



thermo**scientific**

TSQ 9000

Mass Spectrometer

Preinstallation Requirements Guide

1R120618-0001 Revision A March 2018

ThermoFisher
S C I E N T I F I C

© 2018 Thermo Fisher Scientific Inc. All rights reserved.

TSQ, ISQ, TRACE, TriPlus, Chromeleon and TraceFinder are trademarks, and Xcalibur is a registered trademark of Thermo Fisher Scientific in the United States.

The following are registered trademarks in the United States and other countries: Microsoft, Windows, Office, Skydrive, and Excel are registered trademarks of Microsoft. Swagelok® is a registered trademark of Swagelok Company.

All other trademarks are the property of Thermo Fisher Scientific and its subsidiaries.

Thermo Fisher Scientific Inc. provides this document to its customers with a product purchase to use in the product operation. This document is copyright protected and any reproduction of the whole or any part of this document is strictly prohibited, except with the written authorization of Thermo Fisher Scientific Inc.

The contents of this document are subject to change without notice. All technical information in this document is for reference purposes only. System configurations and specifications in this document supersede all previous information received by the purchaser.

Thermo Fisher Scientific Inc. makes no representations that this document is complete, accurate or error-free and assumes no responsibility and will not be liable for any errors, omissions, damage or loss that might result from any use of this document, even if the information in the document is followed properly.

This document is not part of any sales contract between Thermo Fisher Scientific Inc. and a purchaser. This document shall in no way govern or modify any Terms and Conditions of Sale, which Terms and Conditions of Sale shall govern all conflicting information between the two documents.

Release history: Revision A, March 2018.

For Research Use Only. Not for use in diagnostic procedures.

TSQ 9000 Installation Request Form

Before completing this installation request form, read all of the *TSQ 9000 Preinstallation Requirements Guide*. For laboratories outside the U.S., go to www.thermofisher.com, click **Contact Us**, select the **Instrument Service** option, type the product name, and request to be contacted by email to schedule your instrument installation. You can then send this completed and signed form to the office handling the installation. For laboratories in the U.S., send this completed and signed form to ULSConciergeNA@thermofisher.com.

Laboratory setup

- | | |
|---|--|
| <ul style="list-style-type: none"><input type="checkbox"/> All laboratory remodeling is complete and complies with all relevant safety regulations.<input type="checkbox"/> The TSQ 9000 is on site.<input type="checkbox"/> A principal operator will be on site during the installation/certification period.<input type="checkbox"/> Doorways, hallways, and so on are a minimum width of 80 cm (32 in.).<input type="checkbox"/> Laboratory lighting is adequate.<input type="checkbox"/> Air conditioning is adequate for temperature, humidity, and particulate matter control. The laboratory must remain at a constant temperature between 15–35 °C (59–95 °F).<input type="checkbox"/> Relative humidity is 40–80%, noncondensing.<input type="checkbox"/> The work area is free from magnetic disruption and electrostatic discharge.<input type="checkbox"/> Floor space is sufficient and flooring will support the load.<input type="checkbox"/> Main power is installed and complies with local electrical codes.<input type="checkbox"/> Power is free from fluctuations due to slow changes in the average voltage or changes due to surges, sags, or transients.<input type="checkbox"/> Power outlets are of the correct configuration for the power cords.
Note NEMA type: _____<input type="checkbox"/> Voltage of power outlet has been measured.
Note measured voltage:
AC line-to-ground: _____ V
AC neutral-to-ground: _____ V
AC line-to-neutral: _____ V<input type="checkbox"/> Power outlets are available for testing and cleaning equipment. | <ul style="list-style-type: none"><input type="checkbox"/> All required gases are on site, gas lines are installed and terminate within 2 m (6 ft.) of the workbench. All gas line terminate to 1/8 in. compression-type fittings and appropriate gas regulators are available.
Note gas types and actual purity levels:
Gas: _____ purity: _____
Gas: _____ purity: _____<input type="checkbox"/> All gas lines are clean and have no leaks.<input type="checkbox"/> All relevant safety regulations have been followed.<input type="checkbox"/> Sufficient bench or table space is available for all of the equipment. Note the dimensions:
Width: _____
Depth: _____
Height: _____
Does the bench (table) have wheels? Yes__ No__<input type="checkbox"/> Sufficient clearance is provided behind the bench (or table).<input type="checkbox"/> The bench (or table) can support <i>twice</i> the load of the instrument and is free from vibration. |
|---|--|

IMPORTANT Thermo Fisher Scientific reserves the right to invoice for the field service engineer's time if the installation requirements are not met by the installation date.

CONTINUED ON THE NEXT PAGE

For customized installations

Does your contract contain any special acceptance specifications?

☐ Yes☐ No

If YES, attach full details of the specifications.

Does the system require additional equipment?

☐ Yes☐ No

If YES, attach full details of the additional equipment.

I certify that the preinstallation requirements for the TSQ 9000 are complete and accurate.

Signature _____ Date _____

Print name _____ Telephone _____

Email address _____

Principal instrument operator:

Print name _____ Telephone _____

Email address _____

Company _____ Telephone _____

Address _____

Address _____

City _____ State _____ Country _____

Sales order number _____

Note This form is intended to cover the essential components of your TSQ 9000 installation. However, you must use the information in this guide and any additional information that your Thermo Fisher Scientific field service engineer provides to ensure the proper setup of your system. After receiving this form, the installation can be scheduled.

