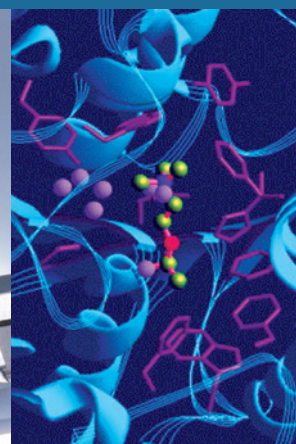
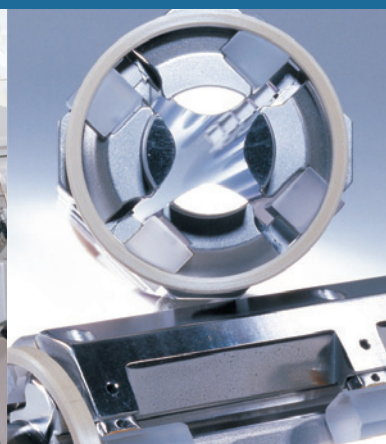


Thermo Fisher Scientific

# **LTO Orbitrap™ Series** Preinstallation Requirements Guide

Revision D - 1225821



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Release History: Revision A released in June 2009.  
Revision B released in December 2009.  
Revision C released in June 2011.  
Revision D released in January 2012.

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

# LTQ Orbitrap Series Installation Request Form

Please refer to the LTQ Orbitrap Series Preinstallation Requirements Guide (P/N 1225821, Revision D) for the complete site requirements. Circle "Yes" or "No" as to whether the site meets the requirements as specified in the Preinstallation Guide. Provide the additional information where requested.

- 1: **Yes** **No** All laboratory remodeling has been completed and the space available is sufficient to meet the minimum requirements for the configuration ordered. See "Space and Load Requirements" on page 2-8.
  - The floor is certified to meet the load requirements of an LTQ Orbitrap Series system with API source (682 kg [1500 lb])?
  - For an LTQ Orbitrap Series system with option, the floor is certified to meet the additional load requirements: MALDI source (+50 kg [+110 lb]), ETD system (+125 kg [+276 lb])?
- 2: **Yes** **No** Your LTQ Orbitrap Series instrument has been delivered and is either in the laboratory or can be delivered immediately on the arrival of the installation engineer?
- 3: **Yes** **No** Doorways, hallways, and so on have sufficient room for maneuvering the instrument. See "Entrance and Movement" on page 2-2.
  - For an LTQ Orbitrap Series system with API source, the entrance to the laboratory and the route from the loading dock are at least 89 cm (35 in) wide with additional space at corners?
  - For an LTQ Orbitrap Series system with MALDI source, the entrance to the laboratory and the route from the loading dock are at least 110 cm (43 in) wide with additional space at corners?
- 4: **Yes** **No** Storage and bench space are sufficient, lighting is adequate?
- 5: **Yes** **No** Floor vibrations and electromagnetic interferences are below the specified levels? See "Vibration" on page 3-3.
- 6: **Yes** **No** Main power is installed and in compliance with local electrical codes?
- 7: **Yes** **No** The power outlets are of the correct configuration? See "Available Outlets" on page 4-2.
- 8: **Yes** **No** The electrical power has been measured?  
Please note voltages: \_\_\_\_\_ Volts AC phase 1 to ground at output of transformer.  
Please note voltages: \_\_\_\_\_ Volts AC phase 2 to ground at output of transformer.  
Please note voltages: \_\_\_\_\_ Volts AC phase 3 to ground at output of transformer.  
Please note voltages: \_\_\_\_\_ Volts AC neutral 1 to ground at output of transformer.
- 9: **Yes** **No** Power is free from fluctuations due to slow changes in the average voltage or changes due to surges, sags, or transients?
- 10: **Yes** **No** Air conditioning is adequate for temperature, humidity, and particulate matter control. The laboratory can be maintained at a constant temperature, between 15 and 27 °C (59 and 81 °F)? See "Temperature" on page 3-2.
- 11: **Yes** **No** The key operator will be available during the installation period. See "Key Operator" on page 8-6. The person with the authority to accept the instrument at the end of the installation will also be available to sign the required acceptance document?  
Please provide the names of these individuals: \_\_\_\_\_
- 12: **Yes** **No** The relative humidity is between 50% and 80%, with no condensation? See "Humidity" on page 3-3.
- 13: **Yes** **No** The system work area is free from magnetic disruption and electrostatic discharge? See "Electrostatic Discharge" on page 3-5.
- 14: **Yes** **No** All gases required are on site, gas lines are installed, and appropriate gas regulators are available? See "Gases" on page 5-3.  
List gases and purity: \_\_\_\_\_
- 15: **Yes** **No** Is there a suitable exhaust system? See "Exhaust System" on page 6-2.
- 16: **Yes** **No** There is a functional telephone close to the system? Phone number \_\_\_\_\_
- 17: **Yes** **No** All relevant local safety regulations have been met and the equipment installed will not affect compliance?
- 18: **Yes** **No** All required chemicals and equipment for installing the system are on site.
  - For an LTQ Orbitrap Series system with API source, all material listed in "Chemicals Needed for Installation" on page 8-2 is available?
  - For an LTQ Orbitrap Series instrument with MALDI source, all material listed in "Chemical Kits, Equipment, and Consumables for the MALDI Source" on page 8-2 is available? The MALDI Preinstallation material checklist is fulfilled?
  - For an LTQ Orbitrap Series instrument with ETD system, all material listed in "ETD Kits" on page 8-4 is available?
- 19: **Yes** **No** Have any special acceptance specifications been agreed within the contract?  
If YES, please attach full details of specification.
- 20: **Yes** **No** Is there any additional equipment that needs to be interfaced for the system?  
If YES, please supply details.

I, the undersigned, confirm that the site requirements as stated above have been accomplished and the laboratory is prepared for the installation of the Thermo Scientific LTQ Orbitrap Series instrument. I understand that I may be liable for a Field Service Representatives' travel or lodging expenses if they are unable to carry out the installation on the pre-scheduled date due to insufficient lab preparation. If circumstances warrants, Thermo Fisher Scientific will make every effort to reschedule an installation as soon as possible with the next available representative.

Signed: \_\_\_\_\_ Print Name: \_\_\_\_\_  
Company name: \_\_\_\_\_ Email: \_\_\_\_\_  
Date: \_\_\_\_\_ Phone: \_\_\_\_\_

Fax to: \_\_\_\_\_ Attn: Local Service Engineer

**Note** After we receive this checklist, your local Field Service Representative will contact you to schedule installation. ▲



# Offices for Thermo Scientific Products

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Fax.....+1 877-373-4006  
E-mail ...us.customer-support.analyze@thermofisher.com

## Canada

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# Offices for Thermo Scientific Products - Continued

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Fax.....+44 1442 233 667  
E-mail ...analyze.uk@thermofisher.com

### Other Europe, Middle East, and Africa

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Phone ....+43 1 333 50 34 0  
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E-mail ...analyze.at@thermofisher.com

## Australia and Asia

### Australia

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Unit 14, 38 - 46 South Street  
Rydalmere, N.S.W. 2116  
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Fax ..... +61 2 8844 9599  
E-mail ...analyze.au@thermofisher.com

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Fax ..... +81 45 453 9235  
E-mail ...analyze.jp@thermofisher.com

### Japan

6F, Ryokuchi-eki Building  
2-4-1 Terauchi, Toyonaka City  
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Fax ..... +81 6 6863-1096  
E-mail ...analyze.jp@thermofisher.com

### P.R. China

Rm. 702-715, 7F Tower West, Younghe Plaza  
No. 28, Andingmen East Street  
Beijing 100007  
Phone.... 800 810 5118, 400 650 5118 (Free lines)  
Fax ..... +86 10 88370548  
E-mail ...analyze.cn@thermofisher.com

### P.R. China

Building 6  
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Shanghai 201206m  
Phone.... 800 810 5118, 400 650 5118 (Free lines)  
Fax ..... +86 21 64457830  
E-mail ...analyze.cn@thermofisher.com

# EG-Konformitätserklärung gemäß ISO/IEC 17050-1:2004

EC Declaration of conformity according to ISO/IEC 17050-1:2004

**Name des Herstellers:** Thermo Fisher Scientific  
manufacturers name

**Adresse des Herstellers:** Hanna-Kunath-Strasse 11  
manufacturers address 28199 Bremen  
Germany

## Der Hersteller erklärt, dass das Produkt

The manufacturer declares that the following product

**Name des Produkts:** Mass Spectrometer  
product name

**Modell:** LTQ ORBITRAP XL  
model number

**Produktoptionen:** inkl. / incl. ETD  
product options

## mit den folgenden EG Richtlinien und harmonisierten Standards übereinstimmt:

is in conformity with the following EC Directives and harmonized standards

|                       |                        |                         |
|-----------------------|------------------------|-------------------------|
| <b>EMV-Richtlinie</b> | EN 55011 (11.2007)     | EN 61000-4-5 (06.2007)  |
| <b>EMC Directive</b>  | EN 61000-3-2 (10.2006) | EN 61000-4-6 (04.2008)  |
| <b>2004/108/EG</b>    | EN 61000-3-3 (06.2006) | EN 61000-4-11 (02.2005) |
|                       | EN 61000-4-2 (12.2001) | EN 61326-1 (10.2006)    |
|                       | EN 61000-4-3 (12.2006) | + Corr. (06.2008)       |
|                       | EN 61000-4-4 (05.2005) |                         |

**Niederspannungsrichtlinie** EN 61010-1 (08.2002)  
**Low Voltage Directive**  
**2006/95/EG**

**Ergänzende Informationen:** -  
Complementary information

Bremen, Germany, 16. September 2008

**ThermoFisher**  
SCIENTIFIC



Jörg Behrens  
Technischer Leiter  
Director of operations



## Declaration of conformity according to ISO/IEC 17050-1:2004

Übereinstimmungserklärung gemäß ISO/IEC 17050-1:2004

Dichiarazione di conformità alla ISO/IEC 17050-1:2004

**Manufacturers name**

Name des Herstellers:

nome produttore

Thermo Fisher Scientific

**Manufacturers address**

Adresse des Herstellers:

indirizzo produttore

355 River Oaks Parkway

San Jose, CA 95134

U.S.A.

