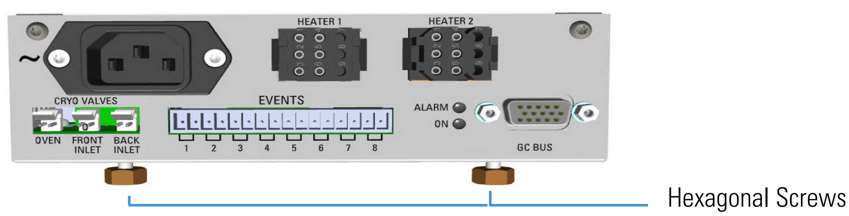
b. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws.

c. Move and drive the cover out from the housing.

8. Install the module into the housing

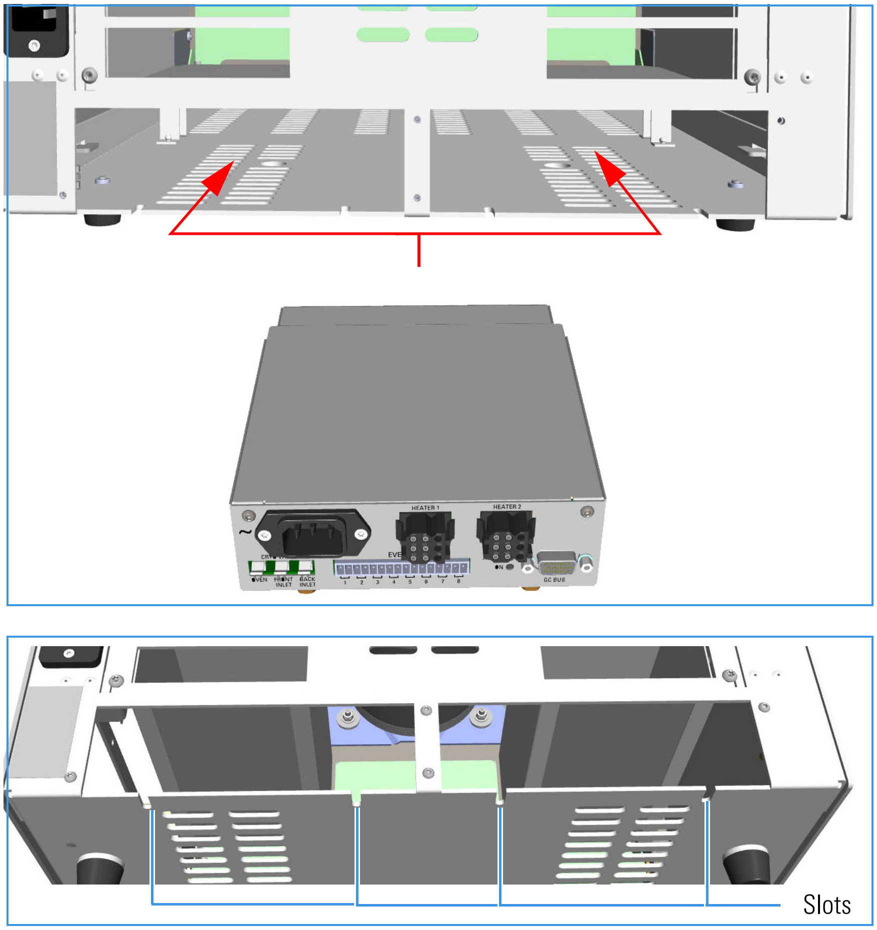
a. Loosen the two hexagonal screws under the module. See Figure 586.

Figure 586. Module Installation (1)



b. Place the module into the left or right housing until the hexagonal screws couple with the slots on the floor of the GC. See Figure 587.

Figure 587. Module Installation (2)

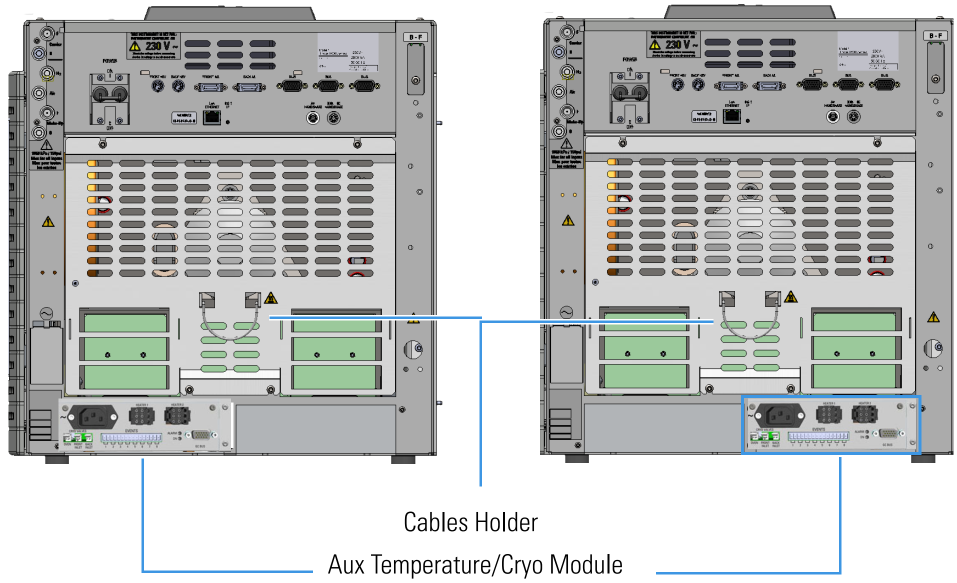


c. Finger-tighten the hexagonal screws slightly or use a 10-mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

The result of the installation is shown in Figure 588.

Figure 588. Aux Temperature/Cryo Module Installed into the GC



9. Install the proper solenoid valve assembly.

   The solenoid valve must be installed in the proper seat on the back of the GC.

   - In case of a single cryo kit, mount the solenoid assembly as shown in Figure 589.
   - In case of double cryo kit, mount the two solenoid valves assembly as shown in Figure 590.

Figure 589. Single Solenoid Valve Assemble Installation

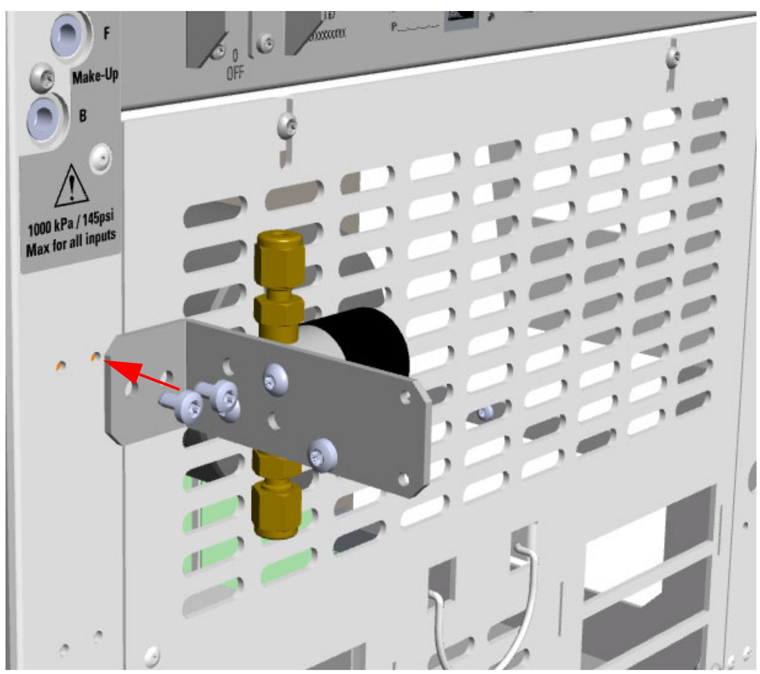
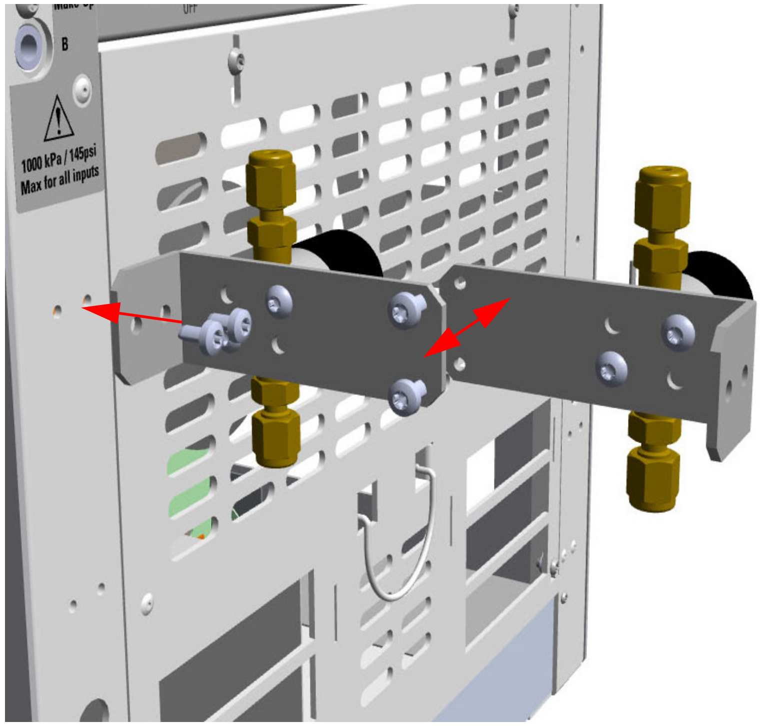
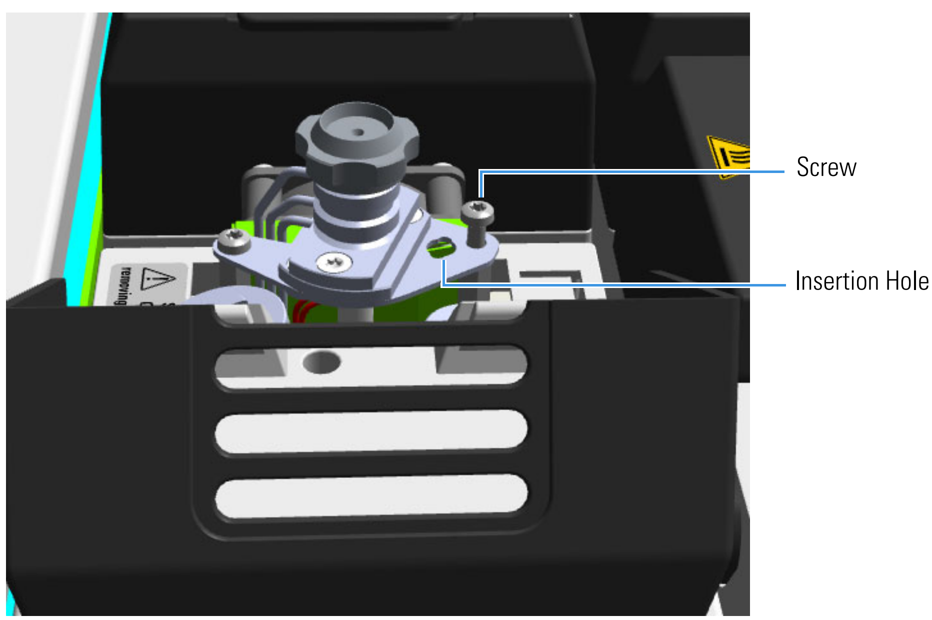


Figure 590. Double Solenoid Valve Assemble Installation



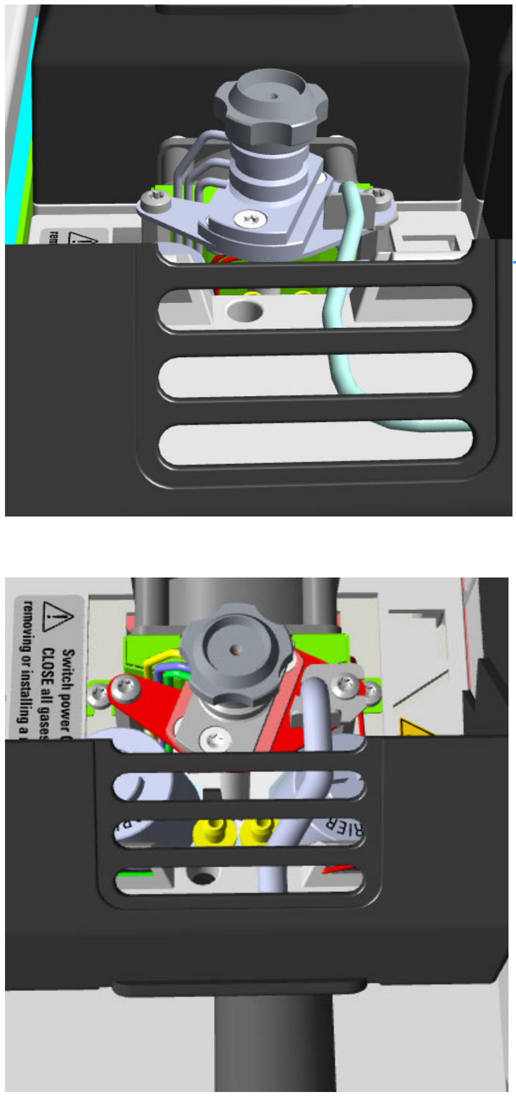
10. Insert the coolant tube into the PTV/PTVBKF injector module.
    a. Open the module flap cover.
    b. On the top of the injector, undo and remove the screw closed to the coolant tube insertion hole. See Figure 591.

Figure 591. Coolant Tube Insertion Hole



c. Insert the coolant tube into the insertion hole, and fix it using the screw previously removed. See Figure 592.

Figure 592. Installation of the Coolant Tubes for Carbon Dioxide and Liquid Nitrogen

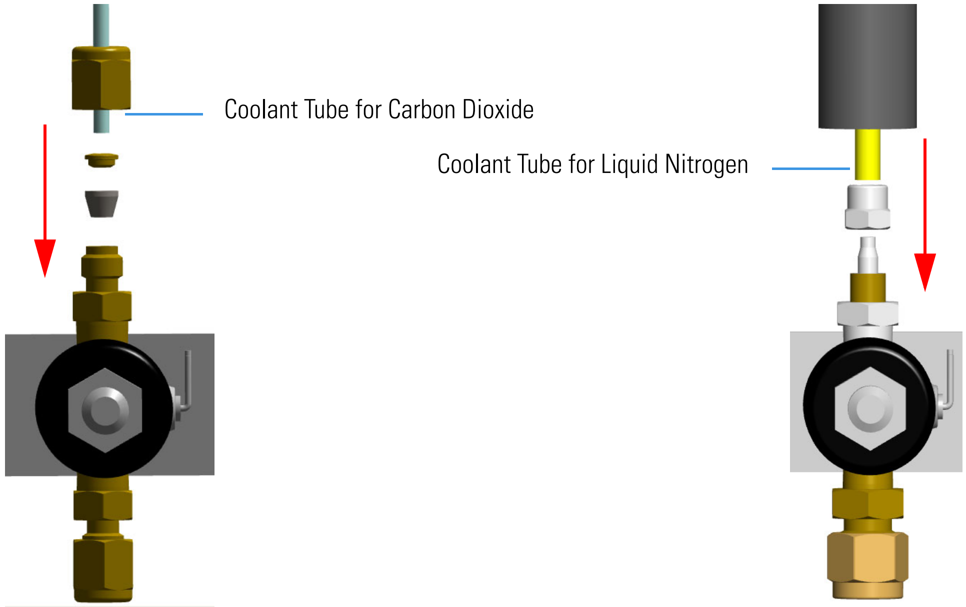


d. Guide the coolant tube along the GC top cover up to reach the solenoid valve assemble on the back of the GC. Bend the tube if necessary.

11. Connect the coolant tube to the solenoid valve assemble.

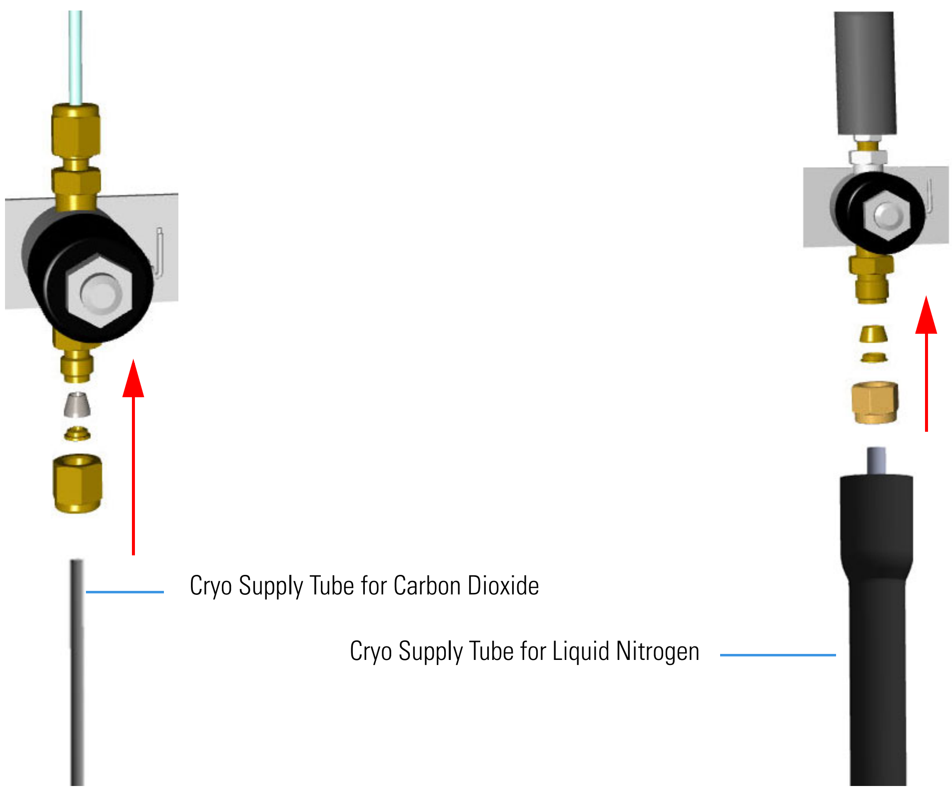
a. Connect the coolant tube to the solenoid valve assembly using the proper nut and ferrule. Use a 7/16-in. wrench for tightening the fittings. See Figure 593.