Contents

Preface	xi
About Your System	xi
Related Documentation	xii
System Requirements	xiii
Safety and Special Notices	xiii
Special Notices	xiii
Safety Symbols and Signal Words	xiv
Hydrogen Safety Precautions	xv
Using Hydrogen with the TSQ 9000 system	xvii
Hydrogen Connection Guidelines	xvii
Purchasing Hydrogen	xix
Properly Storing Hydrogen	xix
Hydrogen Safety Codes, Standards and References	xxi
Hazardous Substances Precautions	xxii
Biological Hazard Warning Note	xxii
Venting Toxic Gases	xxiii
Contacting Us	xxiii
 Chapter 1	 Site Preparation
	1
Entrance Requirements	2
Workbench and Space Requirements	3
Lighting Requirements	5
Power Requirements	5
Environmental Requirements	9
Gas Equipment Requirements	11
GC Carrier Gas	11
CI Gas	12
Collision Gas	13
Other Gas Specifications	14
Using Hydrogen	15
Receiving Requirements	15
What Happens Next?	16

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,
- recalibration, and
- 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.

Regulatory Compliance

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in the next section or sections by product name.

Changes that you make to your system may void compliance with one or more of these EMC and safety standards. Changes to your system include replacing a part or adding components, options, or peripherals not specifically authorized and qualified by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

EMC Directive 89/336/EEC

EMC compliance has been evaluated by Professional Testing.

- ITQ and Ion Trap Series standards: EMC EN 61326-1:2006. Safety IEC 61010-1:2001, IEC 61010-2-081:2001
- Direct Probe Controller (DPC) standards: EMC EN 61326-1:2006. Safety IEC 61010-1:2001, IEC 61010-2-081:2001
- ISQ and ISQ 7000 standards: EMC EN 61326-1:2013. Safety IEC 61010-1:2010, IEC 61010-2-010:2014, IEC 61010-2-081:2015.



- TSQ 8000, TSQ 8000 Evo, TSQ Duo, and TSQ 9000 standards: EMC EN 61326-1:2013. Safety IEC 61010-1:2010, IEC 61010-2-010:2014, IEC 61010-2-081:2015.

Low Voltage Safety Compliance

This device complies with Low Voltage Directive 2006/95/EC and harmonized standard EN 61010-1:2001.

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 UNDESIRE 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 it.

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

Your instrument is designed to work in a controlled electromagnetic environment. Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.
For manufacturing location, see the label on the instrument.

WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See www.thermoscientific.com/rohsweee for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.

WEEE Konformität

Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet:



Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Mehr Information über die Einhaltung dieser Anweisungen durch Thermo Fisher Scientific, über die Verwerter, und weitere Hinweise, die nützlich sind, um die Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden sie unter www.thermoscientific.com/rohsweee.

Conformité DEEE

Ce produit doit être conforme à la directive européenne (2002/96/EC) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant:



Thermo Fisher Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l'union européenne et ce produit devrait être collecté ou recyclé par celles-ci. Davantage d'informations sur la conformité de Thermo Fisher Scientific à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Fisher Scientific qui peuvent aider la détection des substances sujettes à la directive RoHS sont disponibles sur www.thermoscientific.com/rohsweee.

Preface

This guide contains detailed information for preparing your site for installing a Thermo Scientific™ TSQ™ 9000 triple-quadrupole mass spectrometer.

Contents

- [About Your System](#)
- [Related Documentation](#)
- [System Requirements](#)
- [Safety and Special Notices](#)
- [Hydrogen Safety Precautions](#)
- [Hazardous Substances Precautions](#)
- [Contacting Us](#)

About Your System

Thermo Scientific systems provide the highest caliber gas chromatography/mass spectrometry (GC/MS) instrumentation available on today's market.

GC/MS represents a combination of two powerful analytical techniques: GC, which acts as a separation technique, and MS, which acts as a selective-detection technique. Complex mixtures of individual compounds can be injected into the GC, either manually or by an autosampler and then separated for presentation to the MS. The MS will generate a mass spectrum of the GC eluate and its components. The mass spectrum can then be used for qualitative identification as well as accurate and precise quantification of the individual compounds present in the sample.

A triple-quadrupole GC/MS/MS system provides the extra selectivity required for trace analysis of compounds in complex matrices.



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.

Related Documentation

The TSQ 9000 system includes Help and these manuals as PDF files:

- *TSQ 9000 Preinstallation Guide*, PN 1R120618-0001
- *TSQ 9000 User Guide*, PN 1R120618-0002
- *TSQ 9000 Hardware Manual*, PN 1R120618-0003
- *ISQ and TSQ GC-MS Spare Parts Guide*, PN 1R120617-0004
- *Direct Probe System User Guide*, PN 1R120505-0006

❖ To view product manuals

Go to the desktop and then **Manuals > TSQ 9000**.

❖ To open Help

- From the TSQ 9000 window, choose **Help > TSQ 9000 Help**.
- If available for a specific window or dialog box, click **Help** or press the F1 key for information about setting parameters.