**declares that the following product**

erklärt, dass das Produkt

dichiara che il seguente prodotto

### LTQ Orbitrap XL

**complies with the following product specifications**

mit den folgenden Produktspezifikationen übereinstimmt:

rispetta le seguenti specifiche del prodotto

**EMC (emissions)**

EMV (Störemissionen):

EMC (emissioni)

EN 61000-6-3 Störemission (08.02)

EN 55022, Kl.B (09.03), EN 61000-3-2 (10.98),

EN 61000-3-3 (10.98)

**EMC (immunity)**

EMV (Störfestigkeit):

EMC (immunità)

EN 61000-6-2 Störfestigkeit (08.02),

EN 61000-4-2 (12.01), -3 (03.03), -4 (07.02), -5 (12.01), -6 (12.01),

-11 (12.01), EN 50204 (02.96)

**electrical safety**

Elektrische Sicherheit:

sicurezza elettrica

EN 61010-1

**complementary information**

Ergänzende Informationen:

informazioni complementari

This product complies with EMC directive 89/336/EEC and Low Voltage Directive 73/23/EEC.

Dieses Produkt erfüllt die EMV-Richtlinie 89/336/EWG und Niederspannungsrichtlinie 73/23/EWG.

Questo prodotto rispetta la direttiva 89/336/EEC e la direttiva 73/23/EEC.

San Jose CA, USA, 8/15/2008

**Director of Operations:**

Technischer Leiter

Direttore fabbricazione

**ThermoFisher**  
S C I E N T I F I C



( Bret Johnson )



**EG-Konformitätserklärung gemäß ISO/IEC 17050-1:2004**  
**EC Declaration of conformity according to ISO/IEC 17050-1:2004**

**Name des Herstellers:** Thermo Fisher Scientific  
manufacturers name

**Adresse des Herstellers:** Hanna-Kunath-Strasse 11  
manufacturers address 28199 Bremen  
Germany

**Der Hersteller erklärt, dass das Produkt**  
The manufacturer declares that the following product

**Name des Produkts:** Mass Spectrometer  
product name

**Modell:** ORBITRAP VELOS PRO  
model number

**Produktoptionen:** inkl. / incl. ETD  
product options

**mit den folgenden EG Richtlinien und harmonisierten Standards übereinstimmt:**  
is in conformity with the following EC Directives and harmonized standards

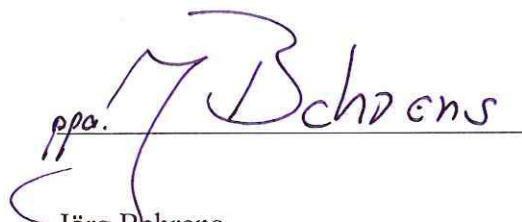
|                       |                        |                         |
|-----------------------|------------------------|-------------------------|
| <b>EMV-Richtlinie</b> | EN 55011 (11.2007)     | EN 61000-4-5 (06.2007)  |
| <b>EMC Directive</b>  | EN 61000-3-2 (10.2006) | EN 61000-4-6 (04.2008)  |
| <b>2004/108/EG</b>    | EN 61000-3-3 (06.2006) | EN 61000-4-11 (02.2005) |
|                       | EN 61000-4-2 (12.2001) | EN 61326-1 (10.2006)    |
|                       | EN 61000-4-3 (12.2006) | + Corr. (06.2008)       |
|                       | EN 61000-4-4 (05.2005) |                         |

**Niederspannungsrichtlinie** EN 61010-1 (08.2002)  
**Low Voltage Directive**  
**2006/95/EG**

**Ergänzende Informationen:** -  
Complementary information

Bremen, Germany, 6. Juni 2011

**ThermoFisher**  
**SCIENTIFIC**

  
Jörg Behrens  
Technischer Leiter  
Director of operations

**EG-Konformitätserklärung gemäß ISO/IEC 17050-1:2004**  
**EC Declaration of conformity according to ISO/IEC 17050-1:2004**

**Name des Herstellers:** Thermo Fisher Scientific  
manufacturers name

**Adresse des Herstellers:** Hanna-Kunath-Strasse 11  
manufacturers address 28199 Bremen  
Germany

**Der Hersteller erklärt, dass das Produkt**  
The manufacturer declares that the following product

**Name des Produkts:** Mass Spectrometer  
product name

**Modell:** ORBITRAP ELITE  
model number

**Produktoptionen:** inkl. / incl. ETD  
product options

**mit den folgenden EG Richtlinien und harmonisierten Standards übereinstimmt:**  
is in conformity with the following EC Directives and harmonized standards


|   |                        |                         |
|---|------------------------|-------------------------|
| <b>EMV-Richtlinie</b><br>EMC Directive<br>2004/108/EG | EN 55011 (11.2007)     | EN 61000-4-5 (06.2007)  |
|   | EN 61000-3-2 (10.2006) | EN 61000-4-6 (04.2008)  |
|   | EN 61000-3-3 (06.2006) | EN 61000-4-11 (02.2005) |
|   | EN 61000-4-2 (12.2001) | EN 61326-1 (10.2006)    |
|   | EN 61000-4-3 (12.2006) | + Corr. (06.2008)       |
|   | EN 61000-4-4 (05.2005) |                         |

**Niederspannungsrichtlinie** EN 61010-1 (08.2002)  
Low Voltage Directive  
2006/95/EG

**Ergänzende Informationen:** -  
Complementary information

Bremen, Germany, 6. Juni 2011

**ThermoFisher**  
S C I E N T I F I C

ppa.   
Jörg Behrens  
Technischer Leiter  
Director of operations

## 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.

### LTQ XL/ETD System (January 2007)

#### EMC Directives 89/336/EEC

EMC compliance has been evaluated by TUV Rheinland of North America, Inc.

|   |                                      |
|---|--------------------------------------|
| EN 61000-3-2: 1995, A1: 1998, A2: 1998, A14: 2000 | EN 61000-4-4:1995, A1: 2000, A2:2001 |
| EN 61000-3-3: 1995, A1:2001                       | EN 61000-4-5: 1995, A1: 2001         |
| EN 61326-1: 1997, A1:1998, A2:2001, A3:2003       | EN 61000-4-6: 2003                   |
| EN 61000-4-2: 2001                                | EN 61000-4-11: 1994, A1: 2001        |
| EN 61000-4-3: 2002                                | CISPR 11: 1999, A1: 1999, A2: 2002   |
| FCC Class A, CFR 47 Part 15: 2005                 |                                      |

#### Low Voltage Safety Compliance

This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.

### Velos Pro/ETD System (April 2011)

#### EMC Directive 2004/108/EEC

EMC compliance has been evaluated by TUV Rheinland of North America, Inc.

|   |                     |
|---|---------------------|
| EN 61326-1: 2006                              | EN 61000-4-3: 2006  |
| EN 55011: 2007, A2: 2007                      | EN 61000-4-4: 2004  |
| CFR 47, FCC Part 15, Subpart B, Class A: 2009 | EN 61000-4-5: 2005  |
| EN 61000-3-2: 2006                            | EN 61000-4-6: 2007  |
| EN 61000-3-3: 1995, A1: 2001, A2: 2005        | EN 61000-4-11: 2004 |
| EN 61000-4-2: 1995, A1: 1999, A2: 2001        |                     |

#### Low Voltage Safety Compliance

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

## FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 18 OF THE FCC RULES.

## 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/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).

## 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 getroffen mit Verwertungs-/Entsorgungsanlagen in allen EU-Mitgliederstaaten und dieses Produkt muss durch diese Firmen wiederverwertet oder entsorgt werden. Mehr Informationen über die Einhaltung dieser Anweisungen durch Thermo Fisher Scientific, die Verwerter und Hinweise die Ihnen nützlich sein können, die Thermo Fisher Scientific Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden Sie unter [www.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).

## 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.thermo.com/WEEERoHS](http://www.thermo.com/WEEERoHS).



# Read This First

Welcome to the Thermo Scientific LTQ Orbitrap™ Series system! LTQ Orbitrap Series instruments are members of the family of LTQ™ mass spectrometer (MS) detectors.

The LTQ Orbitrap Series includes the following Thermo Scientific mass spectrometers:

- The LTQ Orbitrap XL™, a hybrid mass spectrometer comprising a 2D linear ion trap mass spectrometer and an Orbitrap analyzer.
- The LTQ Orbitrap XL ETD™ system where the ETD Module is physically coupled to the back of the LTQ Orbitrap XL.
- The Orbitrap Velos Pro, a hybrid mass spectrometer comprising a dual cell linear ion trap and an Orbitrap analyzer.
- The Orbitrap Velos Pro ETD system where the ETD Module is physically coupled to the back of the Orbitrap Velos Pro.
- The Orbitrap Elite, a hybrid mass spectrometer comprising a dual cell linear ion trap and an Orbitrap analyzer with new geometry and improved signal processing.
- The Orbitrap Elite ETD system where the ETD Module is physically coupled to the back of the Orbitrap Elite.
- MALDI LTQ Orbitrap Series systems with the MALDI sample and control modules connected to an LTQ Orbitrap Series instrument. The optional API kit provides the hardware for LC MS applications with ESI, APCI, and so forth.