Figure 593. Coolant Tube Connection to the Solenoid Valve



b. Connect the proper end of the cryo supply tube to the solenoid valve using the proper nut and ferrule. Use a 7/16-in. wrench for tightening the fittings. See Figure 594.

Figure 594. Cryo Supply Tube Connection to the Solenoid Valve

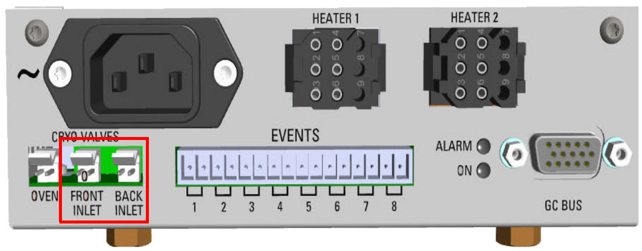


c. Connect the other end of the cryo supply tube to the coolant container using the appropriate nuts and ferrules. Use a 7/16-in. wrench for tightening the fittings.

12. Connect the cryo valve to the Aux Temperature/Cryo Module.

    a. Connect the cryo solenoid valve to the 2-pin connector marked **Cryo Valves - Front Inlet** or **Cryo Valves-Back Inlet** using the cable provided. See Figure 595.

    Figure 595. Cryo Valves: Oven

    b. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

    c. Plug the power cable to the AC Input connector on the front of the module and to the wall outlet. The LED marked **On** lights after the GC is powered on.

    Note For further details regarding the installation of the Aux Temperature/Cryo module, see the section "Adding an Aux Temperature/Cryo Module" on page 486.

    d. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

13. Mount the left side panel proceeding in reverse order which the left side panel was removed.

14. Open the gas supplies.

15. If other external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

16. Power on the GC.

    a. Plug the power cable to the AC Input connector on the back of the GC, and to the wall outlet.

    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

17. Configure and enable the cryogenic system through the user interface of your GC, or through the CDS in use. Refer to the *TRACE 1600/1610 User Guide*.

    a. **Configuration and enabling through the touch screen**.

        i. In the main menu select the **Configuration** icon, the Configuration menu appears.

ii. In the Configuration menu, select the **Front/Back PTV or PTVBKF** icon to open the relevant submenu.

iii. Set the **Cryogenic** parameters.

- **Cryogenic Type** — Enable or disable the cryogenic system when it is installed and configured with Carbon Dioxide or Liquid Nitrogen as a coolant. Select between LN_2, CO_2, none.
- **Cryo timeout** — Enter the time at which the cryo system will be disabled. Enter a value from 0–30 min.
- **Cryo Threshold** — Specify the temperature at which the cryo system begins to supply the coolant. Enter a value from 40-200 °C.
- **Cryo Cool at** — Specify the temperature at which the cryogenic system begins to supply the coolant. Enter a value from 40-200 °C.

iv. Return to main menu.

b. **Configuration and enabling through the Chromatography Data System**.

i. In the **Configuration** window select the **Auxiliary** tab.

ii. Select the **Auxiliary control module** check box to enable the setting for the auxiliary control of module and option installed on your GC.

iii. Select the **Front inlet cryogenics** or/and **Back inlet cryogenics** check box.

iv. Select the **Cryo type** used by your cryogenic option. Choose one: Liquid Nitrogen or Carbon Dioxide.

v. Open the **PTV/PTVBKF** page. Select the **Cryogenics enable** check box to enable the cryogenic system.

vi. In **Cool during** combo box, select when you want the cooling to be done. Choose between Prep-Run or Post -Run.

vii. In **Cryo threshold** text box specify the temperature at which the cryo system begins to supply the coolant. Enter a value in the range 40-200 °C.

viii. In **Cryo timeout** text box enter the time at which the cryo system will be disabled. Enter a value in the range 0–30 min.

18. If present, move the autosampler towards the module to restore the original alignment.

19. Set the normal detector, injector, and GC working conditions.

Adding an Auxiliary Gas System

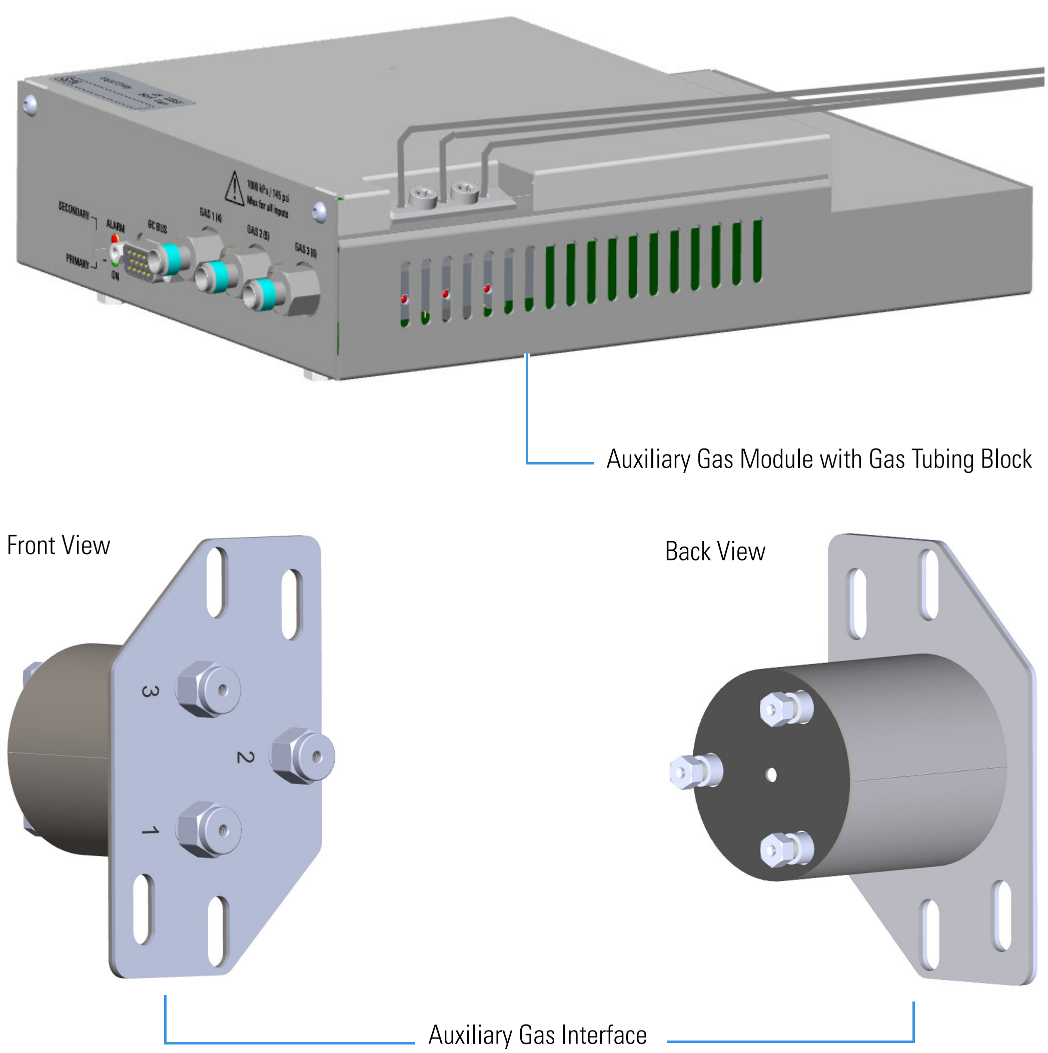
This section provides instructions for updating your TRACE 1600/1610 with the Auxiliary Gas System.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

The Auxiliary Gas Module is shipped with a protecting plate screwed on the manifold. Remove this plate before installing the module. See Installing and Connecting the Auxiliary Gas Module on page 576 for details.

The auxiliary gas system comprises the auxiliary gas module and the auxiliary gas interface. See Figure 596.

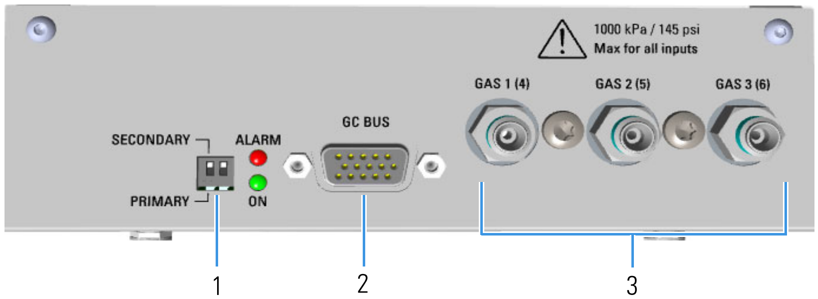
Figure 596. Auxiliary Gas Module and Interface



Auxiliary Gas Module Overview

The **auxiliary gas module** includes the following connections. See Figure 597

Figure 597. Auxiliary Gas Module Connections



1. Switch marked **Primary/Secondary** used to set two Auxiliary Gas modules simultaneously present, one as Primary, and the other as Secondary. The primary module controls the aux pressures from 1 to 3, while the secondary module controls the aux pressures from 4 to 6. See also the point 3.
2. 15-pin female connectors marked **Bus** for the communication with the GC.
3. Three inlet ports marked **Gas 1 (4)**, **Gas 2 (5)**, and **Gas 3 (6)** for the connection up to three auxiliary carrier gases. If two modules are present, up to six auxiliary carrier gases can be connected. See also the point 1.

Auxiliary Gas Interface Overview

The **auxiliary gas interface** is installed and fixed on the right wall of the GC oven, through a duct provided for the coupling with a mass spectrometer. See Figure 598.

Note The Auxiliary Gas Interface is fixed on the exterior wall of the GC oven through the slots provided on the collar duct. Align the slots to the fixing holes accordingly.

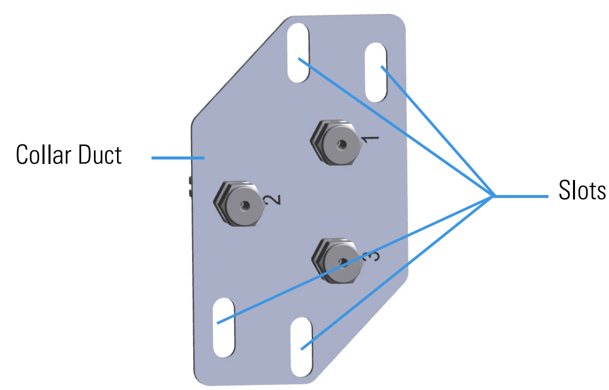
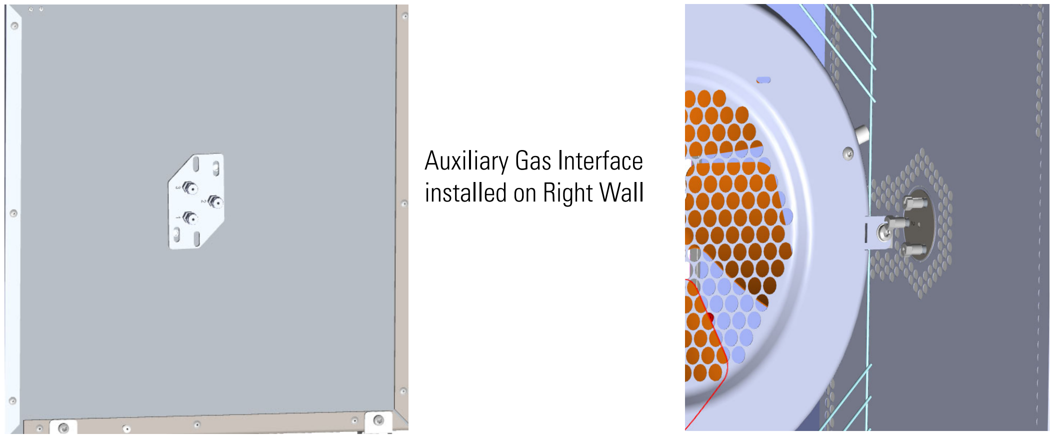
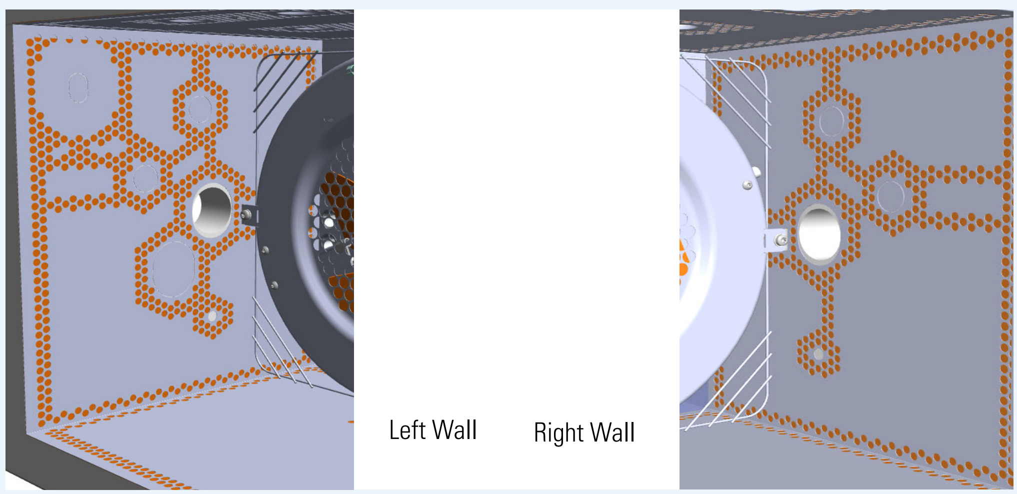


Figure 598. Auxiliary Gas Interface Installed in the Oven

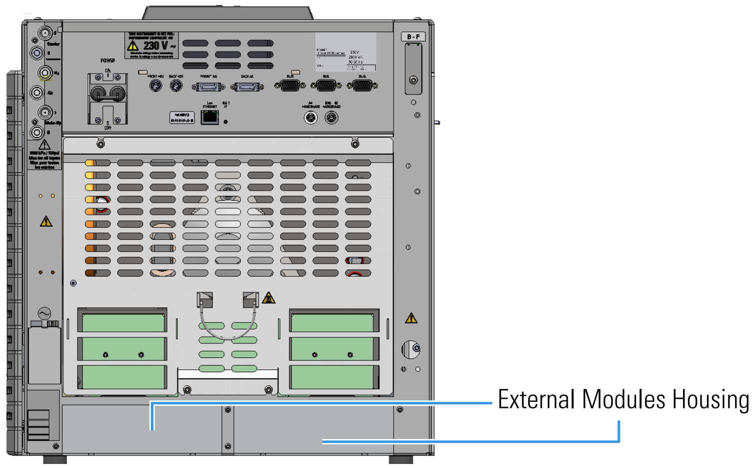


Note If your GC is equipped with the oven for the coupling with a Thermo Scientific high resolution mass spectrometers (HRMS), the Auxiliary Gas Interface is installed through the ducts provided on the left and right walls of the oven as well as the GC equipped with the standard oven. See "Installing the Auxiliary Gas Interface on the Oven for HRMS" on page 573.



The module should be installed into a free external module housing provided on the back of the GC. See Figure 596.

Figure 599. External Modules Housing



Preliminary Operations

Before starting, the following preliminary operation must be carried out.

1. Put the GC in standby condition.
2. Cool the oven, injectors, and detectors to room temperature.

> **Note** By pressing the **Maintenance** button, the GC cool down is automatically carried out.

3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector on the back of the GC, and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

Getting Started

To install and connect the Auxiliary Gas Interface and the Auxiliary Gas Module, see the following sections:

- "Installing the Auxiliary Gas Interface on the Right Wall of the Oven" on page 570
- "Installing the Auxiliary Gas Interface on the Oven for HRMS" on page 573
- "Installing and Connecting the Auxiliary Gas Module" on page 576

Installing the Auxiliary Gas Interface on the Right Wall of the Oven

❖ To install the auxiliary gas interface on the right wall of the oven

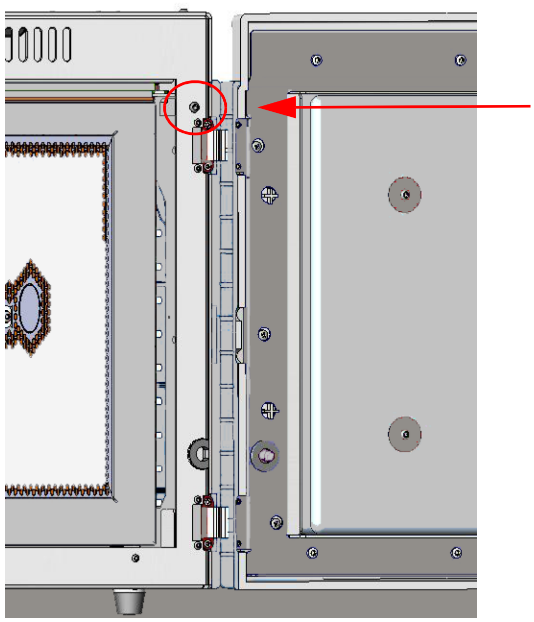
1. Make sure that the preliminary operations have been carried out. See “Preliminary Operations” on page 569.