For more information, visit www.thermofisher.com.

System Requirements

Your TSQ 9000 data system must meet these minimum requirements.

System	Requirements
Hardware	<ul style="list-style-type: none"> • 3.6 GHz dual-core processor enabled • 16 GB RAM with system managed memory enabled • DVD drive • Resolution display 1280 × 1024 (SXGA) • 20 GB available on drive C • NTFS format
Software	<ul style="list-style-type: none"> • Microsoft™ Windows™ 10 Operating System (64-bit) English only or Windows 7 Professional Operating System (64-bit) • Microsoft .NET Framework 4.0 or later • Thermo Scientific™ Xcalibur™ and Foundation software¹ • Thermo Scientific™ TraceFinder™ software² • Thermo Scientific™ Dionex™ Chromeleon software²
¹ Check release notes for compatibility with TSQ Series instrument control software.	
² Check release notes for compatibility with Thermo Foundation, Xcalibur, and TSQ Series instrument control software.	

Safety and Special Notices

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

Special Notices

Special notices include 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 Highlights information of general interest.

Tip Highlights 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. A **WARNING** is intended to prevent improper actions that *could* cause personal injury. A **CAUTION** is intended to prevent improper actions that *might* cause personal injury or instrument damage. You can find the following safety symbols on your instrument or in this guide.

	BIOHAZARD: Indicates that a biohazard <i>will, could, or might</i> occur.
	BURN HAZARD: Alerts you to the presence of a hot surface that <i>could</i> or <i>might</i> cause burn injuries.
	ELECTRICAL SHOCK HAZARD: Indicates that an electrical shock <i>could</i> or <i>might</i> occur.
	FIRE HAZARD: Indicates a risk of fire or flammability <i>could</i> or <i>might</i> occur.
	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 <i>could</i> or <i>might</i> cause physical injury.
	GLOVES REQUIRED: Indicates that you must wear gloves when performing a task or physical injury <i>could</i> or <i>might</i> occur.
	HAND AND CHEMICAL HAZARD: Indicates that chemical damage or physical injury <i>could</i> or <i>might</i> occur.
	INSTRUMENT DAMAGE: Indicates that damage to the instrument or component <i>might</i> occur. This damage might not be covered under the standard warranty.
	LIFTING HAZARD: Indicates that a physical injury <i>could</i> or <i>might</i> occur if two or more people do not lift an object.

	MATERIAL AND EYE HAZARD: Indicates that eye damage <i>could</i> or <i>might</i> occur.
	RADIOACTIVE HAZARD: Indicates that exposure to radioactive material <i>could</i> or <i>might</i> 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 <i>could</i> or <i>might</i> put you at risk for a physical injury.
	TOXIC SUBSTANCES HAZARD: Indicates that exposure to a toxic substance could occur and that exposure <i>could</i> or <i>might</i> cause personal injury or death.
	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 <i>could cause personal injury</i> .

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, this ranges from about 4% to 74.2% by volume.

Hydrogen has a flash point of - 423 °F (- 253 °C) and an auto-ignition temperature of 1,040 °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 FIRE 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, you should conduct a risk assessment based on the quantity of hydrogen to be used and the conditions of your laboratory. You should 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. You should also consider purging the hydrogen to further reduce hazards and ensure anyone who will be working with hydrogen has basic hydrogen safety training.
- As with laboratory safety in general, be sure to wear safety glasses, laboratory coats, gloves, etc. 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, insulated gloves and protective shoes should be worn in addition to eye protection.
- You should post “No Smoking” and “No Open Flames” signs to identify hydrogen sources and cylinders. Maintain, inspect and leak-test all hydrogen sources regularly.
- All hydrogen shutoff valves should be clearly marked and permanent hydrogen piping should be labeled as such at the supply or discharge point and at regular intervals along its length. Where hydrogen gas piping passes through a wall, the piping should be labeled on both sides of the wall.
- There should also be contingency plans in place should an incident occur.
- The site emergency response team, as well as the local fire department, should know the location of all hydrogen storage tanks.

Using Hydrogen with the TSQ 9000 system

To use hydrogen with the TSQ 9000 system, you must always shut off the GC carrier gas before venting or turning off the TSQ 9000 instrument. There are three hydrogen safety screws on the TSQ 9000 MS that **must** be in place. These are attached to your instrument at the factory.

Figure 1. Hydrogen Safety Screws on the TSQ 9000



Before powering on the TSQ 9000 system, ensure that:

- All the covers and panels of the TSQ 9000 system are firmly attached.
- The vent valve is tightly closed if you vented the system.
- All fittings, ferrules, and o-rings are sealed.

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 GC/MS.

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

To prevent the possibility of releasing hydrogen, the hydrogen generator should be set 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 oxygen exhausted by the electrolyzer should be vented to the outside as well.

- **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. However, compressed hydrogen gas cylinders, like all compressed gas cylinders, must be secured in an upright position, ideally with a non-combustible chain or cable. If the cylinder falls over, the valve can be knocked off and the pressurized cylinder can take off like a rocket, which leads 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 is 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 might 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), please read the hazard indications and information reported in the applicable Material Safety Data Sheet (MSDS). Use personal protective equipment according to the safety requirements.