## About This Guide

This *LTQ Orbitrap Series Preinstallation Requirements Guide* provides information to assist in planning and preparing your lab site for the system prior to delivery and installation. Read each section carefully to be sure that your laboratory is ready for the installation of your system.

## Who Uses This Guide

This *LTQ Orbitrap Series Preinstallation Requirements Guide* is intended primarily for those who are responsible for the site planning of a laboratory in preparation for the installation of a new LTQ Orbitrap Series instrument. This guide should be retained for future guidance if your instrument needs to be relocated in future.

## Scope of This Guide

The *LTQ Orbitrap Series Preinstallation Requirements Guide* includes the following chapters:

- [Chapter 1: “Introduction”](#) describes the purchaser’s responsibilities for installation and maintenance of the system.
- [Chapter 2: “Site Preparation”](#) gives details on the physical, electrical, gas, and air conditioning requirements and other laboratory requirements for mass spectrometer and data system.
- [Chapter 3: “Operating Environment”](#) provides additional information about how to prepare your laboratory to provide optimum conditions for instrument operation.
- [Chapter 4: “Line Power”](#) gives details on the electrical outlets, power conditioning devices and power supplies required to properly install your system.
- [Chapter 5: “Consumables”](#) provides information on the gases and other consumables required to install and operate your system.
- [Chapter 6: “Exhaust and Waste”](#) describes how to properly ventilate the laboratory for safe operation of the instrument.
- [Chapter 7: “Instrument Arrival”](#) provides information on insurance claims and on domestic and international shipments.
- [Chapter 8: “Installation”](#) provides details on the final preparations necessary before the arrival of the Thermo Fisher Scientific field service engineer for installation of the system.

## Related Documentation

In addition to this guide, Thermo Fisher Scientific provides the following documents for LTQ Orbitrap Series instruments:

- *LTQ Orbitrap XL Hardware Manual, LTQ Orbitrap XL ETD Hardware Manual, Orbitrap Velos Pro Hardware Manual, or Orbitrap Elite Hardware Manual*
- *LTQ Orbitrap XL Getting Started, Orbitrap Velos Pro Getting Started, or Orbitrap Elite Getting Started*
- LTQ XL manual set or Velos Pro manual set

You can access PDF files of the documents listed above and of this guide from the data system computer. The software also provides Help.

### ❖ To view product manuals

1. From the Microsoft™ Windows™ taskbar, choose **Start > Programs > Thermo Instruments > LTQ > Manuals > *model***.
2. Click the PDF file that you want to view.

## Contacting Us

There are several ways to contact Thermo Fisher Scientific.

### Assistance

For technical support and ordering information, **visit us on the Web:**

[www.thermoscientific.com/ms](http://www.thermoscientific.com/ms)

Service contact details are available under:

[www.unitylabservice.com](http://www.unitylabservice.com)

### Customer Information Service

[cis.thermo-bremen.com](http://cis.thermo-bremen.com) is the Customer Information Service site aimed at providing instant access to

- Latest software updates
- Manuals, application reports, and brochures

Thermo Fisher Scientific recommends that you register with the site as early as possible. To register, visit [register.thermo-bremen.com/form/cis](http://register.thermo-bremen.com/form/cis) and fill in the registration form. Once your registration has been finalized, you will receive confirmation by e-mail.

### Changes to the Manual

#### ❖ To suggest changes to this manual

- Please send your comments to:  
  
Editors, Technical Documentation  
Thermo Fisher Scientific (Bremen) GmbH  
Hanna-Kunath-Str. 11  
  
28199 Bremen  
  
Germany
- Send an e-mail message to the Technical Editor at  
  
[documentation.bremen@thermofisher.com](mailto:documentation.bremen@thermofisher.com)

You are encouraged to report errors or omissions in the text or index. Thank you.

# Typographical Conventions

This section describes typographical conventions that have been established for Thermo Fisher Scientific manuals.

## Data Input

Throughout this manual, the following conventions indicate data input and output via the computer:

- Messages displayed on the screen are represented by capitalizing the initial letter of each word and by italicizing each word.
- Input that you enter by keyboard is identified by quotation marks: single quotes for single characters, double quotes for strings.
- For brevity, expressions such as “choose **File** > **Directories**” are used rather than “pull down the File menu and choose Directories.”
- Any command enclosed in angle brackets < > represents a single keystroke. For example, “press <F1>” means press the key labeled *F1*.
- Any command that requires pressing two or more keys simultaneously is shown with a plus sign connecting the keys. For example, “press <Shift> + <F1>” means press and hold the <Shift> key and then press the <F1> key.
- Any button that you click on the screen is represented in bold face letters. For example, “click **Close**”.

## Topic Headings

The following headings are used to show the organization of topics within a chapter:

### Chapter 1 Chapter Name

#### Second Level Topics

#### Third Level Topics

#### Fourth Level Topics

## Safety and EMC Information

In accordance with our commitment to customer service and safety, this instrument has satisfied the requirements for the European CE Mark including the Low Voltage Directive.

Designed, manufactured and tested in an ISO9001 registered facility, this instrument has been shipped to you from our manufacturing facility in a safe condition.

This instrument must be used as described in this manual. Any use of this instrument in a manner other than described here may result in instrument damage and/or operator injury.

### Notice on Lifting and Handling of Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Scientific instrument *requires a team effort* for lifting and/or moving 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: If this instrument is used in a manner not specified by Thermo Fisher Scientific, the protection provided by the instrument could be impaired.

### 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.

## Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear different from the main flow of text. Safety and special notices include the following:



**Warning** Warnings highlight hazards to human beings. Each Warning is accompanied by a Warning symbol. ▲

**Caution** Cautions highlight information necessary to protect your instrument from damage. ▲

**Note** Notes highlight information that can affect the quality of your data. In addition, notes often contain information that you might need if you are having trouble. ▲

## Identifying Safety Information

This guide contains precautionary statements that can prevent personal injury, instrument damage, and loss of data if properly followed. Warning symbols alert the user to check for hazardous conditions. These appear throughout the manual, where applicable. The most common warning symbols that appear in Thermo Fisher Scientific manuals are shown below.

In addition, every instrument has specific hazards. So, be sure to read and comply with all precautions described in this guide. They will help to ensure the safe and long-term use of your system.



**Warning General Hazard.** This general symbol indicates that a hazard is present that could result in injuries if it is not avoided. The source of danger is described in the accompanying text. ▲



**Warning Electric Shock Hazard.** High voltages capable of causing personal injury are used in the instrument. The instrument must be shut down and disconnected from line power before service is performed. Do not operate the instrument with the top cover off. Do not remove protective covers from PCBs. ▲



**Warning Burn Hazard.** Treat heated zones with respect. Parts of the instrument might be very hot and might cause severe burns if touched. Allow hot components to cool before servicing them. ▲



**Warning Corrosive Material.** Wear gloves when handling toxic, carcinogenic, mutagenic, or corrosive/irritant chemicals. Use approved containers and procedures for disposal of waste solution. ▲



**Warning Laser Radiation.** Avoid eye or skin exposure to direct or scattered radiation! ▲

## General Safety Precautions

Observe the following safety precautions when you operate or perform service on your instrument:

- The system should be operated by trained personnel only. Read the manuals before starting the system and make sure that you are familiar to the warnings and safety precautions!

- Accurate results can be obtained only, if the system is in good condition and properly calibrated.
- Service by the customer should be performed by trained qualified personnel only and should be restricted to servicing mechanical parts! Service on electronical parts should be performed by Thermo Fisher Scientific field service engineers only!
- Before plugging in any of the instrument modules or turning on the power, always make sure that the voltage and fuses are set appropriately for your local line voltage.
- Only use fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.
- The supplied power cord must be inserted into a power outlet with a protective earth contact (ground). When using an extension cord, make sure that the cord also has an earth contact.
- Do not change the external or internal grounding connections. Tampering with or disconnecting these connections could endanger you and/or damage the system.
- The instrument is properly grounded in accordance with regulations when shipped. You do not need to make any changes to the electrical connections or to the instrument's chassis to ensure safe operation.
- Never run the system without the housing on. Permanent damage can occur. When leaving the system, make sure that all protective covers and doors are properly connected and closed, and that heated areas are separated and marked to protect for unqualified personnel!
- Do not turn the instrument on if you suspect that it has incurred any kind of electrical damage. Instead, disconnect the power cord and contact a Thermo Fisher Scientific field service engineer for a product evaluation. Do not attempt to use the instrument until it has been evaluated. (Electrical damage may have occurred if the system shows visible signs of damage, or has been transported under severe stress.)
- Damage can also result if the instrument is stored for prolonged periods under unfavorable conditions (for example, subjected to heat or water).
- Always disconnect the power cord before attempting any type of maintenance.
- Capacitors inside the instrument may still be charged even if the instrument is turned off.



- Never try to repair or replace any component of the system that is not described in this manual without the assistance of a Thermo Fisher Scientific field service engineer.
- Do not place any objects upon the instrument—especially not containers with liquids—unless it is requested by the user documentation. Leaking liquids might get into contact with electronic components and cause a short circuit.
- **Shut Down the Laser Before You Perform any Service on the MALDI Source.** The MALDI source uses a high-energy ultraviolet laser capable of causing personal injury. Do not operate the source with the cover off the sample module.

## **Safety Advice for Possible Contamination**

### **Hazardous Material Might Contaminate Certain Parts of Your System During Analysis.**

In order to protect our employees, we ask you to adhere to special precautions when returning parts for exchange or repair.

If hazardous materials have contaminated mass spectrometer parts, Thermo Fisher Scientific can only accept these parts for repair if they have been properly decontaminated. Materials that due to their structure and the applied concentration might be toxic or that are reported in publications to be toxic are regarded as hazardous. Materials that will generate synergetic hazardous effects in combination with other present materials are also considered hazardous.