2. Remove the right side panel.

   a. Open the front door of the GC.

   b. Using a T20 Torxhead screwdriver, unscrew the left side panel screw from the interior front panel. See Figure 600. Save the screw because it will be reused later.

   Figure 600. Right Side Panel Fixing Screw

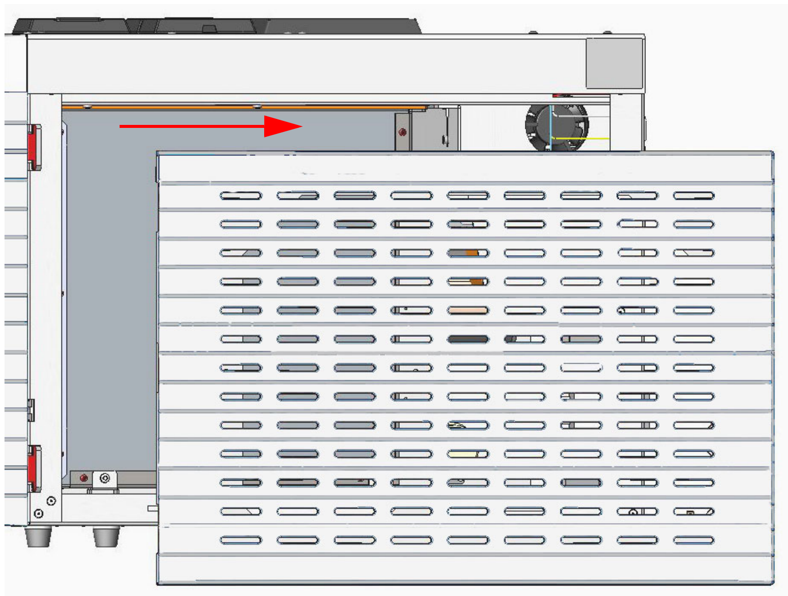
   

   c. Slide the panel towards the back of the instrument up to the stop.

   d. Remove the panel pulling it outward. Be aware that the ground wire is attached to the panel. See Figure 601.

   e. Unplug the ground wire from the panel.

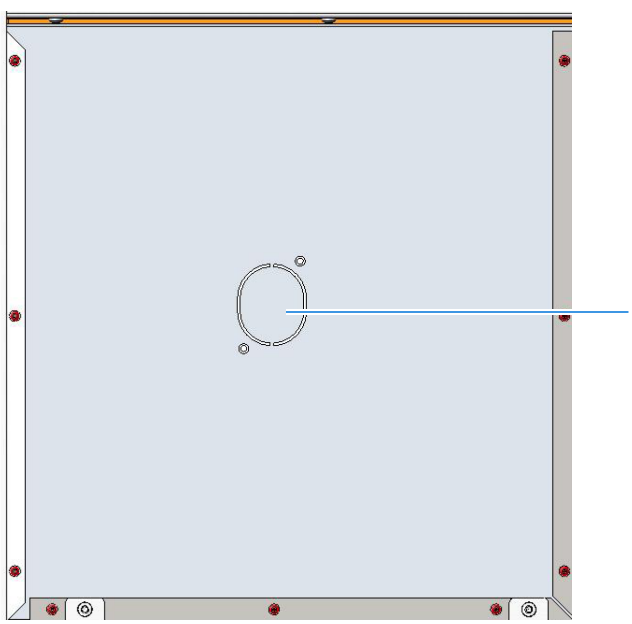
Figure 601. Right Side Panel Removal



3. Prepare the duct for the installation of the auxiliary gas interface.

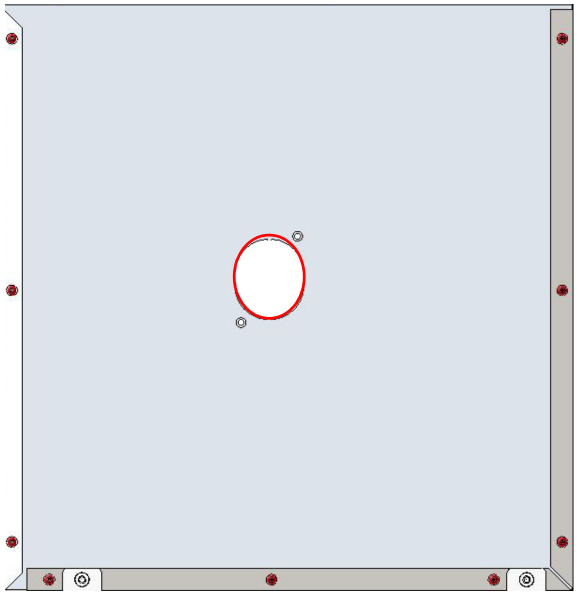
   a. Remove the partial cut shaped plate from the exterior wall of the oven box for accessing the insulating material. See Figure 602.

   Figure 602. Perform the Duct for the Auxiliary Gas Interface (1)

   b. Using a knife or similar tool, gently cut the insulating material following the border. See Figure 603.

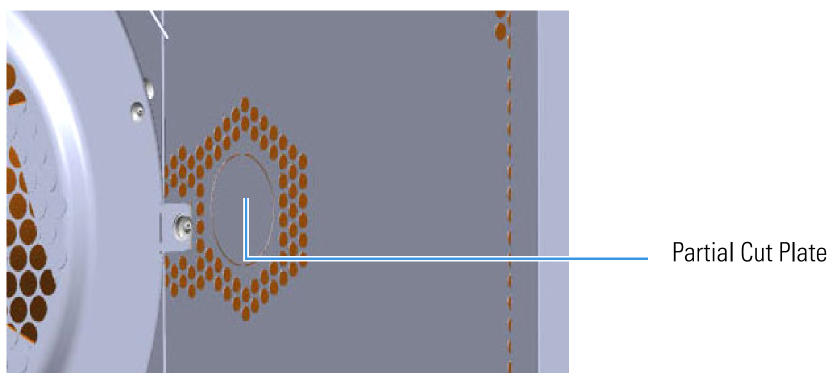
Figure 603. Perform the Duct for the Auxiliary Gas Interface (2)



c. Save the removed insulating material in a safe place because it can be reused.

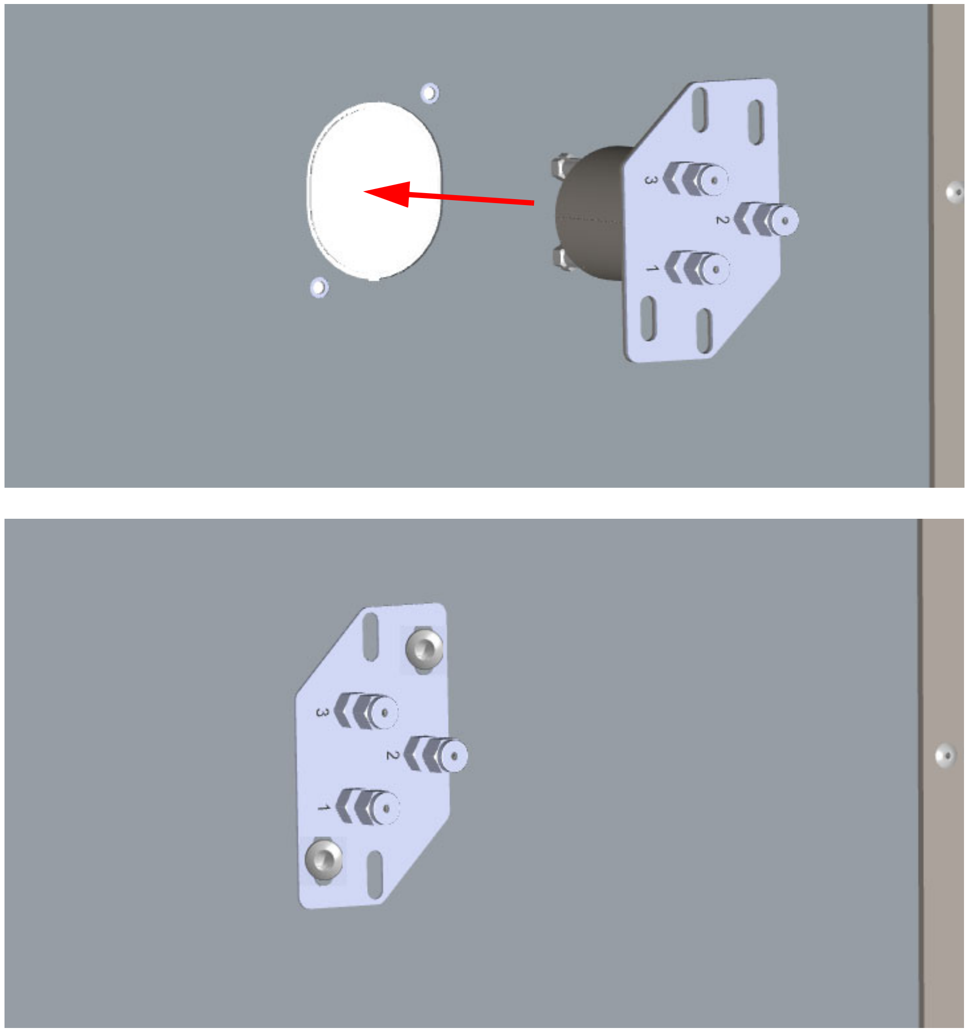
d. On the left side wall in the interior of the oven, remove the partial cut plate from the corresponding duct. See Figure 604.

Figure 604. Perform the Duct for the Auxiliary Gas Interface (3)



e. Insert the auxiliary gas interface into the duct. Fix the interface on the exterior wall of the oven box using the fixing screws provided. See Figure 605.

Figure 605. Perform the Duct for the Auxiliary Gas Interface (4)



4. Jump to the section "Installing and Connecting the Auxiliary Gas Module" on page 576.

Installing the Auxiliary Gas Interface on the Oven for HRMS

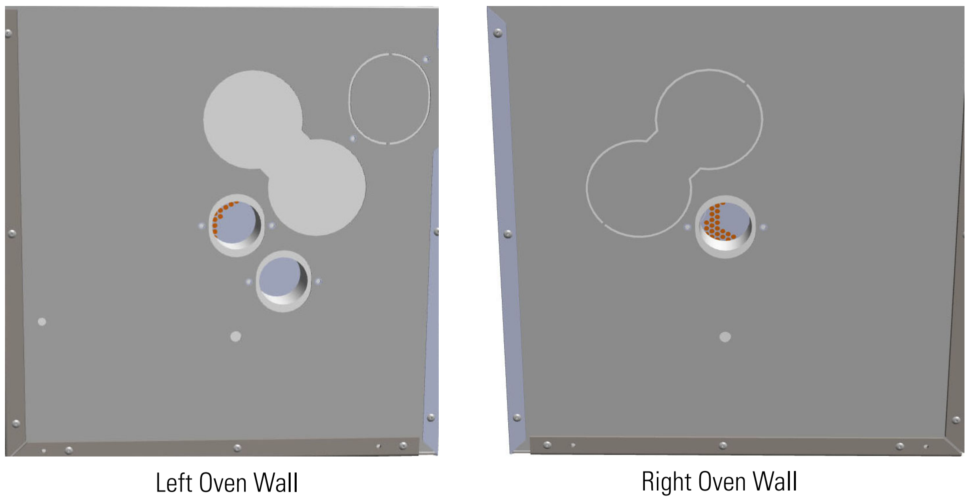
❖ To make the duct into the oven for HRMS

1. Remove the left/right side panel.
   a. Open the front door of the GC.
   b. Use a T20 Torxhead screwdriver to loosen the left/right side panel screw from the interior front panel. Save the screw because it will be reused later.
   c. Slide the panel towards the back of the instrument up to the stop.
   d. Remove the panel pulling it outward being aware that the ground wire is attached to the panel.
2. Prepare the duct for the installation of the auxiliary gas interface.

a. On the left/right exterior wall of the oven box, remove the partial cut plate of the duct of interest.

b. Remove the pre-shaped plug of insulating material from the duct provided. See Figure 606.

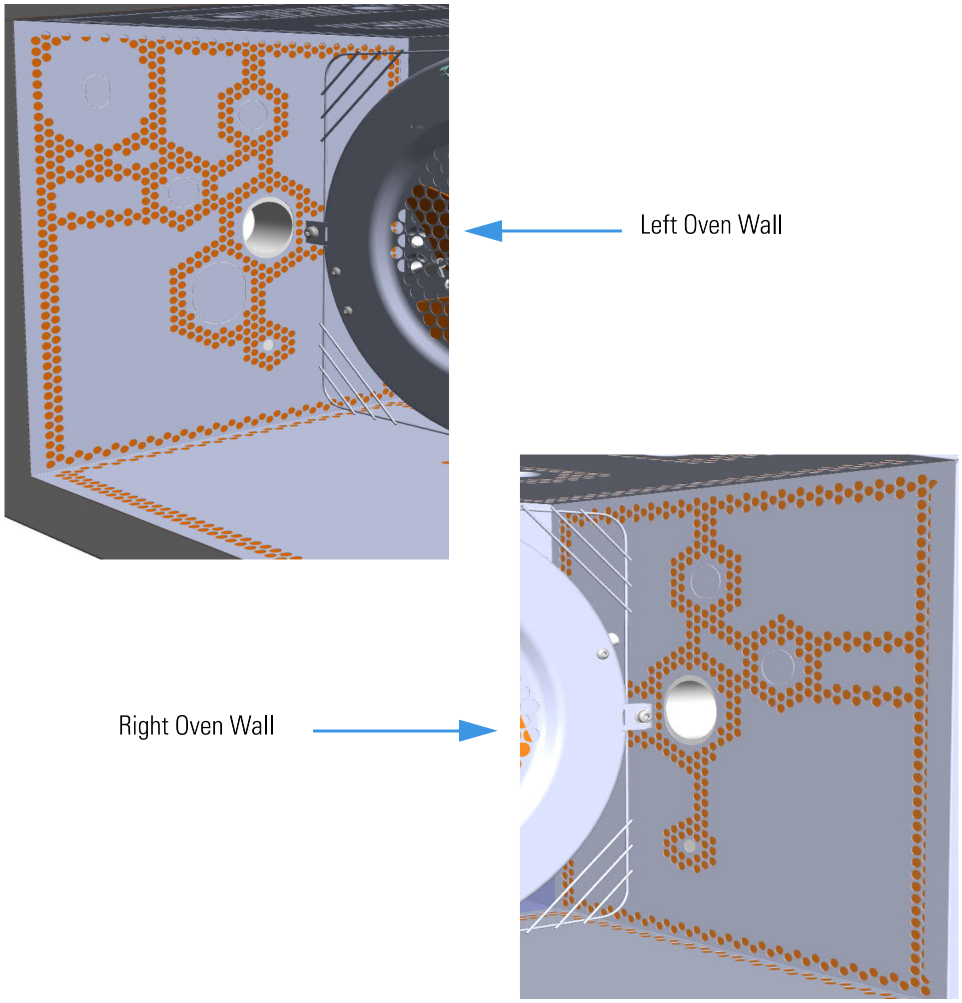
Figure 606. Left/Right Exterior Oven Wall Box View



> **IMPORTANT** Save the pre-shaped plug of insulating material in a safe place because it could be reused.

c. On the interior of the oven box, remove the partial cut plate from the corresponding duct. See Figure 607.

Figure 607. Left/Right Interior Oven Wall Box View



3. Insert the auxiliary gas interface into the duct. Fix the interface on the exterior wall of the oven box using the fixing screws provided.

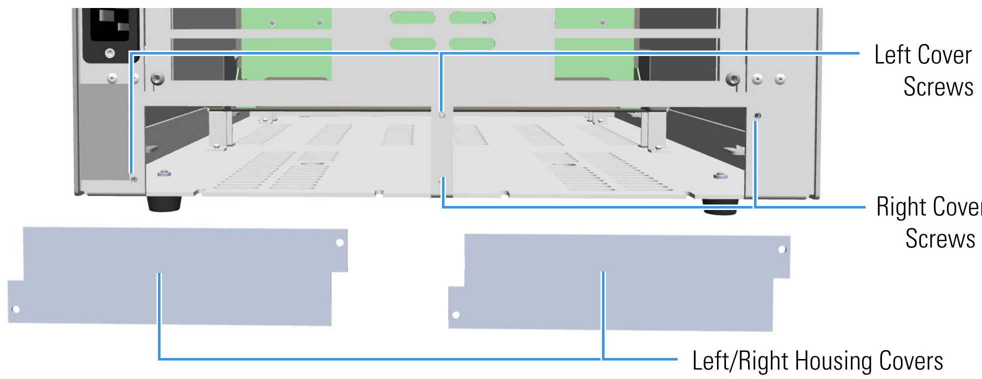
4. Jump to the section "Installing and Connecting the Auxiliary Gas Module" on page 576.