Biological Hazard Warning Note



In laboratories where samples with potential biological hazards are handled, the user must label any equipment or parts which might become contaminated with biohazardous material.

The appropriate warning labels are included with the shipment of the instrument. It is the user's responsibility to label the relevant parts of the equipment.

When working with biohazardous materials, you are responsible for fulfilling the following mandatory requirements:

- Providing instructions on how to safely handle biohazardous material.
- Training operators to be aware of potential hazards.

- Providing personal protective equipment.
- Providing instructions for what to do if operators are exposed to aerosols or vapors during normal operation (within the intended use of the equipment) or in case of single fault situations such as a broken vial. The protective measures must consider potential contact with the skin, mouth, nose (respiratory organs), and eyes.
- Providing instructions for decontamination and safe disposal of relevant parts.



WARNING The user or operator is responsible for the safe handling of hazardous chemicals or biological compounds including (but not limited to) bacterial or viral samples and the associated waste, according to international and local regulations.

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 split and purge flow vents; therefore, be sure to vent the exhaust gases to a fume hood. Consult local environmental and safety regulations for instructions in exhausting fumes from your system.

Contacting Us

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

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

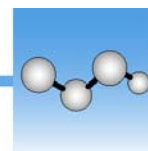
Go to www.thermofisher.com for information about our products.

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

Go to www.unitylabservices.com/en/home.html.

❖ **To suggest changes to documentation or to Help**

- Fill out a reader survey online at www.surveymonkey.com/s/PQM6P62.
- Send an e-mail message to the Technical Publications Editor at techpubs-austin@thermofisher.com.



Site Preparation

This chapter describes how to prepare your site before the Thermo Scientific Field Service Engineer arrives to install the product-name mass spectrometer.

Contents

- [Entrance Requirements](#)
- [Workbench and Space Requirements](#)
- [Lighting Requirements](#)
- [Power Requirements](#)
- [Environmental Requirements](#)
- [Gas Equipment Requirements](#)
- [Receiving Requirements](#)
- [What Happens Next?](#)

Entrance Requirements

Use the following guidelines to ensure the entrance to your site will allow for the delivery of your TSQ 9000 system:

1. Ensure the width of your delivery door opening is at least 81 cm (32 in.).
2. Make sure you have enough room to move boxes around corners, into elevators, or through doorways. The table below contains the dimensions and weight of shipping boxes, so that you can make accommodations.

Table 1. Shipping Box Dimensions and Weight

Box Contents	Length		Width		Height		Weight	
	cm	in.	cm	in.	cm	in.	kg	lbs.
TSQ 9000 MS*	107	43	71	28	112	45	138	304
TRACE 1300 or TRACE 1310 GC	60	24	80	31	80	31	64	140
AI/AS 1310 autosampler	36	14	51	20	36	14	10	22
TriPlus RSH (with standard X-axis)	65	26	100	39	32	13	45-55	99-121
TriPlus RSH (with extended X-axis)	65	26	136	54	32	13	60	132
TriPlus 100 Liquid Sampler	65	26	100	39	32	13	45-55	99-121
TriPlus 300 Headspace Autosampler (Box 1 of 2)	77	30	72	28	84	33	70	154
TriPlus 300 Headspace Autosampler (Box 2 of 2)	79	31	64	25	100	39	25	55

* The computer, keyboard, monitor, foreline pump, and TSQ 9000 Installation Kit are included in the box with the TSQ 9000.

Workbench and Space Requirements

Use the following guidelines to ensure you have enough space to set up the TSQ 9000 system. See [Figure 1](#) and [Figure 2](#) for system orientation.

1. Ensure you have adequate workbench space for the system. Refer to the table below for exact measurements of each component. Use the information in the table below to configure the workbench. Be sure to leave 46 cm (18 in.) of extra space to the left of the TSQ 9000 system for performing maintenance. You will also need space near the instrument for the monitor and keyboard.

Table 2. Workbench and Space Requirements

Instrument	Depth		Width		Height		Weight	
	cm	in.	cm	in.	cm	in.	kg	lbs
TSQ 9000 MS	89	35	40	16	45	18	61	135
Foreline Pump ¹	46	18	20	8	25	10	24	52
Computer ²	48	19	20	8	43	17	12	27
Monitor ²	16	7	46	18	32	13	4	8
Keyboard ²	23	9	46	18	5	2	1	2
TRACE 1300 GC	60	24	44	17	45	18	35 ³	77 ³
TRACE 1310 GC	67	26	44	17	45	18	35 ³	77 ³
AI 1310 Auto Injector ⁴	28	11	23	9	40	19	6	13
AS 1310 Autosampler ⁴	28	11	41	16	40	19	6	13
TriPlus RSH standard X axis autosampler	80	32	99	39	74	29	25	55
TriPlus RSH extended X-axis autosampler	80	32	135	53	74	29	27	60
TriPlus 300 Headspace autosampler	55	22	82	32	73	29	63	139
TriPlus 100 Liquid Sampler	50 ⁵	20 ⁵	85	34	54	21	15 ⁶	34 ⁶
Direct Probe Controller ⁷	58	23	33	13	12	5	6	13

¹ This item is placed on the floor under the system.