Your signature on the Health and Safety Form confirms that the returned parts have been decontaminated and are free of hazardous materials. Download the form from [decon.thermo-bremen.com](https://decon.thermo-bremen.com) or order it from the Thermo Fisher Scientific field service engineer.

Parts contaminated by radioisotopes should not be returned to Thermo Fisher Scientific—neither under warranty nor within the exchange part program. If unsure about parts of the system possibly being contaminated by hazardous material, please make sure the Thermo Fisher Scientific field service engineer is informed before the engineer starts working on the system.

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## Chapter 1 Introduction

Information in this guide will help you to prepare a suitable site for installation of your system. LTQ Orbitrap Series instruments are designed to operate reliably under carefully controlled environmental conditions.

Operating a system or maintaining it in a condition outside the power and operating environment specifications described in this guide might cause failures of many types. The repair of such failures is specifically excluded from the standard warranty and service contract coverage.

**Note** The purchaser is responsible for providing a suitable location, a suitable operating environment, a source of power of acceptable quality, correct gas and solvent supplies, and proper waste and exhaust systems. ▲

For additional information, request specific preinstallation support directly through your local Thermo Fisher Scientific office.



## Chapter 2 Site Preparation

Before your instrument can be installed by the Thermo Fisher Scientific field service engineer, the site must be prepared. The hallways and doors must be wide enough to allow passage of the instrument. A telephone must be installed within reach of the workbench.

**Note** It is your responsibility as the user to provide a suitable location, a source of power of acceptable quality, a suitable operating environment, and a proper exhaust system. ▲

More information on each of the requirements is available under the following topics:

- “Entrance and Movement” on [page 2-2](#)
- “Instrument Dimensions” on [page 2-5](#)
- “Space and Load Requirements” on [page 2-8](#)
- “Telephone” on [page 2-12](#)



## Entrance and Movement

To allow moving an unpacked LTQ Orbitrap Series instrument, the entrance to your facility and the width of all hallways, elevators, and so on should have a minimum width as indicated in the subsequent topics. However, additional room should be allowed for maneuvering the system around corners, into elevators, or through doorways.

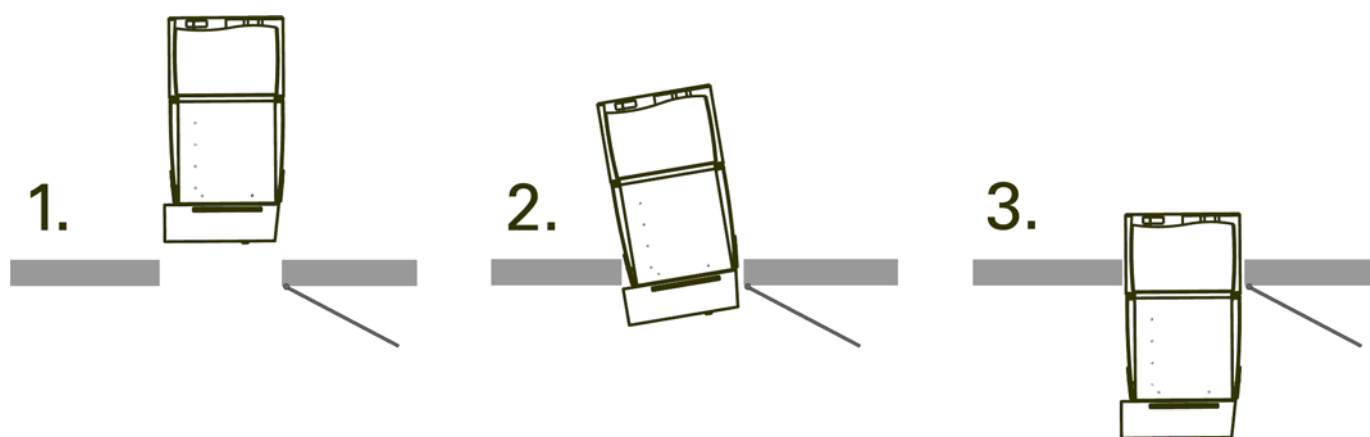
When unpacking the system, consider the additional space that is required for pulling down the ramp.

**Note** Do not remove the instrument from its shipping container unless authorized by Thermo Fisher Scientific personnel. Be sure that all the contents of the container remain with the instrument. ▲

### Moving an LTQ Orbitrap Series ETD System Along Hallways and Through Doors

When moving an LTQ Orbitrap Series ETD system along hallways, the instrument requires a minimum hallway width of 93 cm (37 in.). See [Figure 2-4](#) on [page 2-7](#).

The instrument must be turned by some degrees when passing through a door that is 89 cm wide. Therefore, no obstacles (cabinets, for example) must be located near the door. [Figure 2-1](#) shows how to move the unpacked instrument through laboratory doors.



**Figure 2-1.** Moving an LTQ Orbitrap Series ETD system through laboratory doors

### Box Dimensions and Weights

Transport of the equipment to the site requires wide entrances and hallways. The floors and elevators within the site must be able to support the weight of the equipment.

**Note** Owing to the climatic conditions in some tropic regions, some boxes may be replaced by special packings. As a result, the dimensions will differ from those shown in the tables of this section. ▲

## Box Dimensions and Weights of LTQ Orbitrap Series Instruments

The LTQ Orbitrap Series basic unit is shipped in a container with the following dimensions: *l* 174 cm (69 in.), *w* 112 cm (44 in.), *h* 162 cm (64 in.). The container and its contents weigh approximately 538 kg (1186 lb). Other modules such as the data system, recirculating chiller, and accessories are shipped in a separate container. Its dimensions and weight are less than that of the container for the basic unit. They are given in [Table 2-1](#).

**Table 2-1.** Dimensions and weights of packed units of a typical LTQ Orbitrap Series system

| Module                      | Height |     | Width |     | Length |     | Weight |      |
|-----------------------------|--------|-----|-------|-----|--------|-----|--------|------|
|                             | cm     | in. | cm    | in. | cm     | in. | kg     | lb   |
| Basic unit with linear trap | 162    | 64  | 112   | 44  | 174    | 69  | 538    | 1186 |
| Auxiliary box               | 156    | 62  | 80    | 32  | 120    | 48  | 298    | 657  |

**Note** Some chemicals that are needed for installation will be shipped in a separate package. See “[Chemicals Needed for Installation](#)” on [page 8-2](#) for details. ▲

## Box Dimensions and Weights of Instruments with MALDI Source

To allow moving an unpacked LTQ Orbitrap Series instrument with MALDI source, the entrance to your facility and the width of all hallways, elevators, and so on should have a minimum width of 110 cm (43 in.).<sup>1</sup>

The LTQ Orbitrap Series basic unit is shipped in a container with the following dimensions: *l* 201 cm (79 in.), *w* 149 cm (59 in.), *h* 162 cm (64 in.). The container and its contents weigh approximately 660 kg (1455 lb). Other modules such as data system, recirculating chiller, and MALDI equipment are shipped in separate containers. Their dimensions and weights are less than that of the container for the basic unit. They are given in [Table 2-2](#) on [page 2-4](#).

<sup>1</sup> Your instrument is shipped in a shipping container, the smallest dimension of which is 149 cm (59 in.). If the entrance to your laboratory will not accommodate a 149 cm container, you can remove the individual modules from the container before moving them into the room.

**Note** Some chemicals that are needed for installation will be shipped in a separate package. See “[Required Chemical and Accessory Kits for MALDI](#)” on [page 8-3](#) for details. ▲

**Table 2-2.** Dimensions and weights of packed units of an LTQ Orbitrap Series system with MALDI source

| Module                      | Height |     | Width |     | Length |     | Weight |      |
|-----------------------------|--------|-----|-------|-----|--------|-----|--------|------|
|                             | cm     | in. | cm    | in. | cm     | in. | kg     | lb   |
| Basic unit with linear trap | 162    | 64  | 149   | 59  | 201    | 79  | 660    | 1455 |
| MALDI equipment box         | 146    | 58  | 90    | 36  | 124    | 49  | 199    | 439  |
| Auxiliary box               | 118    | 47  | 80    | 32  | 120    | 48  | 195    | 430  |

## Box Dimensions and Weights of LTQ Orbitrap Series ETD Instruments

To allow moving an unpacked LTQ Orbitrap Series ETD instrument, the entrance to your facility and the width of all hallways, elevators, and so on should have a minimum width of 110 cm (43 in.).<sup>1</sup>

The LTQ Orbitrap Series ETD basic unit is shipped in a container with the following dimensions: *l* 201 cm (79 in.), *w* 149 cm (59 in.), *h* 162 cm (64 in.). The container and its contents weigh approximately 660 kg (1455 lb). Other modules such as the data system, recirculating chiller, and accessories are shipped in a separate container. Its dimensions and weight are less than that of the container for the basic unit. They are given in [Table 2-3](#).