Installing and Connecting the Auxiliary Gas Module

❖ To install and connect the Auxiliary Gas Module

1. Remove the cover of the external modules housing where you want to install the module. See Figure 608.

Figure 608. Housing Cover Removal



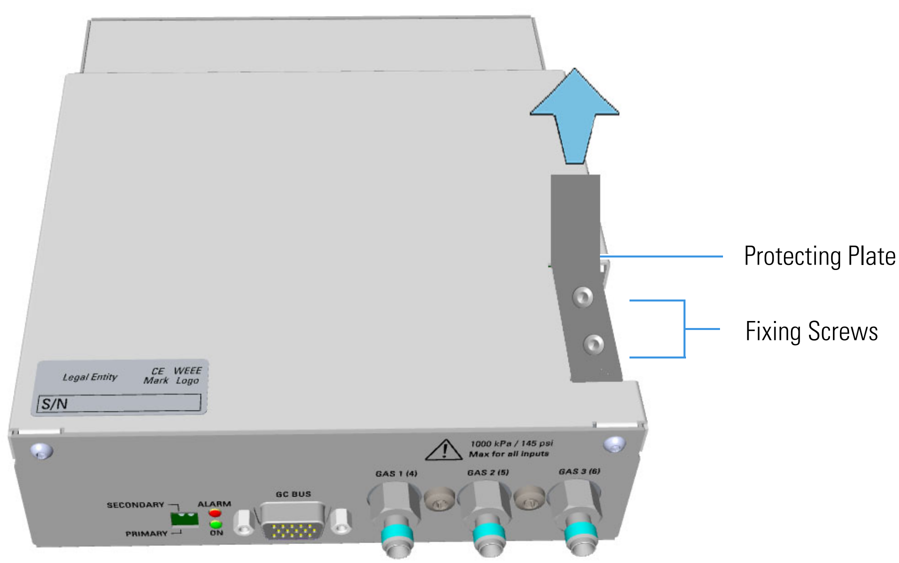
   a. Using a T20 Torxhead screwdriver, unscrew and remove the left or right housing cover screws.

   b. Remove the cover from the housing.

2. Remove the manifold protecting plate

   a. Using a T20 Torxhead screwdriver, unscrew the two fixing screws, and remove the protecting plate from the manifold. Save the protecting plate and the fixing screws.

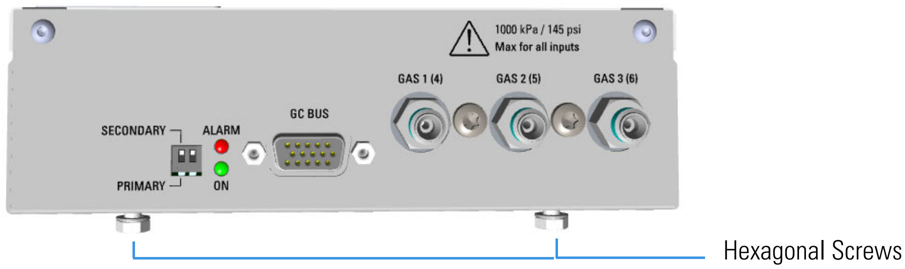
Figure 609. Manifold Protecting Plate



3. Install the module into the housing

a. Loosen the two hexagonal screws under the module. See Figure 610.

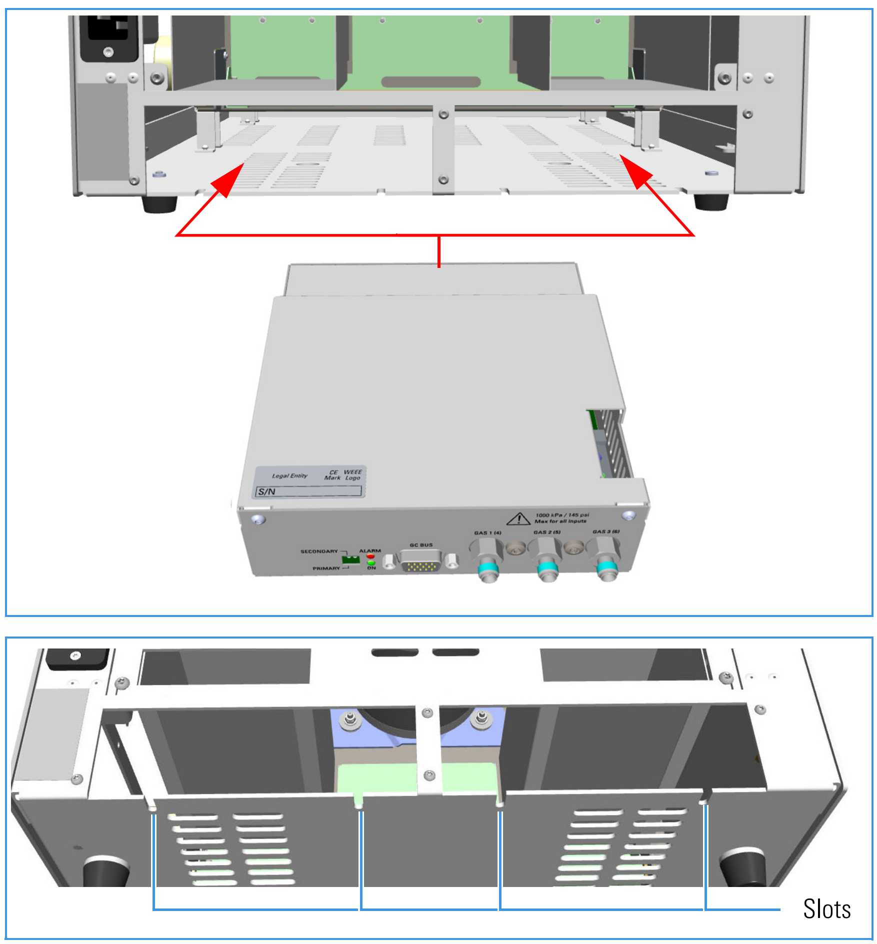
Figure 610. Module Installation (1)



b. Carefully place the module into the left or right housing.

c. Push the module until the hexagonal screws couple with the slots on the floor of the GC. See Figure 611.

Figure 611. Module Installation (2)

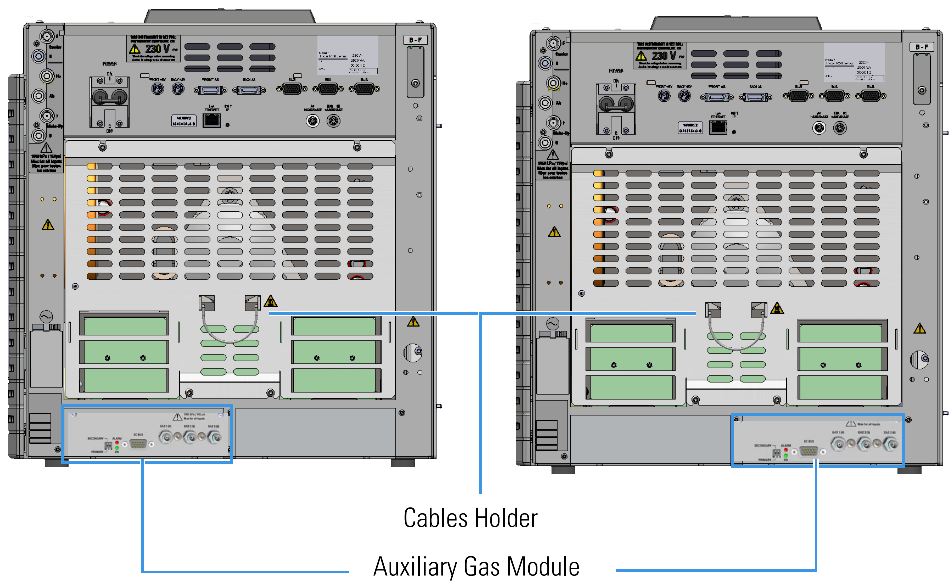


d. Finger-tighten the hexagonal screws slightly, or use a 10-mm wrench.

> **Note** Always keep the hexagonal screws in their place. This allows you an easier removal of the auxiliary module when necessary.

The result of the installation is shown in Figure 612.

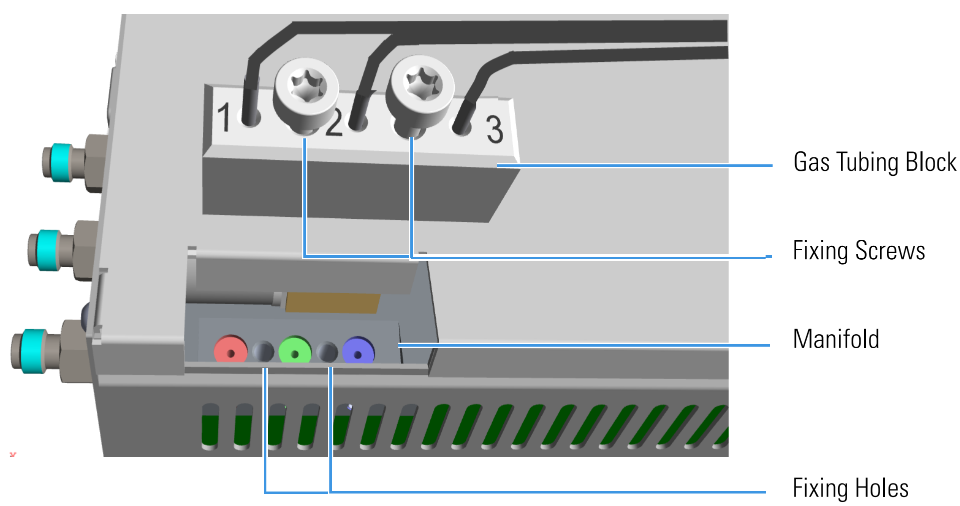
Figure 612. Auxiliary Gas Module Installed into the GC



4. Connect the gas tubing block to the manifold.

   Figure 613 shows the gas tubing block and the manifold located into the auxiliary gas module.

   Figure 613. Gas Tubing Block and Manifold



a. Carefully guide the gas tubing block on the manifold located into the auxiliary gas module. See Figure 614 if the module is installed on the right, or Figure 615 if the module is installed on the left.

Figure 614. Installation on the Right Side

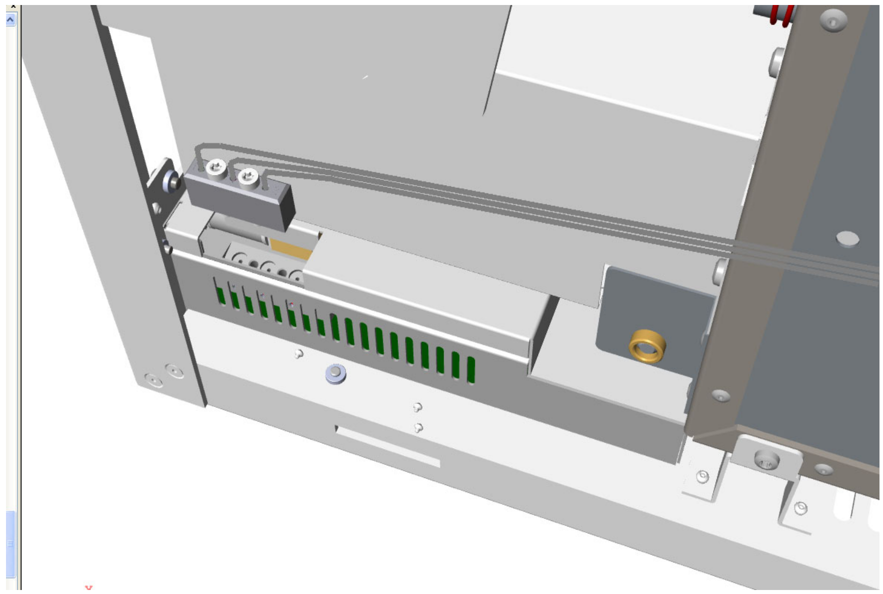
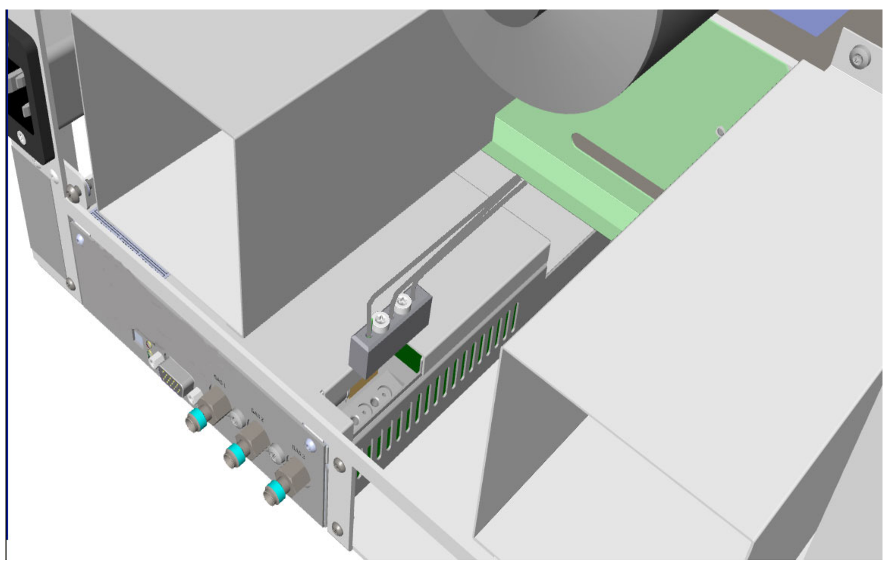


Figure 615. Installation on the Left Side



b. Align the fixing screws of the gas tubing block with the corresponding holes on the manifold.

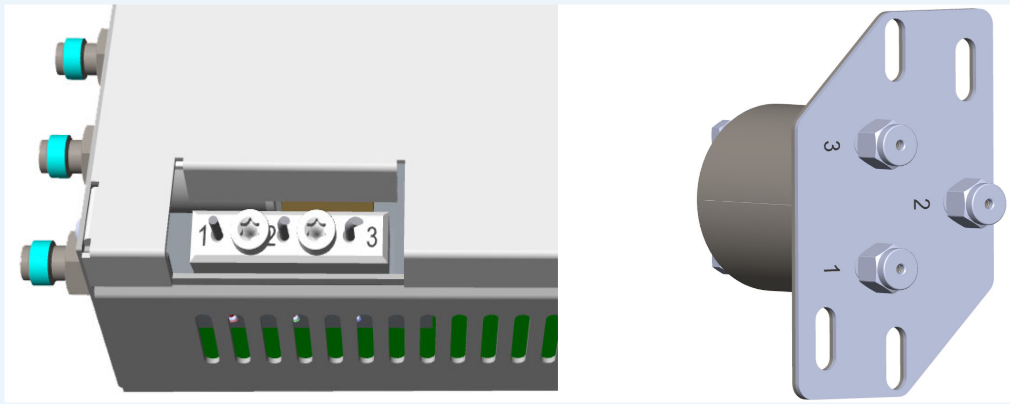
c. Use the T20 Torxhead screwdriver to tighten the two fixing screws without overtightening.

5. Connect the gas tubes of interest to the Auxiliary Gas Interface.

   a. Guide the three gas tubes up to reach the Auxiliary Gas interface.

Note The length of the tubes allows them to reach the Auxiliary Gas Interface whether they are installed on the same side or on the opposite side of the Auxiliary Gas Module.

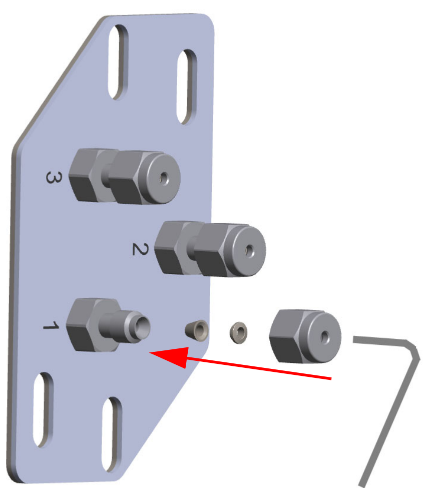
IMPORTANT The three gas tubes, coming from the gas tubing block, are numbered 1, 2, and 3 respectively. Pay attention to the correct order when you connect each tube to the corresponding inlet on the auxiliary gas interface. The end of each tube is provided with a label indicating the type of gas.



b. Bend the gas tube until its end reaches the corresponding numbered inlet port of the auxiliary interface.

c. Connect the gas tube to the corresponding numbered inlet port using the appropriate nut and ferrules. Use a 7/16-in. wrench to tighten the fittings. See Figure 616.

Figure 616. Gas Tubes Connection to the Auxiliary Gas Interface - External View(

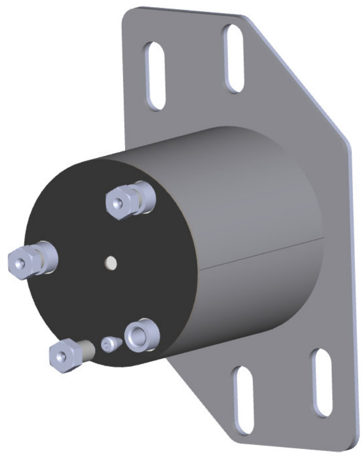


d. Repeat step b and step c until all the gas tubes of interest are connected to the auxiliary gas interface.

e. In the GC oven, carry out the connections of the components of interest to the corresponding inlet ports of the auxiliary gas interface using the appropriate nut and ferrules.

f. Repeat step e until all the components are connected to the auxiliary gas interface. See Figure 617.