² Dimensions vary per manufacturer.

³ Add 0.8 kg (1.8 lbs) for each injector/detector module.

⁴ Mounts on top of the TRACE 1300/TRACE 1310.

⁵ About 20 cm (8 in.) of the orthogonal crossrail (Y-axis) protrudes from the rear of the GC.

⁶ Weight without accessories.

⁷ Mounts on top of the TSQ 9000.

2. Supply a 1-in. i.d. hose to the building exhaust air system, an oil mist filter, or other scrubbing device. The pump exhaust contains carrier gas, solvents, analytes, and a small

Site Preparation

Workbench and Space Requirements

amount of oil vapor. These materials may be flammable, poisonous, or corrosive. Do not allow the exhaust from the foreline pump, which includes your analytes, to accumulate to unsafe levels in your laboratory. Consult your local Environmental and Safety Regulations for information about how to properly exhaust fumes from your laboratory.

3. Make sure you have at least 91 cm (3 ft.) of clearance above the system. This space allows room for optional accessories (such as autosamplers) and proper heat dissipation.
4. Make sure your workbench can support a standard product-name system. Keep in mind, additional instruments add to the total weight.
5. Ensure that your work area is stable and free of vibration from nearby equipment. The product-name system is a sensitive instrument. For this reason, the foreline pump must be placed on the floor below the system.

Figure 1. TSQ 9000 MS and TRACE1300/TRACE 1310 GC bench setup

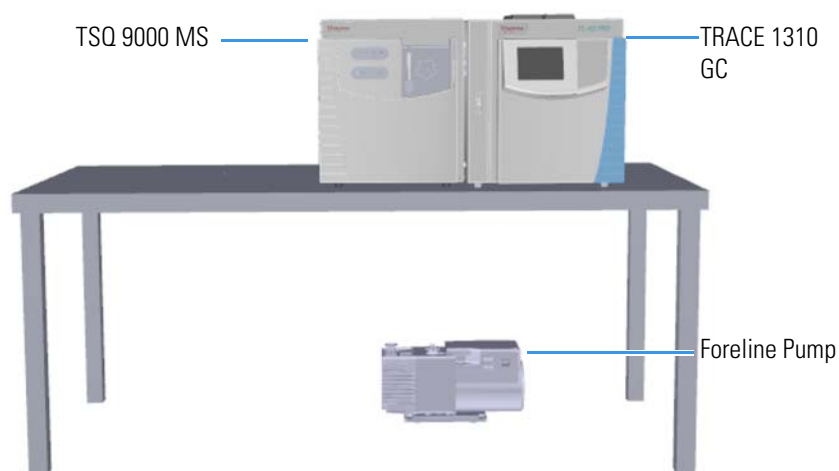
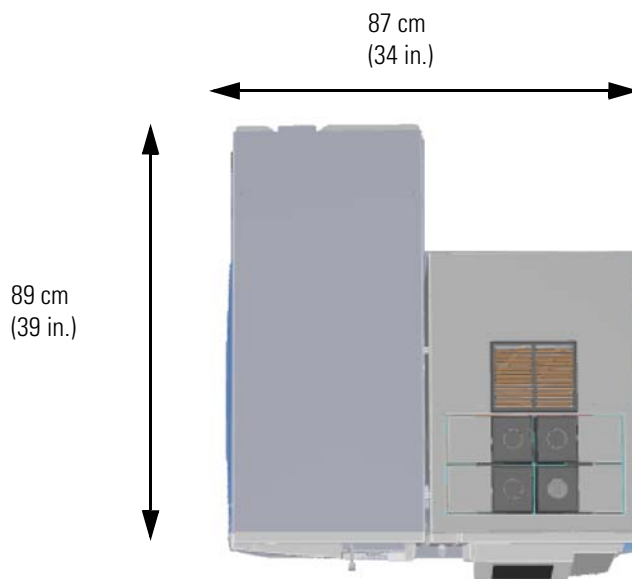


Figure 2. TSQ 9000 and TRACE 1300/TRACE 1310 system dimensions



Lighting Requirements

Use the following guidelines to ensure your site has the proper lighting:

1. Ensure that the work area is properly lit. You may need an overhead lamp to light your work area.
2. You may need a small, high-intensity lamp when you clean the TSQ 9000 or work inside the GC column oven.

Power Requirements

Use the following guidelines to ensure your site is equipped with enough power to support the system. All circuits should be 50/60 Hz \pm 2 Hz, single-phase with < 6% total harmonic distortion.

- **Circuit 1: TSQ 9000 MS plus the foreline pump and optional mech pump.** 100-240 Vac, 15 A_{MAX}. The foreline pump and mech pump must be set to the line voltage used at your location.
- **Circuit 2: GC.** 120 Vac +6/-10%, 16 A_{MAX} or 230 Vac \pm 10%, 10 A_{MAX}. Refer to your customer sales order to determine if the GC is 120 Vac or 230 Vac. The GC cannot be reconfigured in the field.

- **Additional Circuits:** Additional circuits are needed for the computer or other equipment. 120 Vac +6/-10% or 230 Vac \pm 10%.