**Table 2-3.** Dimensions and weights of packed units of an LTQ Orbitrap Series ETD system

| Module                      | Height |     | Width |     | Length |     | Weight |      |
|-----------------------------|--------|-----|-------|-----|--------|-----|--------|------|
|                             | cm     | in. | cm    | in. | cm     | in. | kg     | lb   |
| Basic unit with linear trap | 162    | 64  | 149   | 59  | 201    | 79  | 672    | 1482 |
| Auxiliary box               | 140    | 55  | 80    | 32  | 120    | 48  | 247    | 545  |
| Chiller box                 | 87     | 34  | 101   | 40  | 52     | 21  | 75     | 166  |

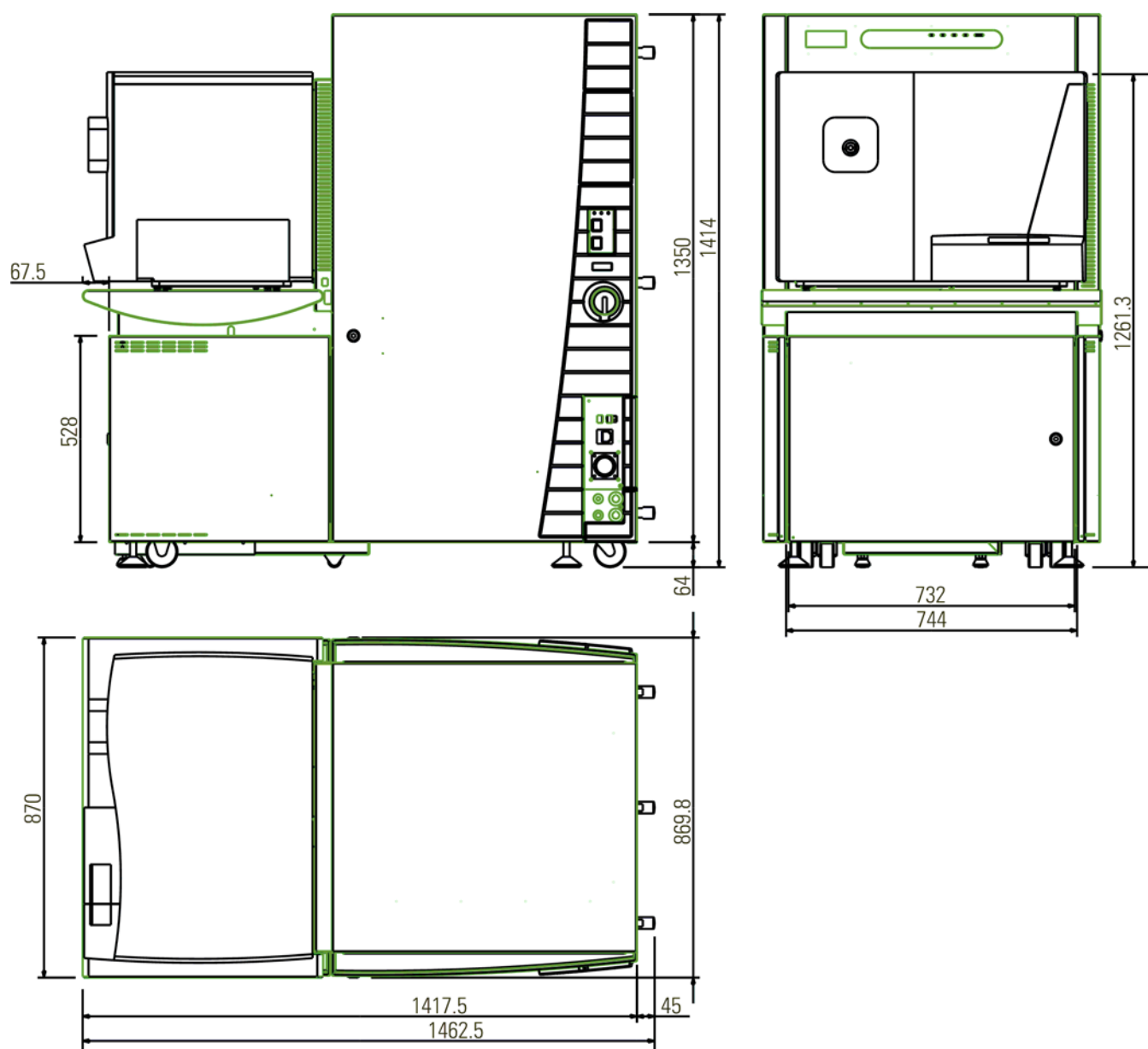
<sup>1</sup> Your instrument is shipped in a shipping container, the smallest dimension of which is 149 cm (59 in.). If the entrance to your laboratory will not accommodate a 149 cm container, you can remove the individual modules from the container before moving them into the room.

## Instrument Dimensions

This section describes the dimensions of the available types of LTQ Orbitrap Series instruments.

### Dimensions of an LTQ Orbitrap Series Instrument

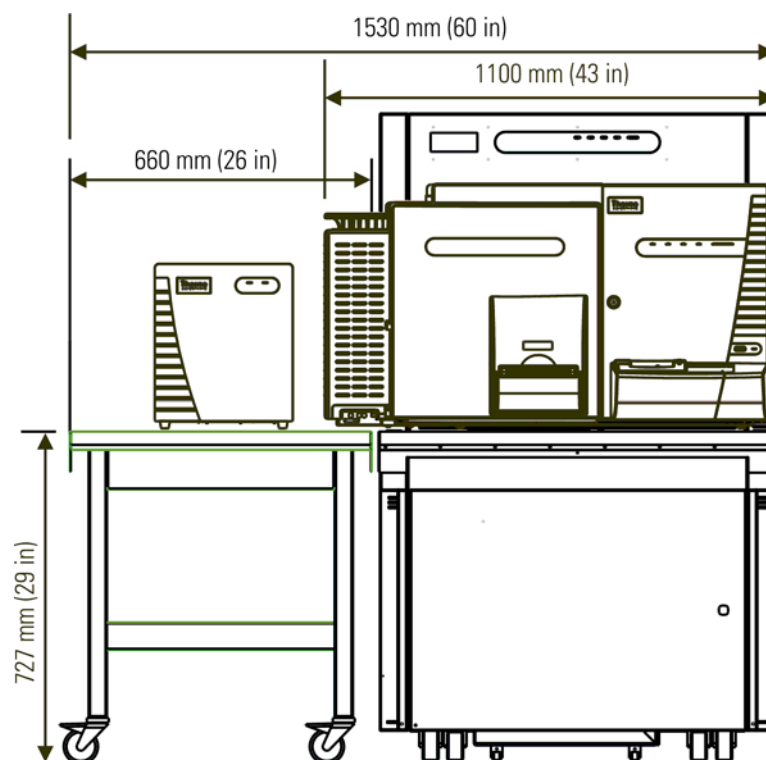
The LTQ Orbitrap Series instrument has dimensions of  $l$  1462.5 mm (58 in.),  $w$  870 mm (35 in.),  $h$  1414 mm (56 in.). See [Figure 2-2](#).



**Figure 2-2.** Dimensions of LTQ Orbitrap Series instruments in mm

## Dimensions of an Instrument with MALDI Source

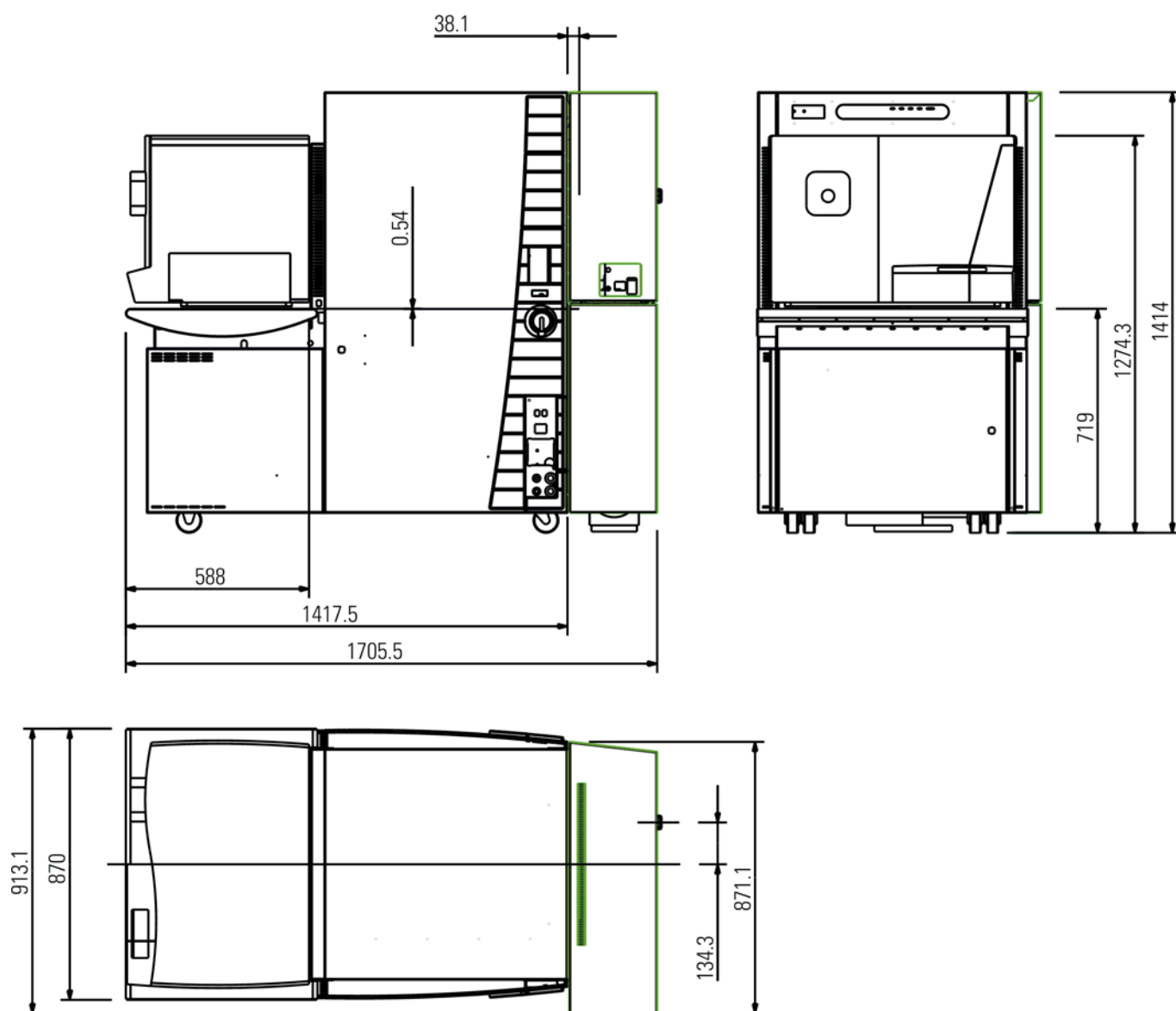
If your LTQ Orbitrap Series instrument is equipped with the MALDI source, a movable bench for the MALDI controller with dimensions of 620 mm × 660 mm (25 × 26 in) is located on the left side of the instrument. The MALDI controller itself has dimensions of *l* 450 mm (18 in.), *w* 290 mm (11.5 in.), *h* 350 mm (14 in.). The complete system has maximum dimensions of *l* 1462.5 mm (58 in.), *w* 1530 mm (60 in.), *h* 1414 mm (56 in.). See [Figure 2-3](#).