Figure 617. Gas Tubes Connection to the Auxiliary Gas Interface - Internal View(



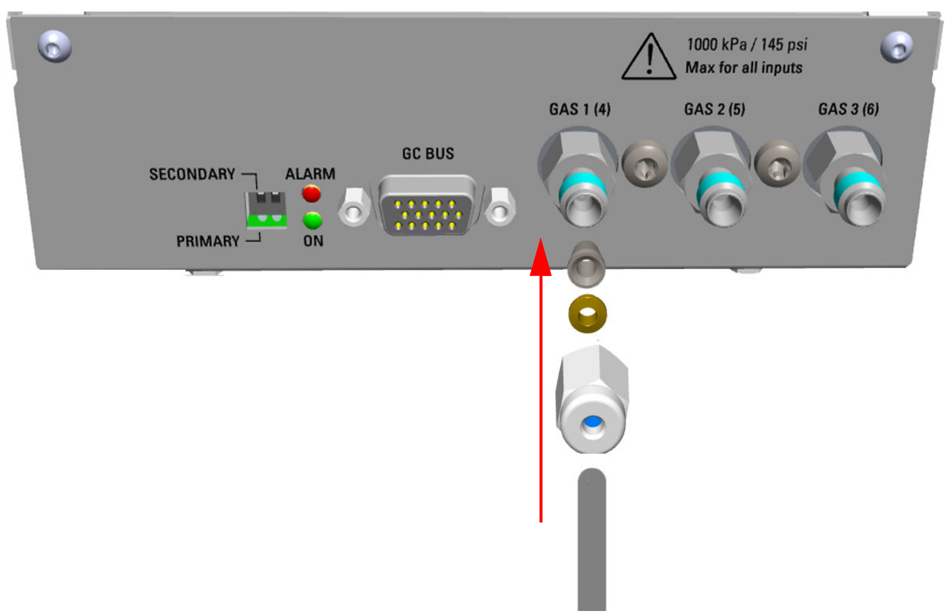
6. Connect the Supply Gas to the Auxiliary Gas Module.

> **Note** Use the 1/8-in. Swagelok fittings provided on the gas inlet ports to connect the gas lines.

a. Connect the gas line to the corresponding inlet port of interest using the appropriate nut and ferrules. Use a 7/16-in. wrench for tightening the fittings.

b. Repeat step a until all the gas lines of interest are connected to the corresponding inlet port on the auxiliary gas module. See Figure 618.

Figure 618. Gas Line Connection to the Auxiliary Gas Interface

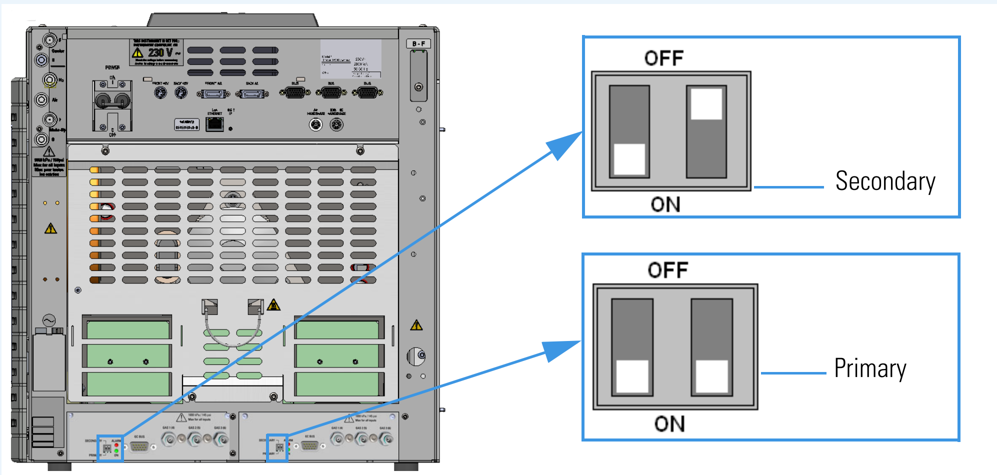


IMPORTANT The maximum nominal inlet pressure for all the inputs is 1050 kPa (152 psig), as indicated on the label under the gas inlets ports on the back of the GC. The working inlet pressure range is from 400 kPa (58 psig) to 1050 kPa (152 psig).

7. Connect the Auxiliary Gas Module electrically.

   a. Using the cable provided, connect the 15-pin female connector marked **GC Bus** on the module to a **Bus** interface on the back of the GC.

IMPORTANT If two Auxiliary Gas modules are installed, one must be set as the Primary and the other as Secondary using the dedicated switch on the back panel. See the following example.



The primary module controls the aux pressures from 1 to 3, while the secondary module controls the aux pressures from 4 to 6.

8. Replace the left/right side panel.

   a. Plug the ground wire previously removed into the left/right panel.

   b. Place the left/right panel and attach the screw holding it in place.

9. Open the gas supplies.

10. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

11. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

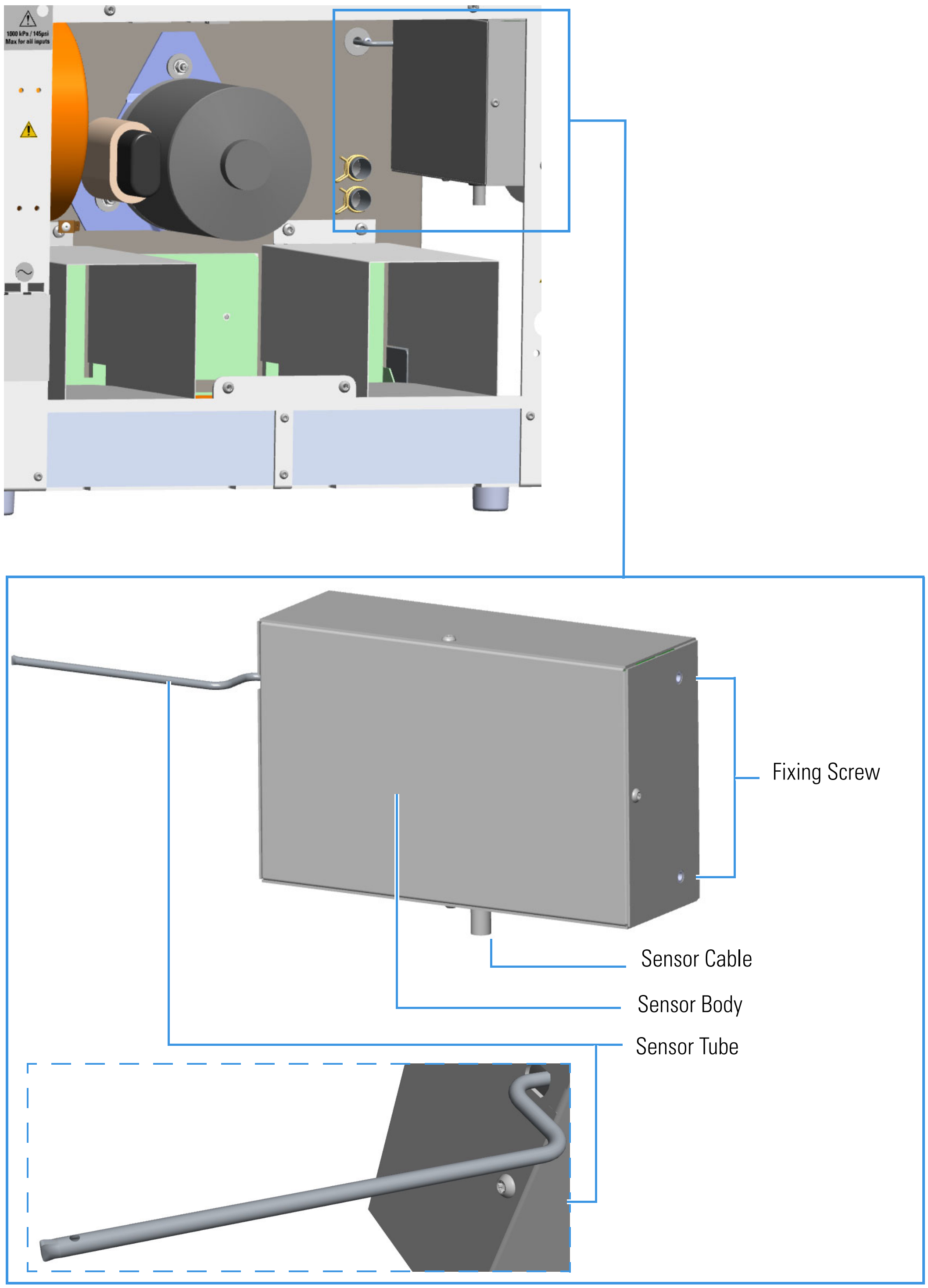
    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

12. Configure and enable the Auxiliary Gas system through the user interface of your GC, or through the CDS in use. Refer to the *TRACE 1600/1610 User Guide*.
    a. **Configuration and enabling through the touch screen**.
        i. In the main menu select the **Instrument control** icon. The Instrument Control menu appears.
        ii. In the Instrument Control menu, select the **Auxiliary** icon to open the relevant submenu.
        iii. Set the **Aux Gas Pressure** values as required, then return to main menu.
    b. **Configuration and enabling through the Chromatography Data System**.
        i. In the **Configuration** window select the **Auxiliary** tab.
        ii. Select the check box **Auxiliary Carrier Module 1/2** according to the auxiliary carrier module installed on your GC.
        iii. Select the **Auxiliary Pressure** check box to enable up to six auxiliary Pressures, and the adjacent field.
        iv. According to the inlet ports connected to the Auxiliary Gas Interface, select the corresponding check box and set the pressure in the adjacent field.
13. Set the normal detector, injector, and GC working conditions.

Adding the Hydrogen Sensor

This section provides instructions for updating your TRACE 1600/1610 with the hydrogen sensor. See Figure 619.

Figure 619. Hydrogen Sensor



❖ To add the hydrogen sensor

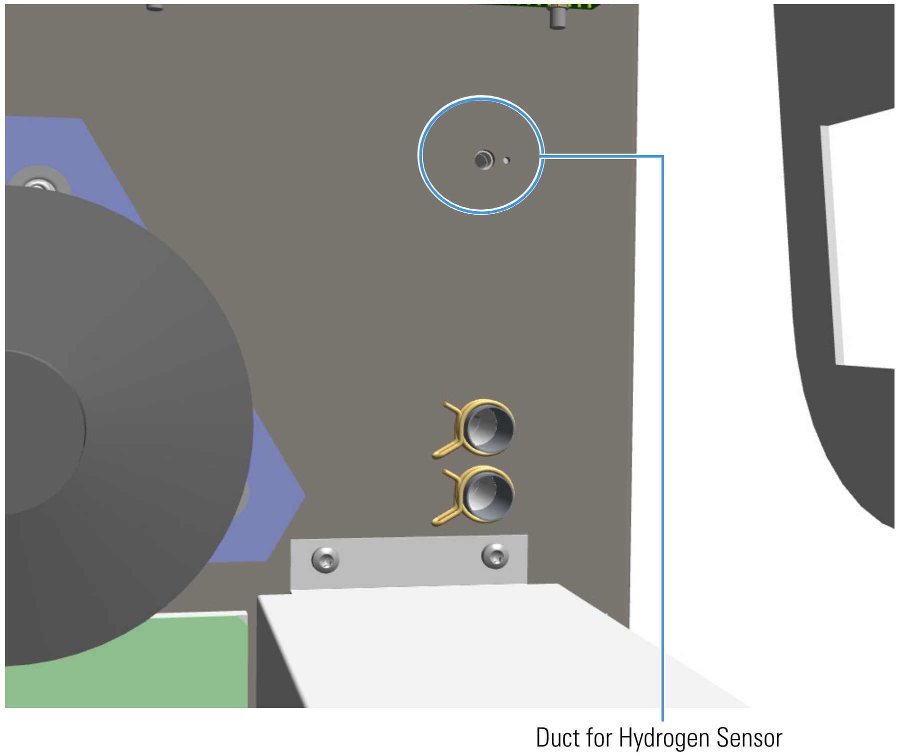
WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.
3. Close the gas supplies.
4. Power off the GC.
   a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
   b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.
6. Remove the left side panel.
   a. Open the front door of the GC.
   b. Using a T20 Torxhead screwdriver, unscrew the left side panel screw from the interior front panel. Save the screw because it will be reused later.
   c. Slide the panel towards the back of the instrument up to the stop.
   d. Remove the panel by pulling it outward. Be aware that the ground wire is attached to the panel.
   e. Unplug the ground wire from the panel.
7. Remove the back cover.
   a. Use a T20 Torxhead screwdriver to remove the four screws that secure the back cover to the GC.
   b. Lift the cover off using the cover handle. Be aware that the ground wire is attached to the back panel.

Note Pay attention to the positioning of the ground wire plug, so it can be reconnected in the same way it was removed.

8. Perforate the duct for the installation of the sensor into the oven.
   a. Looking the interior of the GC from the back side, locate the duct provided on the back wall of the oven. See Figure 620.

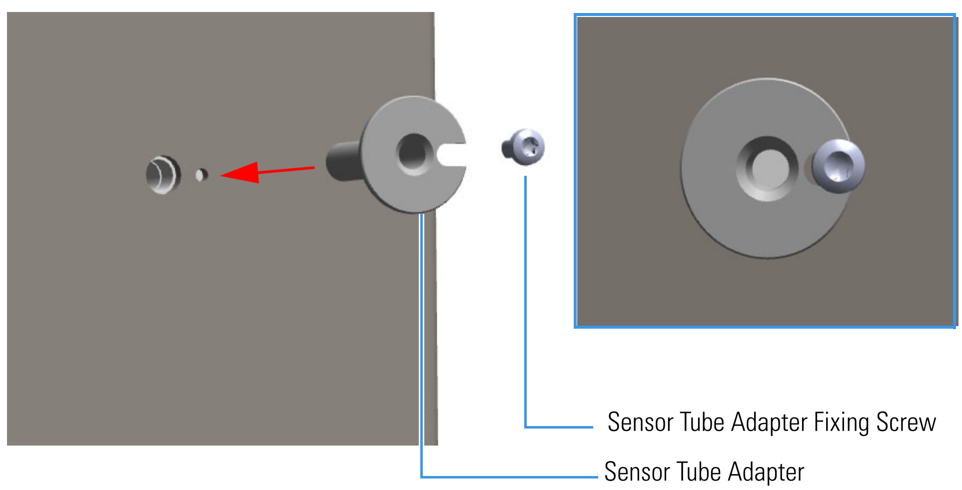
Figure 620. Duct for Hydrogen Sensor



b. Using a tool (for example a punch), perforate the insulating material until the tool protrudes into the oven. Make sure the duct is free of insulating material.

c. Insert the sensor tube adapter into the duct and fix the adapter using the screw provided. See Figure 621.

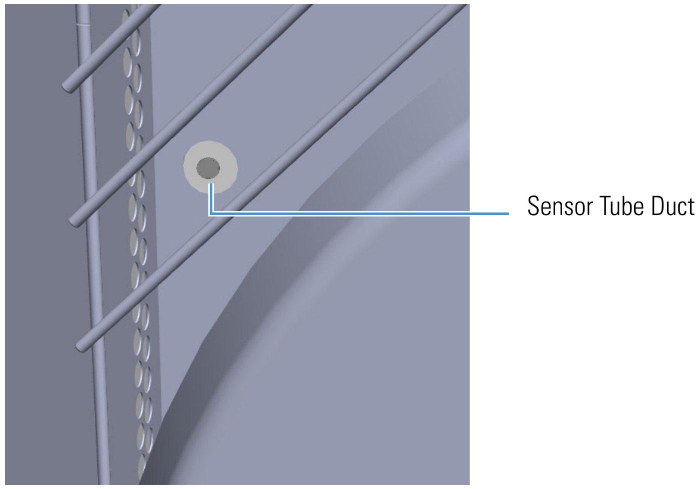
Figure 621. Sensor Tube Adapter Installation (1)



9. Open the front door.

   a. Look into oven the duct for the hydrogen sensor previously done. See Figure 622.

Figure 622. View of the Sensor Tube Duct Into the Oven



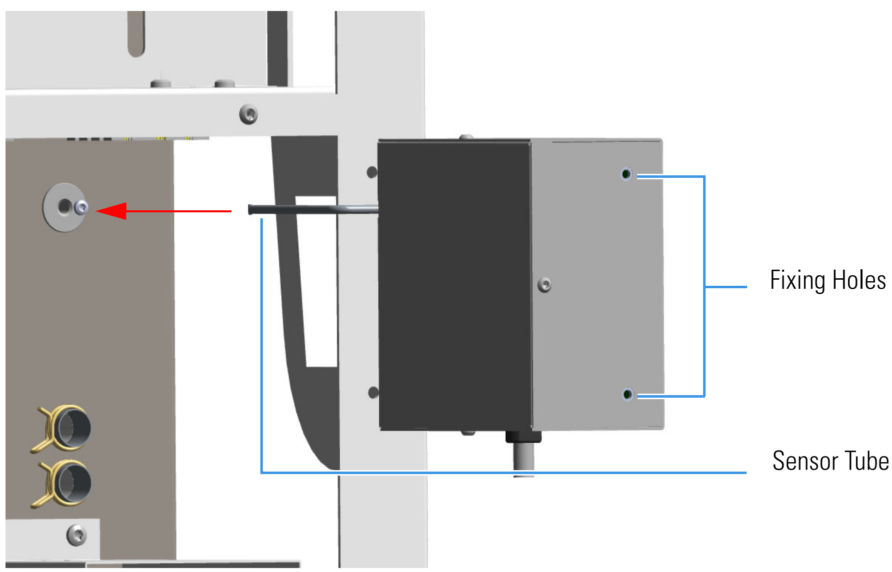
b. Check the duct is free of insulating material; if not, remove it.