Note Due to the power draw of the TSQ 9000 MS and GC, each instrument must be on its own dedicated circuit. These two circuits must be separate from the circuits used for the computer and other equipment such as the autosampler.

Table 3. System Power Requirements

Equipment	Circuits	Max Current (A) at 120 Vac (+ 6/- 10%)	Max Current (A) at 230 Vac (\pm 10%)	Maximum Power (W)
TSQ 9000 MS ¹	1	5.9	3.1	710
Foreline pump ²	N/A	4.6	2.7	550
Optional mech pump ^{2,3}	N/A	4.6	2.7	550
TRACE 1300 and TRACE 1310 ¹	2	16	10	2000
Computer ⁴	Additional (as needed)	5	2.6	600
Monitor ⁴	Additional (as needed)	2	1	240
AI/AS 1310 Sampling systems	Additional (as needed)	0.8	0.4	95
TriPlus RSH ⁵ Sampling system	Additional (as needed)	3.2	1.7	200 with one power module 400 with two power modules
TriPlus 100 Liquid Sampler	Additional (as needed)	–	–	200 with one power module 400 with two power modules
TriPlus 300 Headspace	Additional (as needed)	10.8	5.7	1300
Direct Probe Controller	Additional (as needed)	2	1	240

¹This instrument must be on its own circuit.

²Foreline pump and optional mech pump plug into the TSQ 9000 MS. At startup, the foreline pump and optional mech pump draw an additional 30.8 A at 120 Vac and an additional 17 A at 230 Vac.

³If using the foreline pump and optional mech pump at the same time, the peak power may reach up to 905 W for a brief period of time.

⁴Power requirements vary by manufacturer.

⁵If the using the temperature controlled drawer option, one additional circuit is needed.

1. The power quality supplied to your system is very important. It must be stable and within the minimum specifications listed in this section.

- Test the power source quality in your laboratory to offset line voltage problems. Improving power source quality is a complex task best handled by a company or consultant specializing in that field. Contact your regional Thermo Fisher Scientific Customer Service office for assistance in locating a power consultant. Having a poor quality power source degrades product-name system performance. Some examples of poor power source quality are:
 - Harmonic distortion causes noise in the power supply lines and degrades instrument performance. Harmonic distortion is a high-frequency disturbance that may affect operation of your product-name MS. This disturbance appears as distortion of the fundamental sine wave. Total harmonic distortion should be less than 6%. For more information, refer to the [EMC Directive 89/336/EEC](#). However, the power specifications for the TSQ 9000 system are more exact than those of the IEC.
 - Slow changes are gradual, long-term changes in average root mean square (RMS) voltage level, with typical durations greater than 2 s.
 - Sags and swells are slow changes in average root mean square (RMS) voltage level, with typical durations between 50 ms and 2 s.
 - Transients, even of a few microseconds duration cause electronic devices to fail or to degrade and significantly shorten their lives. Transients (or impulses) are brief voltage excursions of up to several thousand volts with durations less than 50 ms.
 - Voltage variations must not exceed 10% of the nominal value.
 - Transient overvoltages must not exceed those specified in category II of IEC 60364-4-443.
2. Use [Table 3](#) or to determine how many circuits and wall outlets you need. Keep in mind:
- Power must be single-phase.
 - Wall outlets must have earth-ground hard-wired to the main panel.
 - Included power cords are 2 m (6 ft) long .

Contact your local Customer Service office to discuss power cordset concerns.

3. The TSQ 9000 MS comes with the required number and type of power cords for your region. [Table 4](#) will help you identify the correct power cord for your region and instrument. If you need to replace your power cord or buy an additional cord, you may use any brand of power cord, as long as it is appropriate for your region.

Table 4. Power cord identification information by region. (Sheet 1 of 2)



























Region	C13 Power Cords (For PC, Monitors, and Autosamplers)	C19 Power Cords (For GC and MS)
North American 120V		
North American 250V		
Japanese 125V		
Switzerland 250V		
Australian 250V		
China 250V		
Europe-Schuko 250V		
United Kingdom 250V		

Table 4. Power cord identification information by region. (Sheet 2 of 2)

Region	C13 Power Cords (For PC, Monitors, and Autosamplers)	C19 Power Cords (For GC and MS)
Danish 250V		
Italian 250V		
Israeli 250V		
Indian 250V		
Argentina 250V		
Note The 250V region power cords will work with the 230V circuits.		

Environmental Requirements

The normal operating environment for the TSQ 9000 MS must have the following characteristics:

- Indoor use only
- Altitude up to 2000 meters
- Maximum relative humidity between 5% and 95% up to 31 °C. The maximum relative humidity decreases linearly to 67% as the temperature climbs to 35 °C.

Use the following guidelines to ensure your site has the proper environmental conditions for the system:

1. Ensure that your room temperature is 15–35 °C (59–95 °F). The analytical performance is only confirmed for these temperatures. For best performance, the operating temperature should be constant. Use [Table 5](#) to calculate the amount of heat your system will generate and ensure your air-conditioning system can handle that amount of heat.

IMPORTANT If you are not operating the TSQ 9000 MS, it is safe to leave the instrument powered on in a room with a temperature between 5 and 40 °C.