**Figure 2-3.** Important dimensions of instrument with MALDI source

## Dimensions of LTQ Orbitrap Series ETD Instruments

In LTQ Orbitrap Series ETD systems, the ETD Module is attached to the rear of the instrument. The instrument has maximum dimensions of  $l$  1705 mm (67 in.),  $w$  913 mm (36 in.),  $h$  1414 mm (56 in.). See [Figure 2-4](#).



**Figure 2-4.** Important dimensions of LTQ Orbitrap Series ETD instrument

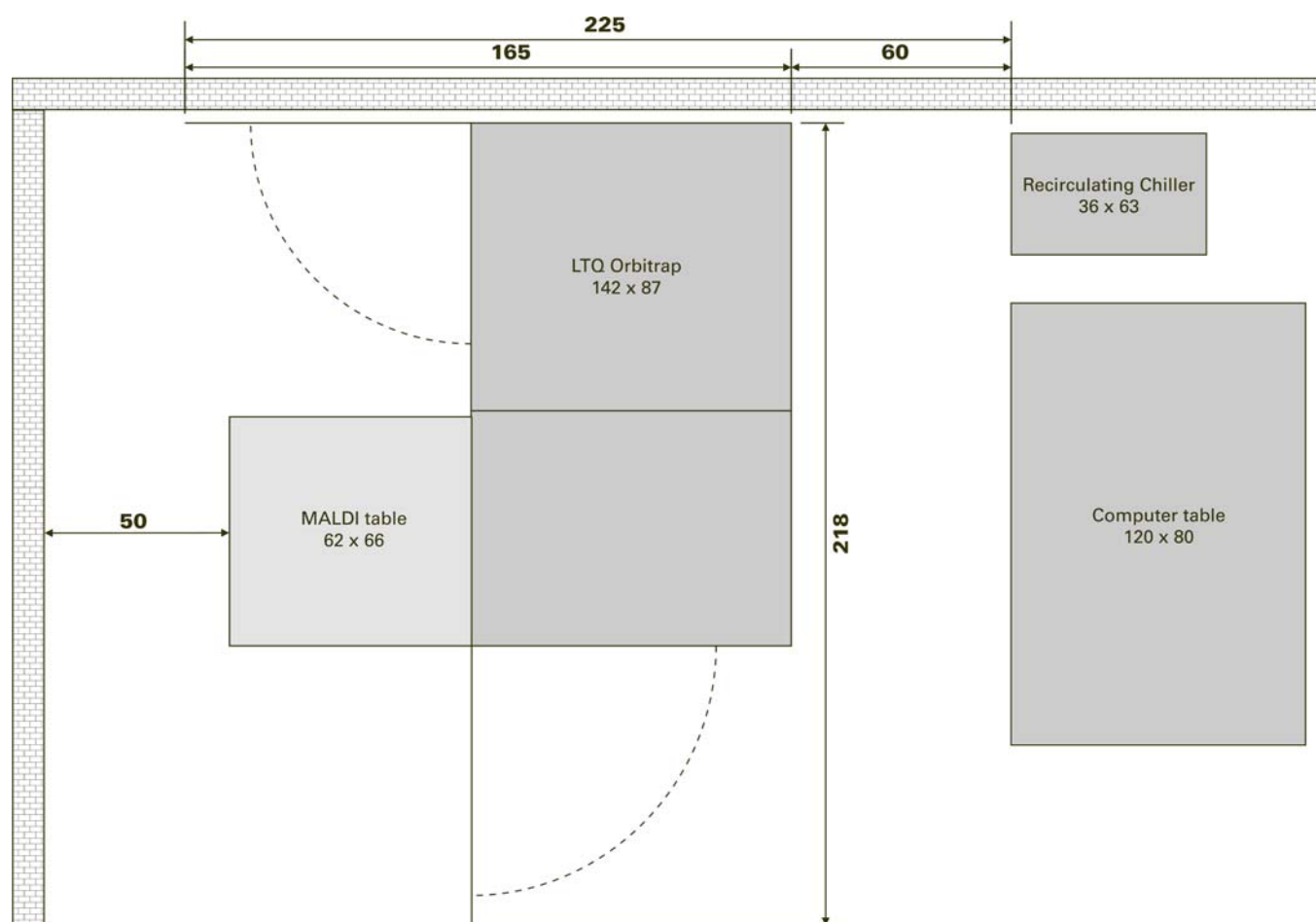
## Space and Load Requirements

This section contains the following topics:

- “Minimum Floor Space” on page 2-8
- “Load Distribution” on page 2-10

### Minimum Floor Space

Wheels at the bottom side of the instrument facilitate positioning the LTQ Orbitrap Series instrument at the intended place in the laboratory. The instrument is designed to be placed with its rear panel against a wall. To ensure a sufficient airflow for cooling the instrument, spacers on the rear panel provide for minimum distance to the wall.



**Figure 2-5.** Space requirements for working with your LTQ Orbitrap Series system (dimensions in cm)

The footprint for the LTQ Orbitrap Series system is shown in [Figure 2-5](#). In the laboratory, the position of your instrument should allow easy access to all sides; the figure shows the required minimum clearance. The front panel and the left side panel of the instrument are

mounted on hinges; the right side panel is removable. In addition, consider the layout when all system components are present (data system, recirculating chiller).

### **Required Space with MALDI Equipment**

In case your instrument is equipped with the MALDI source, the table with the laser is positioned on the left hand side. In principle, the space indicated in [Figure 2-5](#) on [page 2-8](#) is sufficient. To give personnel access to the left side of the LTQ Orbitrap Series instrument, allow for sufficient space between the table and the wall, at least 50 cm (20 in.).

A tissue imaging kit is available as option for the MALDI system. To provide sufficient space for the scanner, a larger workbench for the data system is required.

### **Required Space with ETD Equipment**

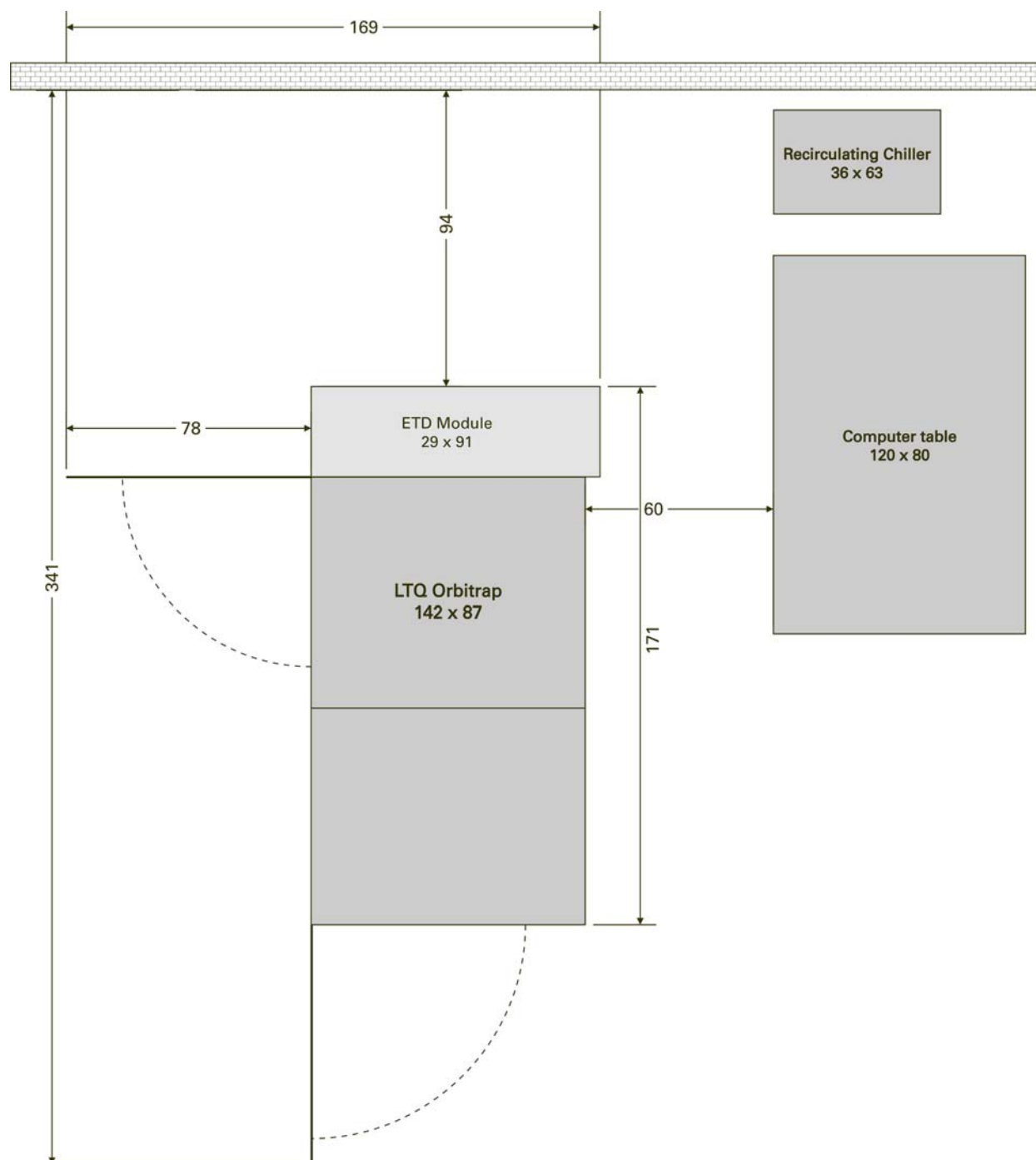
The footprint for an LTQ Orbitrap Series ETD system is shown in [Figure 2-6](#) on [page 2-10](#).