> **IMPORTANT** The duct must be free of the insulating material. If not, it could obstruct the tube sensor.

10. Install the hydrogen sensor.

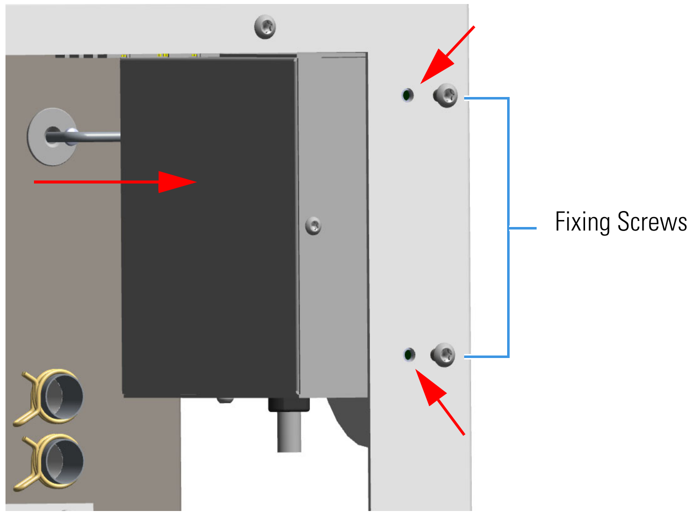
    a. Move and guide the sensor tube into the duct for the hydrogen sensor. See Figure 623.

Figure 623. Hydrogen Sensor Installation (1)



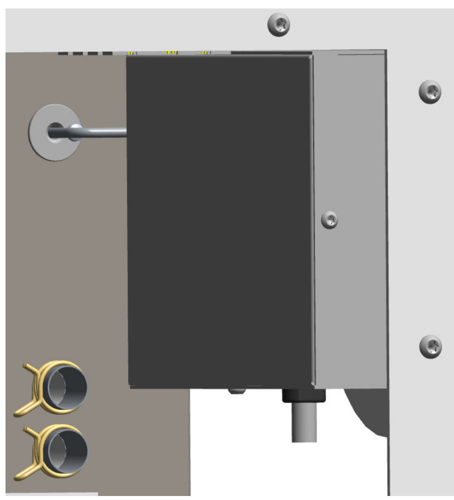
b. Place the hydrogen sensor into the back of the GC aligning the fixing holes to the corresponding holes on the GC chassis. See Figure 624.

Figure 624. Hydrogen Sensor Installation (2)



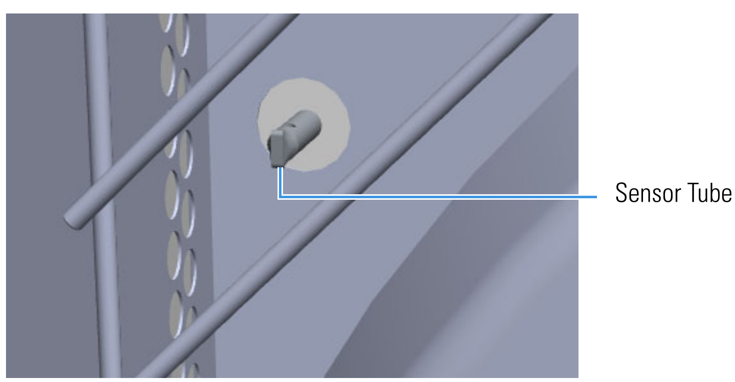
c. Fix the hydrogen sensor using the two fixing screws. See Figure 625.

Figure 625. Hydrogen Sensor Installation (3)



d. Look into oven the hydrogen sensor tube that protrudes into the oven. See Figure 626.

Figure 626. Sensor Tube Protruding Into the Oven



11. Connect the sensor cable to the 10-pin connector marked **J8 Hydrogen Sensor** of the Backplane board.
12. Close the oven door.
13. Reinstall the back cover.
    a. Reconnect the ground wire to the back cover terminal.
    b. Replace the cover proceeding in the reverse order in which it was removed.
14. Reinstall the left side panel.
    a. Plug the ground wire to the panel.
    b. Reinstall the panel proceeding in the reverse order in which it was removed.
15. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
16. Power on the GC.
    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.
    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.
17. Set the normal injector, detector and GC working conditions.

11

Upgrading Equipment

This chapter describes how to upgrade the TRACE 1600/1610. See the *TRACE 1600/1610 Spare Parts Guide* for information about ordering the equipment in this chapter.

Contents

Upgrading a TRACE 1600 to a TRACE 1610

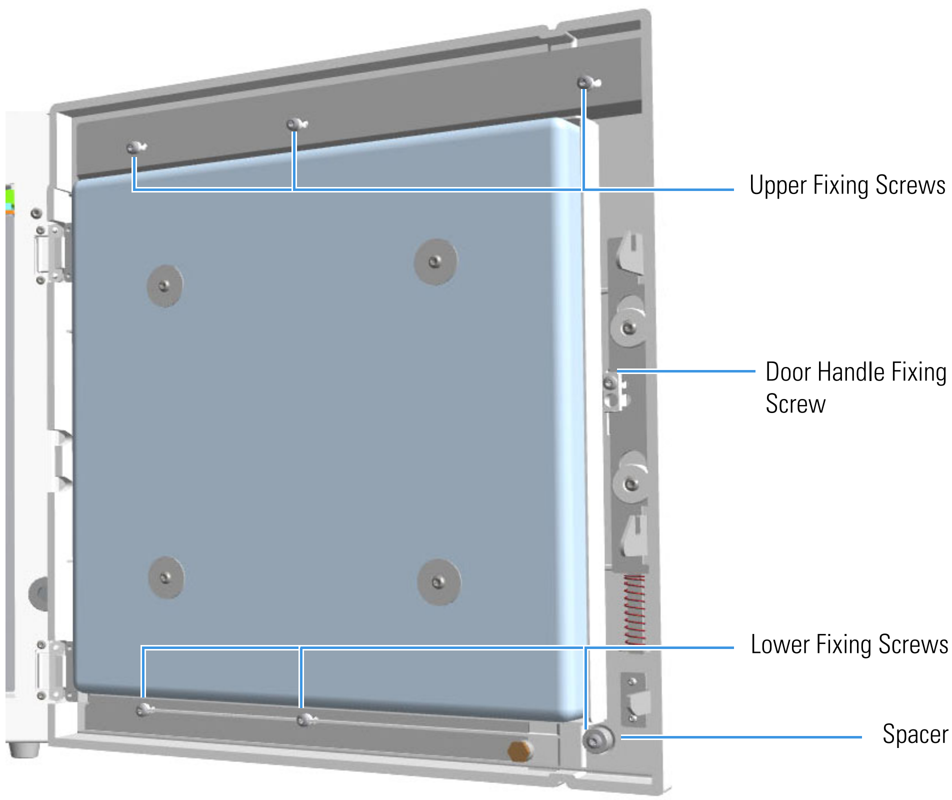
This section provides the instruction to upgrade a TRACE 1600 to a TRACE 1610 GC.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

❖ To upgrade a TRACE 1600 to a TRACE 1610 GC

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.
3. Close the gas supplies.
4. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.
6. Remove the door cover of the TRACE 1600.
    a. Open the front door and look for the fixing screws that secure the cover and the handle to the door. See Figure 627.

Figure 627. Front Door Back View

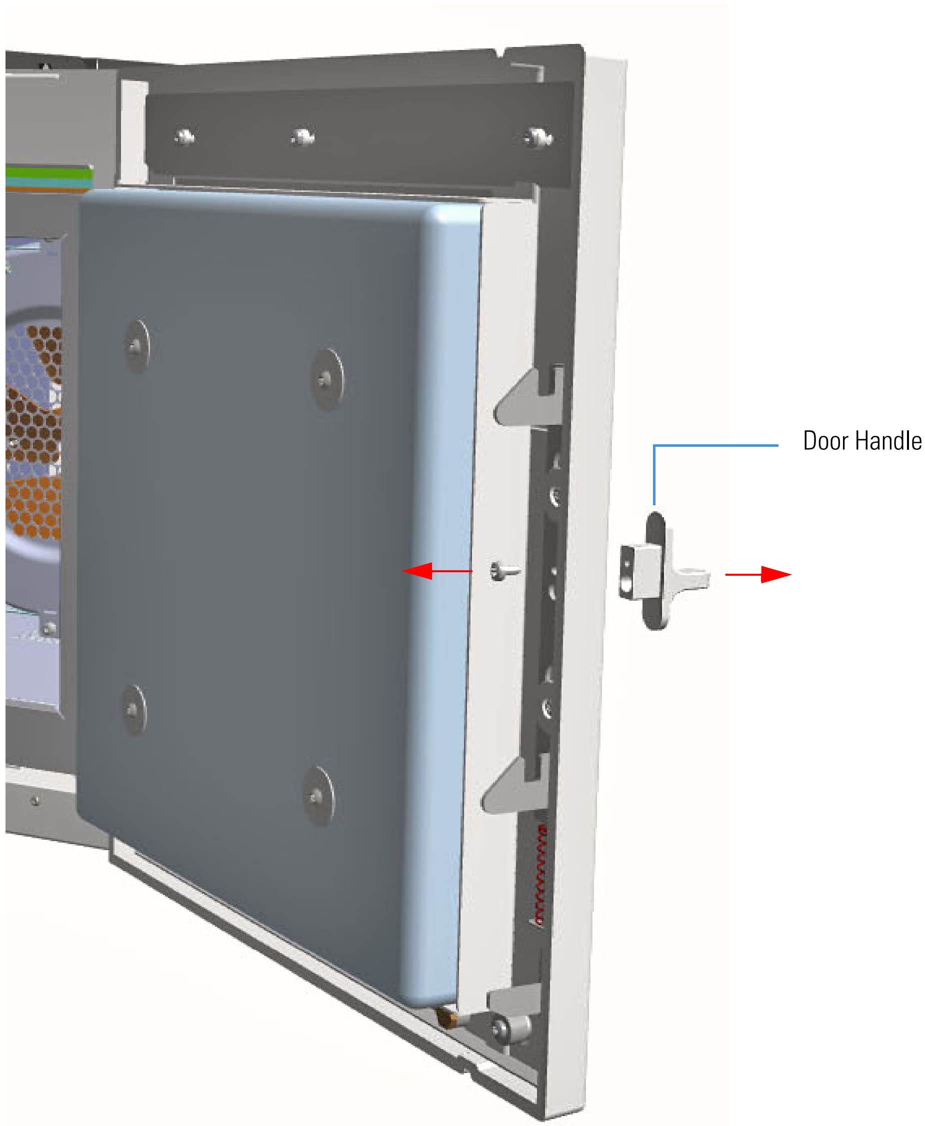


b. Use a T20 Torxhead screwdriver to remove the screw that secure the handle to the front door.

c. Pull the door handle out from the front door. See Figure 628.

Save the handle because it must be re-used.

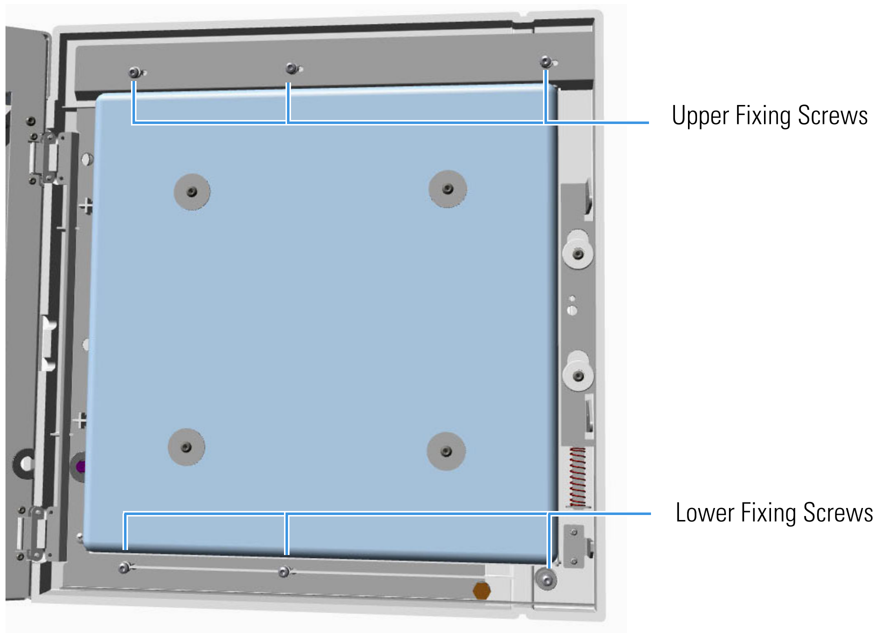
Figure 628. Door Handle Removal



d. Use a T20 Torxhead screwdriver to remove the three upper and the three lower screws that secure the cover to the front door. See Figure 629.

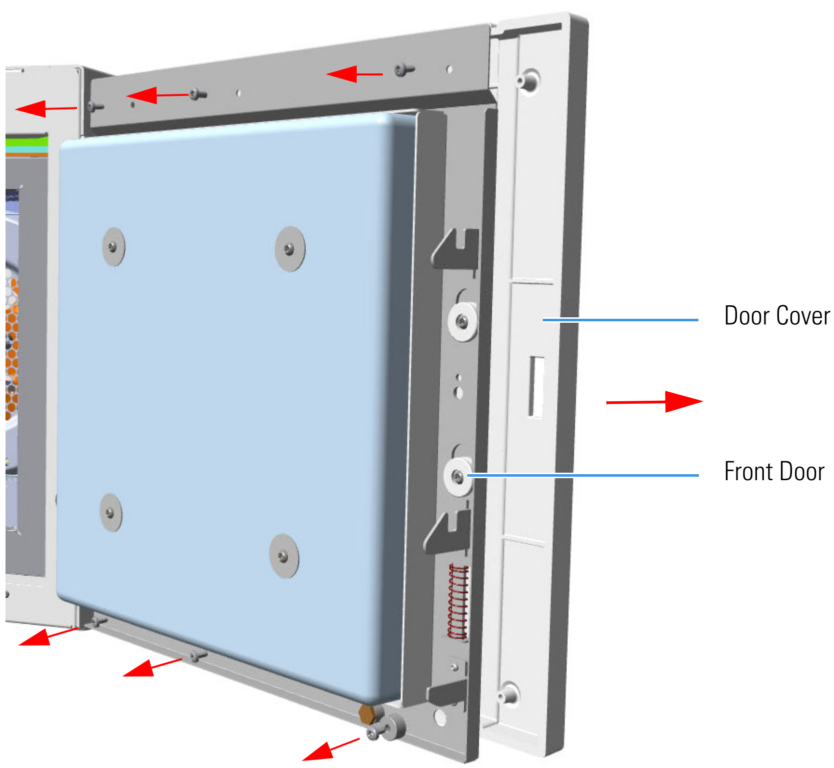
> **Note** The lower screw on the lower right corner is screwed into a spacer.

Figure 629. Door Cover Fixing Screws Removal



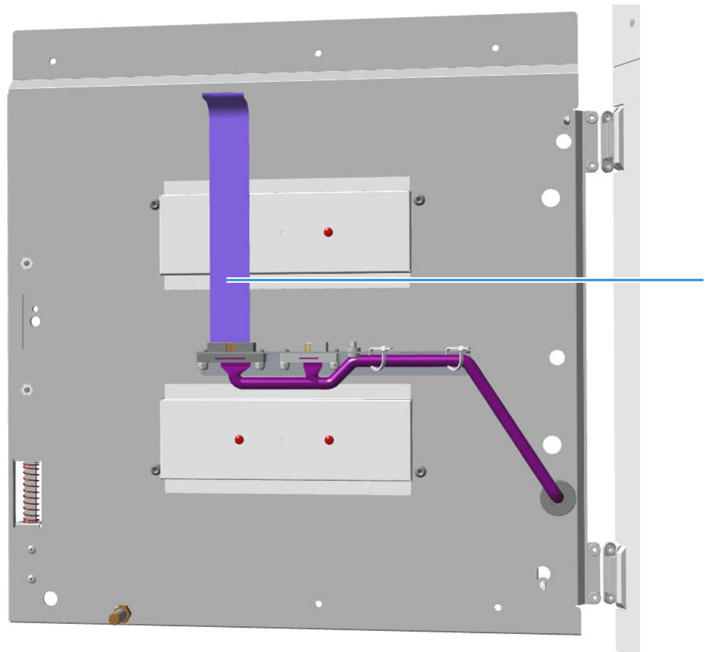
e. Carefully pull the door cover off (see Figure 630), paying attention to the cables that connect the status panel to the internal section of the door.

Figure 630. Front Door Removal



f. Disconnect the flat cables from the connector located on the front of the door. See Figure 631.