Table 5. Heat output of system components

Instrument	Heat Output (BTU per Hr)	Heat Output (W)
TSQ 9000, including foreline pump	4300	1260
TRACE 1300 and TRACE 1310	6830	2000
Computer ¹	2050	600
Monitor ¹	820	240
Optional mech pump	1880	550
AI/AS 1310 auto-injector/autosampler	325	95
TriPlus RSH autosampler	683 ² or 1366 ³	200 ² or 400 ³
TriPlus 100 Liquid Sampler	683 ² or 1366 ³	200 ² or 400 ³
TriPlus 300 Headspace autosampler	4440	1300
Direct Probe Controller	820	240
¹ Power requirements vary by manufacturer.		
² With one power module.		
³ With two power modules.		

2. Ensure that the relative humidity in your laboratory is between 5 and 95% with no condensation. A temperature and humidity monitor in your laboratory helps ensure that the climate is within these specifications.

3. Ensure that the air in your site is free of excess particulate matter.

For reference, the air should contain fewer than 100,000 particles (larger than 5 µm) per cubic meter. If the concentration is larger than this amount, dust can accumulate on electronic components. This accumulation reduces their ability to cool off properly and could cause them to overheat. If your environment is particularly dusty, we recommend that you purchase the optional dust filter for your system.

4. Ensure that your site is free of electrostatic discharge (ESD), which may damage the electronic components of your system. Ensure your static has been discharged before touching internal components of the instrument. ESD can damage sensitive components, resulting in premature failures.

Gas Equipment Requirements

Use the following guidelines to ensure you have the proper gas supplies ready in advance of installation:

GC Carrier Gas

- You will need a supply of ultra-high purity GC carrier gas. Typical cylinders are about 23 cm (9 in.) wide by 140 cm (55 in.) tall and output >15,000 kPa (>2200 psig). A single full-size tank will last about three months with a typical usage rate of 50 mL/min. If you have additional detectors or optional accessories, please refer to your GC or autosampler manuals for information about gas requirements.

Note Thermo Fisher Scientific installation specifications require helium as a carrier gas and argon as a collision gas. You must have one tank of each gas at installation, or the field service engineer will not be able to run specifications on your TSQ 9000 MS.

Table 6. Carrier Gas Specifications

Gas Type	Purity ¹	Outlet Pressure	Regulator	Connector ²
Helium	99.999%	400-700 kPa (58-100 psig)	Dual-stage brass regulator with stainless steel diaphragm	CGA-580
Hydrogen	99.999%	400-700 kPa (58-100 psig)	Dual-stage brass regulator with stainless steel diaphragm	CGA-350

¹ Ultra-high purity with less than 1.0 ppm each of water, oxygen, and total hydrocarbons and contained in one tank.
² Connectors will vary with cylinder size. Confirm that your regulator will work with your gas tank. All connections to the GC/MS are 1/8 in. Swagelok fittings.

Note Systems using the Advanced EI source must use helium carrier gas only.



WARNING FIRE HAZARD: When using hydrogen, be aware that it can flow into the oven and create a fire hazard. Turn off the supply until the GC column is in the inlet of the TSQ 9000 MS. Whenever you use hydrogen, it is critical to test all connections, lines, and valves for leaks before using the instrument. When performing maintenance, be sure to turn off the hydrogen supply.

- Oxygen and moisture cannot be prevented from entering the system during cylinder changes. To minimize the impact of these contaminants on the GC system, high purity gas handling equipment should be used. To further protect the system from oxygen and moisture, point-of-use purifiers should be installed in the carrier gas lines just prior to the GC to remove any residual contaminants.

CI Gas

Note Thermo Fisher Scientific installation specifications require methane as a CI gas. You must have one tank of methane at installation, or the field service engineer will not be able to run specifications on your TSQ 9000 MS.

- If your TSQ 9000 system is equipped with the Chemical Ionization (CI) Reagent Gas Flow module, make sure you have the proper gas for it. Typical flow rates are only 1-3 mL/min, so smaller tanks like lecture bottles can be used.

Table 7. CI Gas Specifications

Gas Type	Purity	Outlet Pressure	Regulator	Connector*
Methane	99.99% high-purity	35-240 kPa (5-35 psig)	Dual-stage brass regulator with stainless steel diaphragm	CGA-350
Isobutane	99.9% instrument grade	35-240 kPa (5-35 psig),	Dual-stage brass regulator with stainless steel diaphragm	CGA-510
Ammonia	99.99%, anhydrous grade	35-240 kPa, (5-35 psig)	Consult your gas supplier for specific regulator requirements.	CGA-240

* Connectors will vary with cylinder size. Confirm that your regulator will work with your gas tank. All connections to the GC/MS are 1/8 in. Swagelok fittings.



WARNING FIRE HAZARD: Some CI gases, such as methane and isobutane, are flammable. Make sure these gases are properly exhausted and all gas fittings on the system are leak-free. Consult your local Environmental and Safety Regulations for information about how to properly exhaust fumes from your laboratory.



WARNING TOXIC SUBSTANCES HAZARD: Some CI gases, such as ammonia, are toxic. Make sure these gases are properly exhausted and all gas fittings on the system are leak-free. Consult your local Environmental and Safety Regulations for information about how to properly exhaust fumes from your laboratory.