Free access to the rear side of the instrument is required. The fully extended ion probe handle extends 48 cm (19 in.) beyond the back panel of the instrument. A *minimum* clearance of 31 cm (12 in.) is required between the wall and the fully extended ion probe handle on the back of the ETD Module, or 79 cm (31 in.) from the back panel of the instrument to the wall is the minimum clearance. The *recommended* clearance is 46 cm (18 in.) between the wall and the fully extended ion probe handle on the back of the ETD Module, or 94 cm (37 in.) from the back panel of the instrument to the wall is the recommended clearance.



## Site Preparation

### Space and Load Requirements



**Figure 2-6.** Footprint of an LTQ Orbitrap Series ETD instrument (dimensions in cm)

## Load Distribution

The LTQ Orbitrap Series instruments are supported by four height adjustable feet. The floor of your laboratory should be able to carry the weight of the installed LTQ Orbitrap Series instrument with data system and recirculating chiller of about 685 kg (1 510 lb). Also, consider the weight of any other option that is added to the system.

## **Weight of MALDI Equipment**

The MALDI ion source for the LTQ Orbitrap Series instrument weighs approximately 50 kg (110 lb) including movable desk and MALDI controller. If you intend to purchase this option, be certain to take the additional weight into account when designing your laboratory.

## **Weight of ETD System**

The components of the ETD system weigh approximately 125 kg (276 lb), including the ETD Module, the transfer mechanics, and the pumps. If you intend to purchase this option, be certain to take the additional weight into account when designing your laboratory.

## Telephone

It is recommended that a telephone be installed in your laboratory near the instrument so, if necessary, you can conveniently operate the system while you are working by telephone with a Thermo Fisher Scientific field service engineer. The voice telephone outlet should be within 2 m (7 ft) of your system.

**Note** 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. ▲

## Chapter 3 Operating Environment

Attention to the operating environment will insure continued high performance of your LTQ Orbitrap Series system. Any expenditures for air conditioning are more than offset by good sample throughput and reduced repair costs. The air conditioning must be capable of maintaining a constant temperature in the immediate vicinity of the system without producing excessive draft.

**Note** It is your responsibility as the user to provide an acceptable operating environment. ▲

Operating environment includes the following:

- “Temperature” on page 3-2
- “Humidity” on page 3-3
- “Vibration” on page 3-3
- “Lighting” on page 3-4
- “Particulate Matter” on page 3-4
- “Radio Frequencies” on page 3-4
- “Electrostatic Discharge” on page 3-5

## Temperature

The laboratory room temperature must be maintained between 15 and 27 °C (59 and 81 °F). The optimum temperature of operation is between 18 and 21 °C (65 and 70 °F).

**Note** As the laboratory temperature increases, system reliability decreases. All electronic components generate heat while operating. This heat must be dissipated to the surrounding air for the components to continue to operate reliably. ▲

There must be a good flow of room air around the system, and the air conditioning system must be capable of maintaining a constant temperature (within the temperature specification given above) in the immediate vicinity of the system.

We recommend the installation of an air conditioner, if the specified limits will be exceeded due to unfavorable climatic conditions. Preferably, the air conditioner should be equipped with a flow controller valve and PID microprocessor control (for example, available from Landis & Gyr, Polygyr RWX..., see [www.landisgyr.com](http://www.landisgyr.com)). This ensures temperature drifts within the limits given above.

**Note** Do not place the LTQ Orbitrap Series instrument under an air duct, near windows, or near heating and cooling sources. Temperature fluctuations of 5 °C or more over a 5 minutes period of time can effect performance. ▲

The air conditioning load for a typical LTQ Orbitrap Series system (with recirculating chiller and a typical LC) is approximately 6.5 kW (22400 BTU/h). The heat output of an LTQ Orbitrap Series ETD system is 700 W higher. Therefore, the air conditioning load is approximately 7.2 kW (24700 BTU/h). Refer to your LC manual for the heat output of your LC equipment. Table 3-1 shows the approximate heat output of each module.

**Table 3-1.** Heat output for typical LTQ Orbitrap Series systems

| Module                 | Heat output [W]    | Heat output [BTU/h]   |
|------------------------|--------------------|-----------------------|
| LTQ Orbitrap Series MS | 2800 (3500)        | 9550 (11 950)         |
| Liquid chromatograph   | 1080 <sup>a</sup>  | 3690 <sup>a</sup>     |
| Recirculating chiller  | 1600 <sup>a</sup>  | 5460 <sup>a</sup>     |
| Monitor                | 240 <sup>a</sup>   | 820 <sup>a</sup>      |
| Computer               | 470 <sup>a</sup>   | 1 640 <sup>a</sup>    |
| Laser printer          | 350 <sup>a</sup>   | 1 230 <sup>a</sup>    |
| <b>Total</b>           | <b>6540 (7240)</b> | <b>22 390 (24720)</b> |

<sup>a</sup> Approximate. The actual value depends on your equipment.

## Humidity

The relative humidity of the operating environment must be between 50 and 80%, with no condensation. It is recommended that your laboratory be equipped with a temperature/humidity monitor to insure that your laboratory is always within the required temperature and humidity specifications.

**Caution** Operating an LTQ Orbitrap Series system at very low humidity might cause the accumulation and discharge of static electricity, which can shorten the life of electronic components. Operating the system at high humidity might cause condensation, oxidation, and short circuits, and will also block the filters on the cooling fans. ▲

## Vibration

Floors must be free of vibration caused, for example, by equipment in adjoining locations. Propagation of vibrations and their influence on complex instrumentations are difficult to predict. Thermo Fisher Scientific encourages you to contact us at [support.ftms.bremen@thermofisher.com](mailto:support.ftms.bremen@thermofisher.com) if you have questions or concerns about your laboratory.

Thermo Fisher Scientific has made vibration measurements of an environment where the LTQ Orbitrap Series instrument is successfully operated. For your information, the data are listed in [Table 3-2](#).<sup>1</sup>

**Table 3-2.** Vibration measurement data

| Frequency [Hz] | Velocity [mm/s] |
|----------------|-----------------|
| 48.3           | 0.09            |
| 25.25          | 0.07            |
| 11.0           | 0.05            |
| 10.8           | 0.06            |
| 6.5            | 0.02            |
| 2.5            | 0.02            |

<sup>1</sup> The relation between frequency, velocity and acceleration is given by the following equation:  
$$\text{Velocity [mm/s]} = \text{Acceleration [mm/s}^2\text{]} / \text{Frequency [Hz]}$$

## Lighting

Good lighting makes any work area more enjoyable. Since a lot of work is done on the computer terminal, it may be convenient to have a dimmer switch on the lights to reduce eyestrain. A small, high-intensity lamp is recommended for cleaning mass spectrometer components, source inspection, and manipulation of small components.

## Particulate Matter

The air in your laboratory must not have excessive dust, smoke, or other particulate matter. For reference, the air should contain fewer than 3 500 000 particles per cubic meter (100 000 particles per cubic foot) in excess of 5  $\mu\text{m}$ .

Dust can clog the air filters, causing a reduction in airflow around electronic components. Dust will also form a layer on electronic components that will act as an insulating blanket and thus reduce the transfer of heat from the components to the surrounding air.

## Radio Frequencies

The LTQ Orbitrap Series systems are able to withstand electromagnetic fields of 3 V/m in the frequency range 26 MHz to 1 GHz without any influence to operation.

If strong radio transmitters are operating close to your laboratory, you should contact us at [support.ftms.bremen@thermofisher.com](mailto:support.ftms.bremen@thermofisher.com) for advice. Because of the complexity of such influences, no general suggestion can be given in this guide.

## Electrostatic Discharge

Electrostatic discharge (ESD) can damage the electronic components of your LTQ Orbitrap Series system. Thermo Scientific instruments are designed to withstand electrostatic discharges (ESD) up to 4 kV (air discharge) and 4 kV (contact discharge) with all panels in place. However, if the panels are removed and the PCBs are handled without proper precautions, the electronic components might be damaged or fail prematurely. Static electricity can develop in various ways. A few examples of how electrostatic charge can develop are as follows:

- When walking across a carpet in a room that is at 20% relative humidity, as much as 35 000 V of electrostatic potential can be generated on the surface of your body. This same motion in a room at 80% relative humidity generates about 1500 V of electrostatic potential.
- Sitting and working in a chair padded with polyurethane foam in a room at 20% relative humidity can cause as much as 18000 V of electrostatic potential to develop on your skin or 1500 V at 80% relative humidity.
- Working in laboratory coats and clothing made of synthetic fibers can cause the accumulation of static electricity on your skin.
- Styrofoam™ cups and packing materials typically have a considerable electrostatic charge on them.