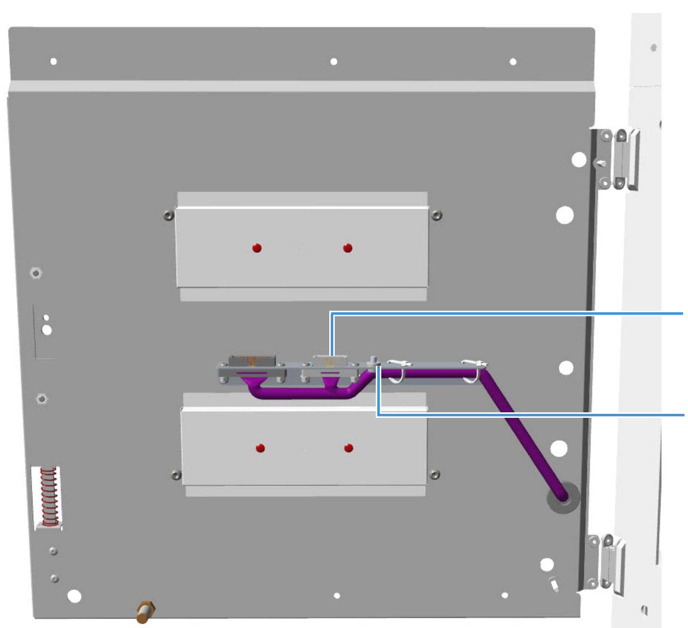
Figure 631. Cable Removal



7. Install the door cover of the TRACE 1610.

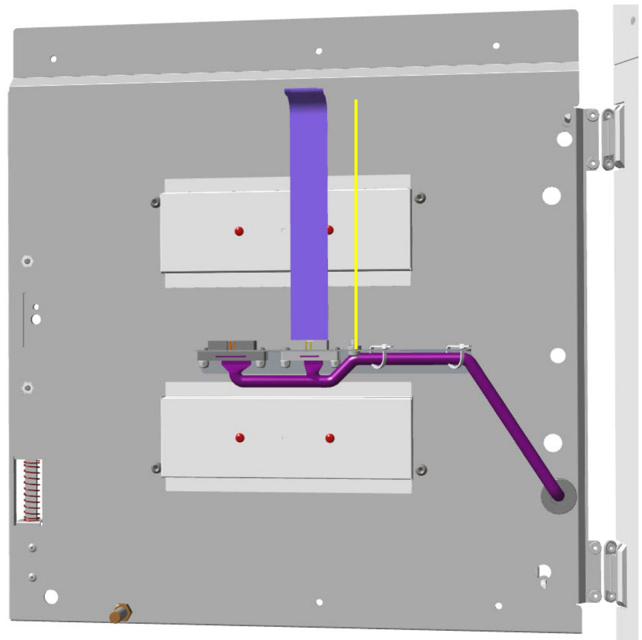
   a. The door cover of the TRACE 1610 includes the touch screen and the cables for its connection. Figure 632 shows the connection points on the internal section of the door where the touch screen and ground cables must be connected.

Figure 632. Cables Connections Points



b. Connect the touch screen and ground cables to the proper connection points located on the front of the door. See Figure 633.

Figure 633. Cables Connections



8. Mount the TRACE 1610 cover door proceeding in the reverse order in which the TRACE 1600 cover door was removed.

9. Remount the door handle.

10. Open the gas supplies.

11. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

12. Power on the GC.

    a. Plug the power cable to the AC Input connector into the back of the GC and to the wall outlet.

    b. Flip up the power switch (breaker), located at the back of the instrument, to the position I.

13. Configure the system.

14. Set the normal detector, injector, and GC working conditions.

Upgrading a Standalone TRACE 1600/1610 to MS Version

This section provides the instructions for updating your TRACE 1600/1610 standalone version to a MS version. According to Thermo Scientific you need a dedicated upgrade kit to couple the GC with an ISQ Series or TSQ Series mass spectrometer.

WARNING This operation must be carried out by authorized and trained Thermo Fisher Scientific Service Field Engineers.

Preliminary Operations

Before starting, the following preliminary operation must be carried out.

1. Put the GC in standby condition.
2. Cool the oven, injectors and detectors to room temperature.
3. Close the gas supplies.
4. Power off the GC.
    a. Push down the power switch (breaker), located at the back of the instrument, to the position O.
    b. Unplug the power cable from the AC Input connector into the back of the GC and from the wall outlet.
5. If external modules are present, unplug the power cable from the AC Input connector of each external module, and from the wall outlet.

Getting Started

CAUTION - INSTRUMENT DAMAGE: Condition the column before connecting it to the transfer line. The material released from the column (column bleed) during conditioning may contaminate the detector.

ATTENTION – RISQUE D’ENDOMMAGEMENT DE L’INSTRUMENT : procédez au conditionnement de la colonne avant de la brancher sur la ligne de transfert. Le matériau libéré par la colonne (bleeding de la colonne) pendant le conditionnement risque de contaminer le détecteur.

Coupling with the ISQ Series or TSQ Series Mass Spectrometer

❖ **To update the GC for the coupling with the ISQ Series or TSQ Series mass spectrometer**

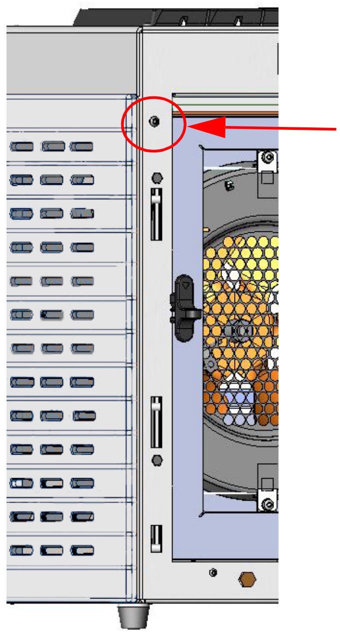
1. Make sure that the preliminary operations have been carried out. See “Preliminary Operations” on page 598.

2. Remove the left side panel.

    a. Open the front door of the GC.

    b. Use a T20 Torxhead screwdriver to screw the left side panel screw from the interior front panel. See Figure 634. Save the screw because it will be reused later.

Figure 634. Left Side Panel Fixing Screw

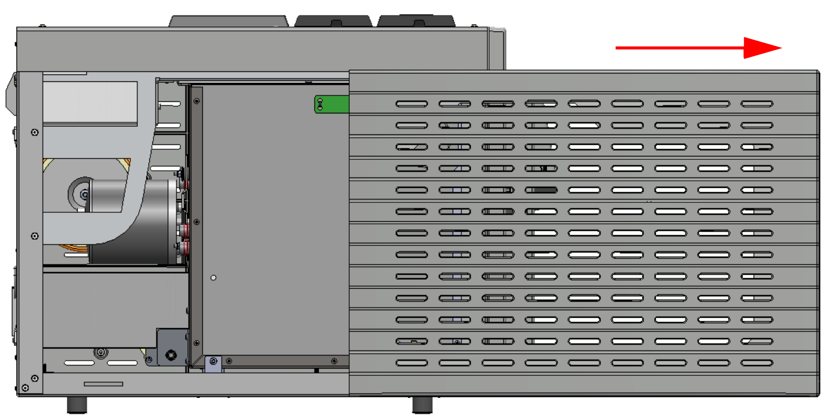


    c. Slide the panel towards the back of the instrument up to the stop.

    d. Remove the panel pulling it outward being aware that the ground wire is attached to the panel. See Figure 635.

    e. Unplug the ground wire from the panel.

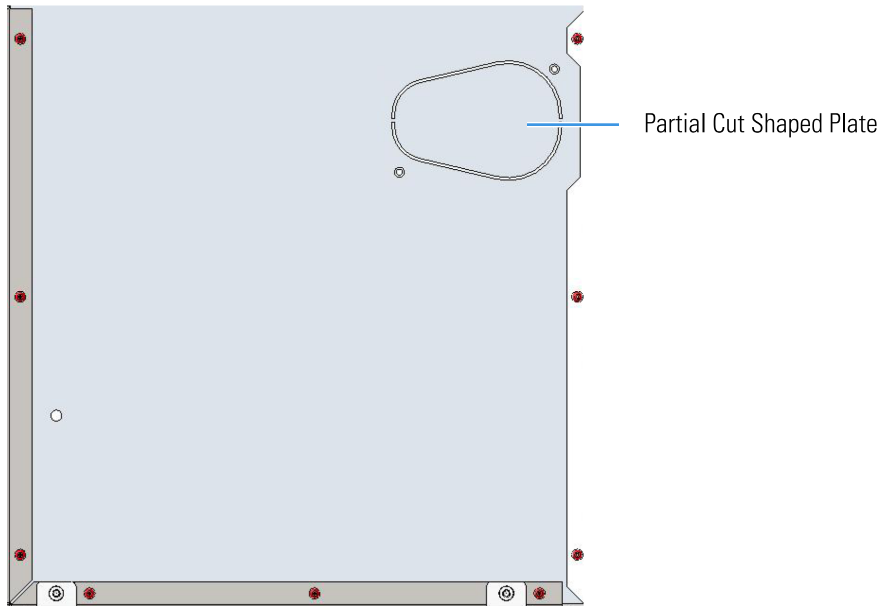
Figure 635. Left Side Panel Removal



3. Prepare the duct for the transfer line inner tube.

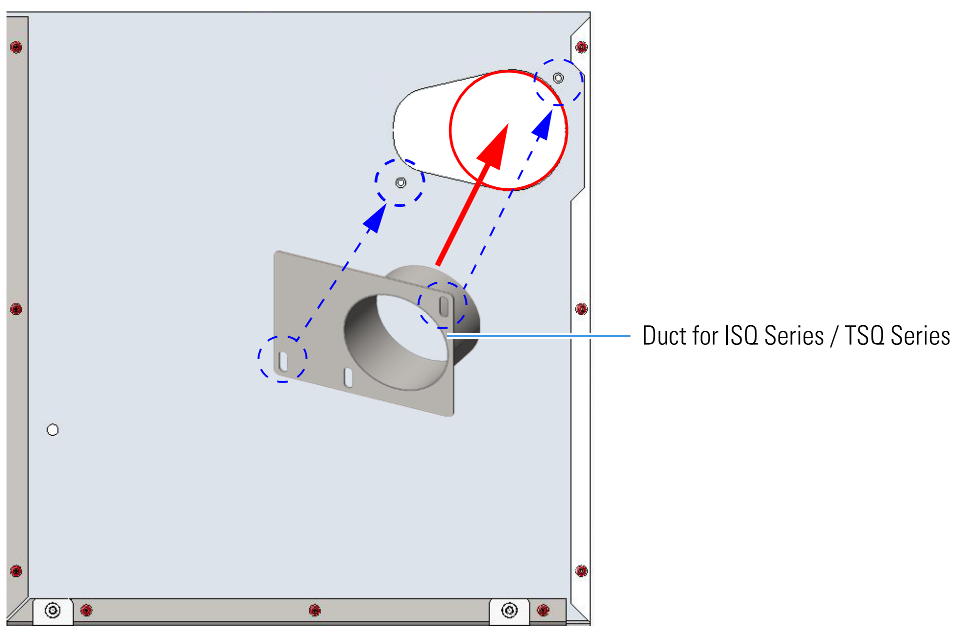
a. Remove the partial cut shaped plate from the exterior wall of the oven box to access the insulating material. See Figure 636.

Figure 636. Perform the Duct for ISQ Series / TSQ Series (1)



b. Draw up the duct aligning the slot to the fixing holes on the exterior oven wall and push the duct against the insulating material up to obtain a trace. See Figure 637.

Figure 637. Perform the Duct for ISQ Series / TSQ Series (2)

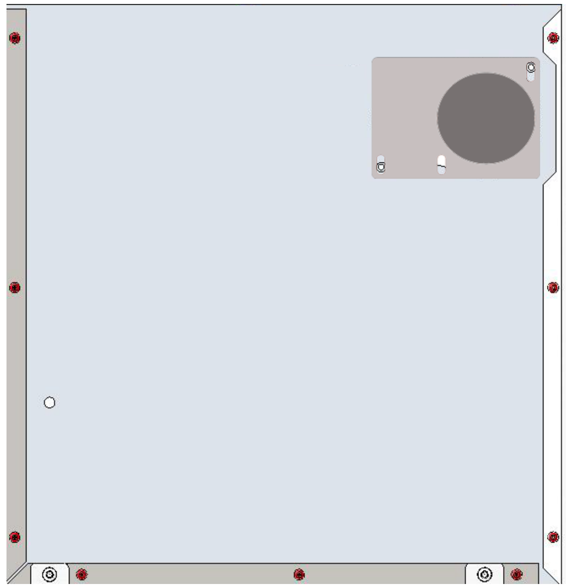


c. Using a knife or similar tool, gently cut the insulating material following the track.

d. Save the removed insulating material in a safe place because it can be reused.

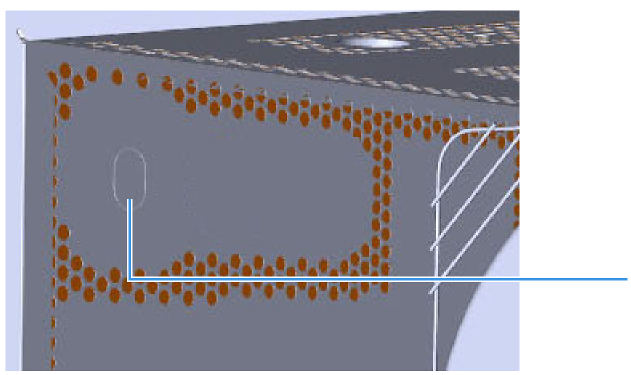
e. Place the duct and fix it on the exterior wall of the oven box using the fixing screws provided. See Figure 638.

Figure 638. Perform the Duct for ISQ Series / TSQ Series (3)



f. On the left side wall in the interior of the oven, remove the partial cut plate from the corresponding duct. See Figure 639.

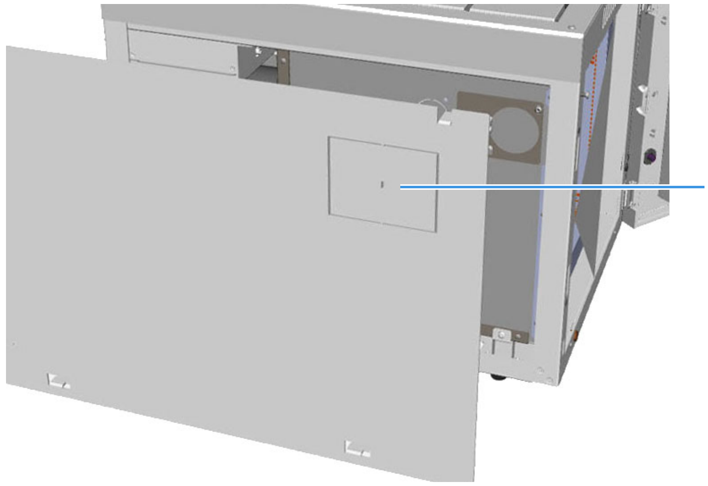
Figure 639. Perform the Duct for ISQ Series and TSQ Series (4)



4. Replace the left side panel with the left panel for MS provided.

   a. Remove the partial cut plate on the GC left panel for MS. See Figure 640.

Figure 640. Left Panel for MS



b. Plug the ground wire previously removed to the left panel for MS provided.

c. Place the left panel for MS and attach the screw holding it in place.

5. Introduce the ISQ Series / TSQ Series transfer line inner tube into the oven through the duct provided.

6. Attach the transfer line to the GC column using the proper nut and ferrule.

> **Note** The column must be conditioned before installing into the transfer line. See "Installing the Column" on page 53

7. Close the front door of the GC.

8. If external modules are present, plug the power cable to the AC Input connector of each external module, and to the wall outlet.

9. Power on the GC.

Updating HMI Software From USB Stick

This section contains instructions for updating the TRACE 1610 HMI software using a USB stick.

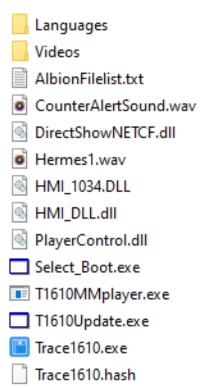
> **IMPORTANT** The upgrade must be performed by authorized and trained Thermo Fisher Scientific technical personnel.

❖ To update the HMI Software

1. Copy **HMI SW XX.XX.XX.ZIP** to the folder on your PC with the last HMI software version received from Thermo Fisher Scientific GC-GC/MS Customer Support.
2. Unzip the folder and extract the files.

> **IMPORTANT** The **Trace1610.exe** file and the **Languages** folder are fundamental components always present in the list. The other files might change from one software version to the next.

Figure 641.



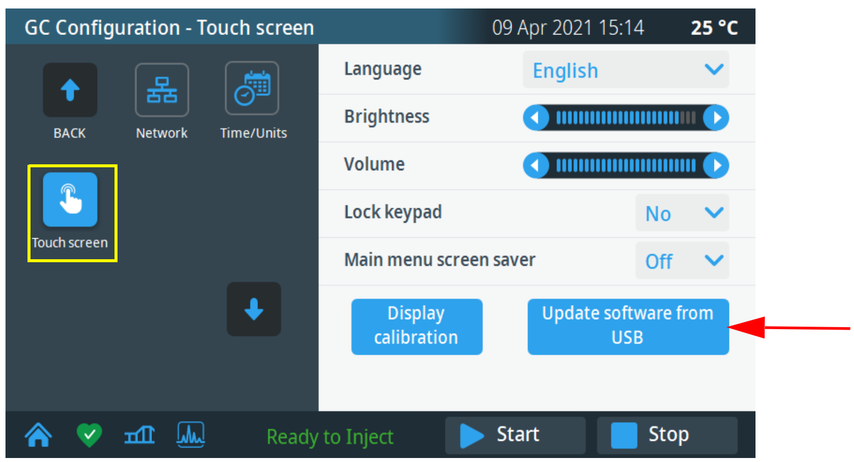
3. Copy **all** the files in the root of the USB stick.
4. Insert the USB stick into the USB port on the left side of the touch screen.