CAUTION INSTRUMENT DAMAGE: Do not exceed 240 kPa (35 psig) or you could damage the CI reagent gas flow module.

Collision Gas

- You may use argon or nitrogen as collision gases for the TSQ 9000 MS. Typical cylinders are about 23 cm (9 in.) in diameter by 140 cm (55 in.) tall and output >15,000 kPa (>2200 psig). A cylinder should last about three years at a constant purge flow rate of 5.0 atm-mL/min. [Table 8](#) provides the various collision gas specifications.

Table 8. Collision Gas Specifications

Gas Type	Purity	Input Pressure	Regulator	Connector*
Argon	99.999%	407-421 kPa (59-61 psig)	Dual-stage brass regulator with stainless steel diaphragm	CGA-580
Nitrogen	99.999%	386-400 kPa (56-58 psig)	Dual-stage brass regulator with stainless steel diaphragm	CGA-580

* Connectors will vary with cylinder size. Confirm that your regulator will work with your gas tank. All connections to the GC/MS are 1/8 in. Swagelok fittings.



CAUTION Collision gas input pressure must remain constant for proper instrument performance. The regulator you use to supply the collision gas must be able to deliver 60 ± 1 psig for argon or 57 ± 1 psig for nitrogen. It should be marked clearly at 60 or 57 psig and be stable enough to supply constant pressure at 60 ± 1 psig for argon or 57 ± 1 psig for nitrogen.



CAUTION If your TRACE 1300/TRACE 1310 and PTV injector will be equipped with a cryogenic cooling option, see the *TRACE 1300 and TRACE 1310 Preinstallation Requirements Guide* for more information.

Other Gas Specifications

- If your TSQ 9000 system will be equipped with a Direct Insertion Probe, make sure you have compressed air, which is used to cool the probe.
- If you have a Thermo Scientific™ TriPlus™ RSH autosampler with the SPME conditioning station or a Thermo Scientific Headspace autosampler, you need to obtain a low-pressure, single-stage regulator (0-30 psi) for nitrogen purging.

Table 9. Other Gas Specifications

Equipment	Gas Type	Purity	Maximum Pressure	Regulator	Connector
Direct Insertion Probe	Air	90% ¹	700 kPa (100 psig)	Dual-stage brass regulator	CGA-346
TriPlus SPME Headspace	Nitrogen	99.999%	200 kPa (30 psi)	Dual-stage brass regulator with stainless steel diaphragm	CGA-580

¹ Pure, particle and oil free, and contained in one tank.

² Connectors will vary with cylinder size. Confirm that your regulator will work with your gas tank. All connections to the GC/MS are 1/8 in. Swagelok fittings.

- Gas lines should be:
 - As short as possible and close to the TSQ 9000 system.
 - Made of copper or stainless steel when using helium, hydrogen, methane or isobutane.
 - Made of stainless steel when using ammonia or other corrosive gases.
 - Free of oil and moisture.
- Obtain the proper gas line filters, which help prevent impurities and contaminants from entering your system. Water, oxygen, and total hydrocarbons should be less than 1 ppm to avoid high background noise and prevent contamination. The GC is equipped with two intake filters that trap moisture, oxygen, and hydrocarbons.
- Store gas tanks and bottles properly so they will not damage cables or gas lines. Ensure they are secured in accordance with standard safety practices.

Using Hydrogen

To safely use hydrogen in your TSQ 9000 system, you should have a hydrogen sensor installed in your GC. Field Service Engineers can install a sensor, but they are not authorized to install or repair any instrument using hydrogen as a carrier gas unless the instrument is equipped with the appropriate sensor. The sensor must be calibrated occasionally, as described in the sensor's documentation.

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.
- Ensure your GC has a Thermo Fisher Scientific hydrogen sensor installed. A hydrogen sensor continuously monitors the hydrogen level in the oven.
- Always turn off the GC and shut off the hydrogen at its source before venting the TSQ 9000 MS.
- If you use a hydrogen pump, ensure it has a palladium drier.
- Remove as many sources of ignition as possible from your laboratory. Sources can include open flames, electrostatic discharges, or devices that spark.
- Do not open a cylinder of hydrogen without a regulator attached because it may self-ignite.

Receiving Requirements

When you receive the TSQ 9000 system:

1. Inspect the boxes for damage when the instrument arrives. Our instruments are shipped by electronic equipment carriers who specialize in the handling of delicate equipment. Occasionally, however, equipment is inadvertently damaged in transit. If you notice evidence of external damage, do not refuse shipment. Instead, call Customer Service.
2. Once you are finished inspecting your shipment, move the cartons to a protected location, preferably the installation site.

IMPORTANT Leave the boxes complete and do not unpack or open the boxes. Doing otherwise may void your warranty or order.

3. Complete the Installation Request Form located at the front of this guide and forward it to Customer Support.

What Happens Next?

Fill out and follow the instructions on the [TSQ 9000 Installation Request Form](#). After the installation request form is received, Customer Support will contact you to schedule the installation of your system. It is important to confirm that all the requirements on the form are met BEFORE the Field Service Engineer arrives.

The Field Service Engineer will install the system and confirm that all performance tests pass.