Figure 642. USB stick in the USB port below the touch screen

5. On the touch screen main menu, press the **Configuration** icon to open the Configuration menu.

6. Press **Touch screen** to open the relevant menu. See Figure 643.

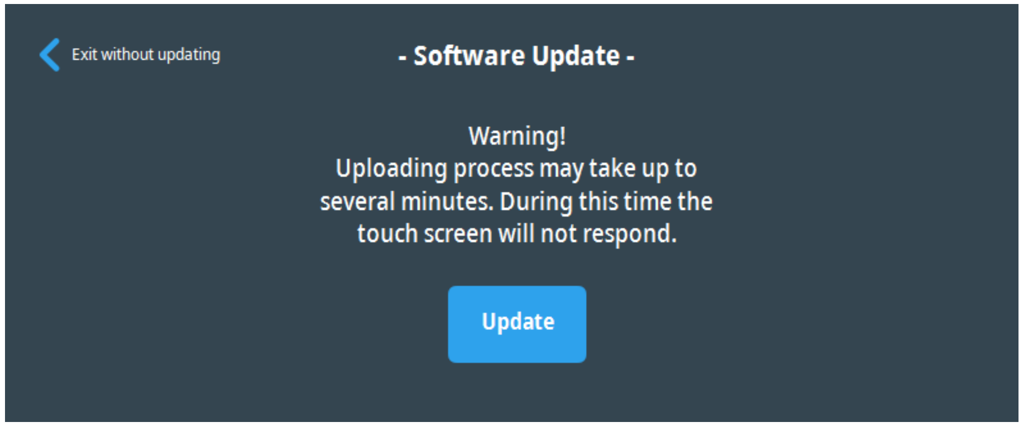
Figure 643. Touch Screen Main Menu: Configuration



7. Press **Update software from USB**.

> **Note** It may take a few moments for USB stick to be recognized by the TRACE 1610. If you do not see the icon **Update software from USB** in the menu, then return to the Home screen, and re-enter the **Touch screen** portion of the Configuration menu.

8. The following page is displays:



9. Press **Update** to start the update process.

WARNING DO NOT REMOVE THE USB STICK DURING THE SOFTWARE UPDATE PROCESS, THIS COULD DAMAGE THE INSTRUMENT.

10. The software will restart once the update is complete.

11. You may now remove the USB stick from the USB port.

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Troubleshooting

In this chapter, we describe the symptoms of and remedy for each known issue with the TRACE 1600/1610 gas chromatograph. All of these issues are related to hardware, but your instrument or software will alert you to them. For issues that you discover while reviewing your data, see the Analytical Troubleshooting section of the *TRACE 1600/1610 User Guide*.

Contents

Investigating Power Supply Issues

Verify the correct power supply to the instrument.

TRACE 1600/1610 will not power-on

Possible Remedies
Make sure the TRACE 1600/1610 power cable is properly connected to the instrument and to the correct 220/120 V main power line outlet.
Verify that the electrical outlet is functioning properly.
Power supply system is faulty. Contact your local Thermo Fisher Scientific customer support organization.

Investigating Communication Issues

Verify the instruments is communicating with the computer.

Software is not communicating with the TRACE 1600/1610

Possible Remedies
Make sure the LAN cable is properly connected to the GC.
Confirm the TCP/IP configuration on the computer matches the GC.
Restart the GC.

TRACE 1600/1610 does not start or is not ready

Possible Remedies
Verify the GC methods and configuration.
Make sure the electrical connections have been properly carried out.
Confirm the GC handshaking parameters are set properly.

Cannot download methods to the TRACE 1600/1610

Possible Remedies
Verify that your instruments are properly configured.

Sample data are not acquired

Possible Remedies
Make sure the autosampler methods and configuration include starting up and injecting a sample.
You should also make sure the sample has been injected.
Make sure the cables between autosampler and GC are properly connected.
Add more disk space to the computer if necessary.

GC is not communicating with the PC

Possible Remedies
Make sure the GC is powered on.
Make sure the GC is properly configured.

Autosampler is not communicating with the PC

Possible Remedies
Make sure the autosampler is powered on.
Make sure the autosampler is properly configured.
Make sure the cable between the autosampler and PC is properly connected.

Investigating Sensitivity Issues

Sensitivity issues are usually the result of an air leak, dirty components, or contamination. Sometimes sensitivity issues can be caused by simple problems such as the carrier gas tank running out or a sample not being injected into the GC.

If the problem is more complex, then check for air leaks or dirty components. You can prevent these problems by properly cleaning and maintaining your GC system.

It is normal to see a decrease in sensitivity in the first few injections on a clean system. Before troubleshooting for sensitivity issues, look for simple solutions, such as fixing a clogged autosampler syringe or raising the level of your sample.

Poor sensitivity or sudden loss in sensitivity

Possible Remedies
Check the system for leaks and address them.
Clean or replace the GC injection port liner to remove possible contamination, trim the injector end of the column, or replace the septum.

Error Messages

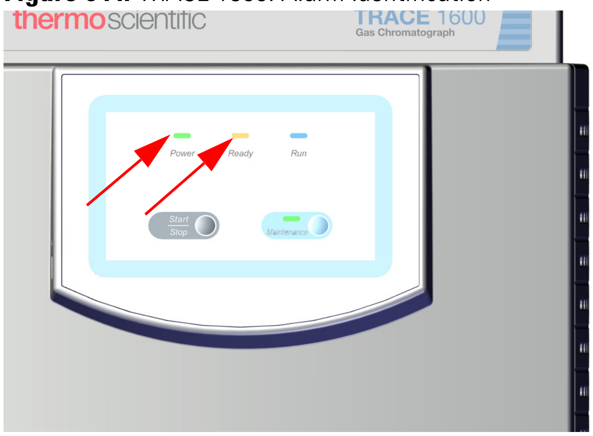
Error messages are visualized in case of GC malfunctioning. See the following sections:

- TRACE 1600 Error Messages
- TRACE 1610 Error Messages

TRACE 1600 Error Messages

A **TRACE 1600** instrument malfunction, due to a component failure or to abnormal operating condition is signaled by the blinking of both **Power** and **Ready** lights located on the TRACE 1600 Status Panel. See Figure 644.

Figure 644. TRACE 1600: Alarm Identification



A typical sound (beep) is heard. Power and temperatures will automatically cut off. To reset an alarm, the GC must be powered off, and then powered on.

TRACE 1610 Error Messages

TRACE 1610 instrument malfunctioning, due to a component failure or to abnormal operating condition, is identified by an error messages displayed before or during the runs.

IMPORTANT When an alarm is displayed in the message bar, try to solve the problem, then go to the **Diagnostics** menu and press the **Reset** button to reboot the system. If the problem persists, contact the Technical Support; see "Contacting Technical Support" on page 615.

- **FID Front/Back/Left/Right**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100

- Thermal safety: Not Heating or Auto Heating
- Reset detected

• **ECD Front/Back/Left/Right**
  - Unconnected
  - PLD error
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Thermal safety: Not Heating or Auto Heating
  - Reset detected

• **NPD Front/Back/Left/Right**
  - Unconnected
  - Bead Current Over or Under range
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Thermal safety: Not Heating or Auto Heating
  - Reset detected
  - High Voltage shorted

• **TCD Front/Back/Left/Right**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Thermal safety: Not Heating or Auto Heating
  - Reset detected

• **FPD Front/Back/Left/Right**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Thermal safety: Not Heating or Auto Heating

  - Reset detected
  - Opened Cell PT100
  - Shorted Cell PT100
- **PDD Front/Back/Left/Right**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Reset detected
- **GDI Front/Back/Left/Right**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Reset detected
- **SSL-SSLBKF Front/back**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100
  - Thermal safety: Not Heating or Auto Heating
  - Reset detected
  - Loss of Carrier
- **PTV-PTVBKF Front/Back**
  - Unconnected
  - Temperature over limit
  - Opened Temperature Sensor
  - Shorted Temperature Sensor
  - Thermal safety: Not Heating or Auto Heating
  - Reset detected
  - Loss of Carrier
- **AUX Temperature EXT-V Sub Ambient**

- Unconnected
- X-Line B over limit
- X-Line B Opened PT100
- X-Line B Shorted PT100
- X-Line A over limit
- X-Line A Opened PT100
- X-Line A Shorted PT100
- Thermal safety: Not Heating or Auto Heating

- **Valve Oven**
  - Unconnected
  - Heater B over limit
  - Heater B Opened PT100
  - Heater B Shorted PT100
  - Heater A over limit
  - Heater A Opened PT100
  - Heater A Shorted PT100
  - Thermal safety: Not Heating or Auto Heating Heater A or B
- **AUX Carrier Primary**
  - Unconnected
  - Channel 1 Loss of Carrier
  - Channel 2 Loss of Carrier
  - Channel 3 Loss of Carrier
- **AUX Carrier Secondary**
  - Unconnected
  - Channel 1 Loss of Carrier
  - Channel 2 Loss of Carrier
  - Channel 3 Loss of Carrier
- **Oven**
  - Unconnected
  - Temperature over limit
  - Opened PT100
  - Shorted PT100

- Thermal safety: Oven Auto Heating
- Hydrogen Sensor Alarm
- Hydrogen Sensor Fault
- Reset detected
- Thermal safety: Oven Not Heating
- Max Temperature reached

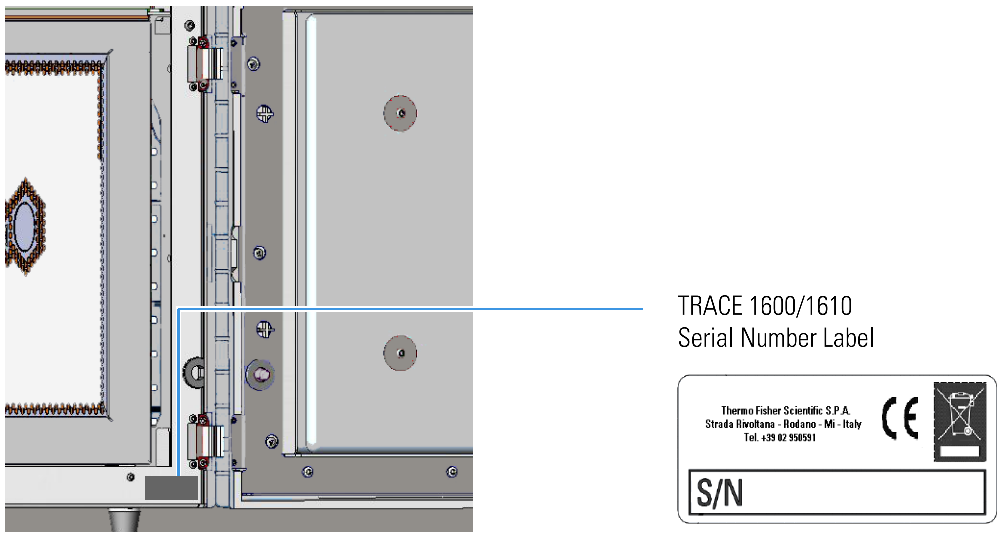
- **Main CPU**
  - Master Safety detected
  - Main I2C Bus fault
  - Detector I2C Bus fault
  - EMI RAM Memory fault
  - Main CPU Overheating
  - Manifold Temperature Overheating
  - 48Vac missing
  - +24Vcc missing
  - +15Vcc missing
  - -15Vcc missing
  - AC Mains out of range

Contacting Technical Support

If the information in this section does not help solve your problem, you should contact Technical Support. Be sure to reference the model, serial number, and power supply of your instrument when contacting them.

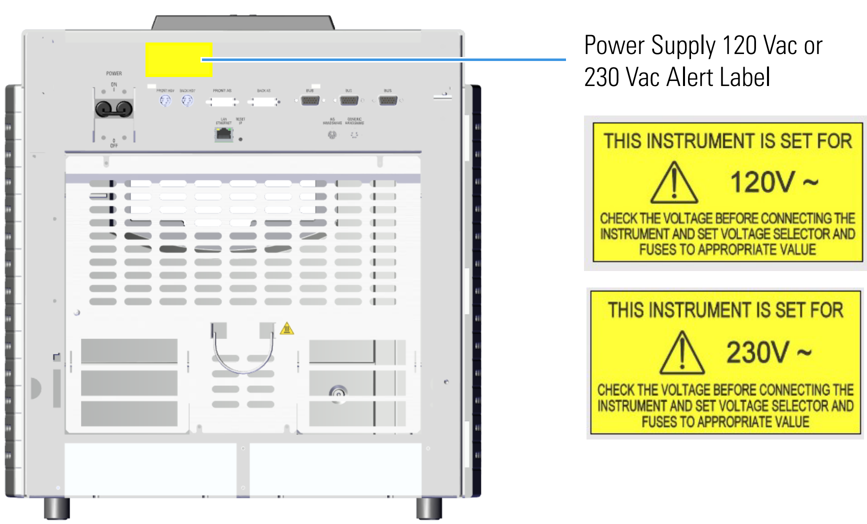
- **Serial Number** — You can find the serial number of the GC by opening the front door, and reading the serial number label on the right lower corner. See Figure 645.

Figure 645. Identify Your Instrument: Serial Number



- **Power supply your GC is set** — The 120 Vac or 230 Vac power supply is indicated on the yellow label on the electronic module. See Figure 646.

Figure 646. Identify Your Instrument: Power Supply Data



For contacting your local Thermo Fisher Scientific office or affiliate GC-GC/MS Customer Support, see the section “Contacting Us” on page xx.

G

Glossary

This section lists and defines terms used in this manual.
It also includes acronyms, metric prefixes, and symbols.

A B C D E F G H I J K L M N O P Q R S T V V W X Y Z

A

A ampere

ac alternating current

ADC analog-to-digital converter

AOI Analog Output Interface

B

b bit

B byte (8 b)

baud rate data transmission speed in events per second

C

C Carbon

°C Celsius

CDS Chromatography Data System

CIP Carriage and Insurance Paid To

cm centimeter

CPU central processing unit (of a computer)

<Ctrl> control key of the keyboard

D

d depth

DAC digital-to-analog converter

dc direct current

DS data system

E

ECD Electron Capture Detector

EMC electromagnetic compatibility

ESD electrostatic discharge

F

f femto

°F Fahrenheit

FID Flame Ionization Detector

FOB Free on board

FSE Field Service Engineer

FPD Flame Photometric Detector

ft foot

FT-IR fourier transform infrared spectroscopy/fourier transform infrared spectrometer

G

g gram

GC gas chromatography- gas chromatograph

GDI Generic Detector Interface

GND electrical ground

GSV Gas Sampling Valve

H

h height

h hour

H Hydrogen

harmonic distortion A high-frequency disturbance that appears as distortion of the fundamental sine wave

He Helium

HeS-S/SL Instant Connect Helium Saver Injector

HV high voltage

Hz hertz (cycles per second)

I

ID inside diameter

IEC International Electrotechnical Commission

Impulse See *transient*

in. inch

I/O input/output

K

k kilo (10^3 or 1024)

K Kelvin

kg kilogram

kPa kilopascal

L

l length

L liter

LAN Local Area Network

lb pound

LED light-emitting diode

M

m meter (or milli [10^{-3}])

M mega (10^6)

µ micro (10^{-6})

MBq megabecquerel

Ci millicurie

min minute

mL or ml milliliter

mm millimeter

MS mass spectrometry-mass spectrometer

m/z mass-to- charge ratio

N

n nano (10^{-9})

N Nitrogen

negative polarity The inverse of a detector signal polarity.

nm nanometer

NPD Nitrogen Phosphorous Detector

O

OD outside diameter

Ω ohm

P

p pico (10^{-12})

Pa pascal

PCB printed circuit board

PDD Pulsed Discharge Detector

PN part number

psi pounds per square inch

PTV Programmable Temperature Vaporizing Injector

PTVBKF Programmable Temperature Vaporizing Injector with backflush

R

RAM random access memory

<Return> <Return> key on the keyboard

RF radio frequency

ROM read-only memory

RS-232 industry standard for serial communication

S

s second

sag See *surge*

slow average A gradual long-term change in average RMS voltage level, with typical duration greater than 2 s.

SOP Standard Operating Procedures

SSL split/splitless injector

SSLBKF split/splitless injector with Backflush

source current The current needed to ignite a source, such as a detector lamp.

surge A sudden change in average RMS voltage level, with typical duration between 50 µs and 2 s.

T

TCD Thermal Conductivity Detector

transient A brief voltage surge of up to several thousand volts, with a duration of less than 50 µs.

V

V volt

Vac volts, alternating current

Vdc volts, direct current

VGA Video Graphics Array

W

w width

W Watt

When a unit of measure has a quotient (e.g. Celsius degrees per minute or grams per liter) this can be written as negative exponent instead of the denominator:

For example:
°C min^{-1} instead of °C/min
g L^{-1} instead of g/L