The discharge of static electricity is not perceptible to a human being until the potential is at least 4000 V. Many electronic components can be damaged by a discharge of electrostatic potential of as little as 50 V. ESD damage can be catastrophic causing your system to cease functioning. More commonly, however, ESD damage might cause latent problems that are detrimental to sensitive electrical components, causing premature failures. Therefore, Thermo Fisher Scientific recommends the following precautions, especially when you are operating your system at the lower end of the relative humidity specification listed above:

- Use a static-dissipating floor covering (such as tile or conductive linoleum) in the room that houses your instrument.
- Use laboratory chairs covered with natural fiber or other static dissipating material.
- When operating the instrument, wear laboratory coats and clothing made of natural fiber or other static-dissipating material.
- Keep Styrofoam cups or packing materials away from the instrument.





## Chapter 4 Line Power

The performance and longevity of your system can be affected by the quality of line power delivered to the system. To ensure that your instrument performs optimally and that it is not damaged by line power fluctuations, please verify that you comply with all power quality requirements.

**Note** It is your responsibility as the user to provide a source of power of acceptable quality for the operation of your system. ▲

More information on each of the requirements is available under the following topics:

- “Available Outlets” on page 4-2
- “Connecting Mass Spectrometer and Modules to Wall Outlets” on page 4-4
- “Quality of Power” on page 4-6
- “Power Monitoring Devices” on page 4-7
- “Power Conditioning Devices” on page 4-8
- “Uninterruptible Power Supply” on page 4-8
- “Delta-to-Y Conversion Transformer” on page 4-9
- “Technical Assistance” on page 4-10

## Available Outlets

LTQ Orbitrap Series instruments are designed to operate at a nominal voltage of 230 V AC, 50/60 Hz. The minimum and maximum voltage tolerances are in compliance with IEC 950, Amend 2, 1993, paragraph 1.6.5, as follows:

“Equipment intended to operate directly from the main supply shall be designed for a minimum supply tolerance of +6% and -10%. If the rated voltage is 230 V AC single phase or 400 V AC three phase, the equipment shall operate safely within a minimum supply tolerance of  $\pm 10\%$ .”

The basic power requirements for a LTQ Orbitrap Series system consist of the following:

- A wall outlet for the mass spectrometer:
  - Nominal voltage of 230 V AC,  $\pm 10\%$ , frequency of 50/60 Hz.
  - Three phases, 5-wire system in Y configuration (neutral wire connected to earth). See [“Delta-to-Y Conversion Transformer”](#) on [page 4-9](#) for further information.
  - Each phase fused with 15 A (tripping characteristic B).
- A wall outlet for the recirculating chiller as specified in [Table 4-2](#) on [page 4-4](#).
- Additional single-phase wall outlets (for computer, monitor, and printer)  
Nominal voltage 230 V  $\pm 10\%$ , 50 or 60 Hz AC, fused with 10 A.

**Note** The LTQ Orbitrap Series system must have an earth ground hard-wired to the main panel. The interconnected power outlets for the LTQ Orbitrap Series system are to have a common point to one ground connector. If there are two such points, each of which is connected to separate external ground, they will cause noise current to flow through the ground system via the ground loop that is formed. ▲

**Note** Power is to remain on. The LTQ Orbitrap Series system should remain on and pumping continuously for optimum performance. ▲

## Power Cables, Connectors

The power cables to the LTQ Orbitrap Series instruments are 5 m (16 ft) long. The cables from the personal computer, monitor, and printer are approximately 2 m (6 ft) long.

LTQ Orbitrap Series instruments are shipped with the 16 A version of a 5 pole CEE male connector which is rated at 3×16 A and 230 V AC. See left photo in [Figure 4-1](#). The right photo in [Figure 4-1](#) shows the wall receptacle required for the LTQ Orbitrap Series instruments (IP 44; 5 poles; 380 Volt; 50/60 Hz; red; CEE-Norm IEC 309.1 and 309.2). The receptacle is provided by Thermo Fisher Scientific as part of the Preinstallation Kit.



**Figure 4-1.** Connector and wall receptacle for the LTQ Orbitrap Series

Local codes in your area may require another type of plug and receptacle be installed. The Thermo Fisher Scientific field service engineer for your country will provide the appropriate power plugs.

## Connecting Mass Spectrometer and Modules to Wall Outlets

Ensure that the wall outlet specifications are not exceeded. The LTQ Orbitrap Series instrument must have a separate “clean” line leading to a main fuse to guarantee disturbance-free operation. Locally supplied personal computer hardware must use the same power line and ground connection as the LTQ Orbitrap Series instrument.

The electrical wall outlet for the main power of the LTQ Orbitrap Series instrument should be located at the wall near the intended location of the instrument.

## Power Supply for Chiller and other Modules

Additional power outlets might be required for test and cleaning equipment, such as an oscilloscope and ultrasonic bath. The maximum load for a 230 V AC fourplex outlet is typically 16 A. We recommend at least six (6) spare 230 V AC outlets behind the system and three (3) close to the workbench space within your laboratory.

Electric power for linear ion trap and liquid chromatograph is provided by the LTQ Orbitrap Series instrument. In LTQ Orbitrap Series ETD instruments, the ETD Module is connected to the power outlet for peripheral devices and the data system is connected to a wall outlet. In all other LTQ Orbitrap Series instruments, the mass spectrometer provides the electric power for the data system. See [Table 4-1](#).

**Table 4-1.** Electric power supply for data system

| System  | Power for data system supplied by |
|---|-----------------------------------|
| (MALDI) LTQ Orbitrap XL<br>LTQ Orbitrap Velos<br>Orbitrap Elite     | mass spectrometer                 |
| LTQ Orbitrap XL ETD<br>LTQ Orbitrap Velos ETD<br>Orbitrap Elite ETD | wall outlet                       |

For the recirculating chiller and all other additional devices, please use wall outlets instead. The Thermo Scientific NESLAB ThermoFlex 900 recirculating chiller requires a dedicated power outlet that complies with the specifications listed in [Table 4-2](#).

**Table 4-2.** Power outlet requirements for NESLAB ThermoFlex 900

| Voltage [V AC] | Frequency [Hz] | Phase | Receptacle Rating [A] |
|----------------|----------------|-------|-----------------------|
| 115            | 60             | 1Ø    | 15                    |
| 230            | 50             | 1Ø    | 15                    |

**Note** All single-phase auxiliary wall outlets should use the same ground as power line of the instrument. ▲

The specifications on the individual modules might vary from those in this guide. The power specifications on the module and in the respective manual always supersede those in this guide.

**Note** Refer to your LC equipment manual for power requirements and specifications. ▲

## Quality of Power

The quality of power supplied to your LTQ Orbitrap Series system is very important. The quality of line voltage must be stable and within the specifications listed in this guide. The line voltage must be free of fluctuations due to slow changes in the average voltage, surges, sags, or transients.

Below are definitions for the most common voltage disturbances:

- **Harmonic distortion** is a high-frequency disturbance that may affect operation of your LTQ Orbitrap Series instrument. This disturbance appears as distortion of the fundamental sine wave.
- **Slow average** is a gradual, long-term change in average root mean square (RMS) voltage level, with typical durations greater than 2 s.
- **Sags and surges** are sudden changes in average RMS voltage level, with typical durations between 50  $\mu$ s and 2 s.
- **Transients** (or impulses) are brief voltage excursions of up to several thousand volts with durations of less than 50  $\mu$ s.

Harmonic distortion causes noise in the power supply lines and degrades instrument performance. Constant high line voltage, impulses, or surges in voltage can cause overheating and component failures. Constant low line voltage or sags in voltage can cause the system to function erratically or not at all. Transients, even of a few microseconds duration, can cause electronic devices to fail catastrophically or to degrade and eventually shorten the lifetime of your system. Therefore, it is important to establish the quality of the line voltage in your laboratory before your LTQ Orbitrap Series system is installed.

## Power Monitoring Devices

Various devices are available to monitor the quality of your line power. The power line disturbance analyzers are capable of detecting and recording most types of power supply problems. These instruments provide a continuous record of line performance by analyzing and printing out information on three types of voltage disturbances:

- Slow average
- Sag and surge
- Transient

In the first two cases, the duration as well as the amplitude of the disturbance is indicated by time interval recording.

The power line must be monitored continuously for seven consecutive days, 24 hours a day. If inspection of the printout indicates disturbances, the test should be terminated and corrective action taken. Then, the power should be monitored again as described above.

Line monitors can be rented from electrical equipment suppliers (see [“Technical Assistance”](#) on [page 4-10](#)). If necessary, your local Thermo Fisher Scientific office can assist in interpretation of the results and recommend appropriate corrective measures.



## Power Conditioning Devices

Various line voltage conditioning devices are available that can correct your line voltage problem. If you have good regulation but the power line disturbance analyzer shows transient voltages, then an isolation/noise suppression transformer should be adequate to resolve the problem. If there are transient and regulation problems, then you should consider power conditioners, which control both of these problems.

The conditioning transformer that would be installed between your laboratory power and the instrument requires your electrician to install a circuit with current rating (ampacity) for the power conditioner power requirements which are 60 amps, 60 Hz, 3-phase, 208–240 volt, North America (phase-to-phase) AC, 4 conductor (3 phase plus ground) power feed for its hard-wired input.

When nominal voltage is free from voltage sags, surges, and impulses but more than  $\pm 10\%$  outside the required 230 V, the supply voltage can be lowered (bucked) or raised (boosted) using a buck/boost transformer. Buck/boost transformers are available from Thermo Fisher Scientific.

Your electrician should install the buck/boost transformer before the installation of your system is started.

Additional information can be obtained by contacting your local Service Technician.

**Note** For compliance and safety, ensure that your power conditioning devices are certified by recognized domestic and international organizations (for example, UL, CSA, TÜV, and VDE). ▲

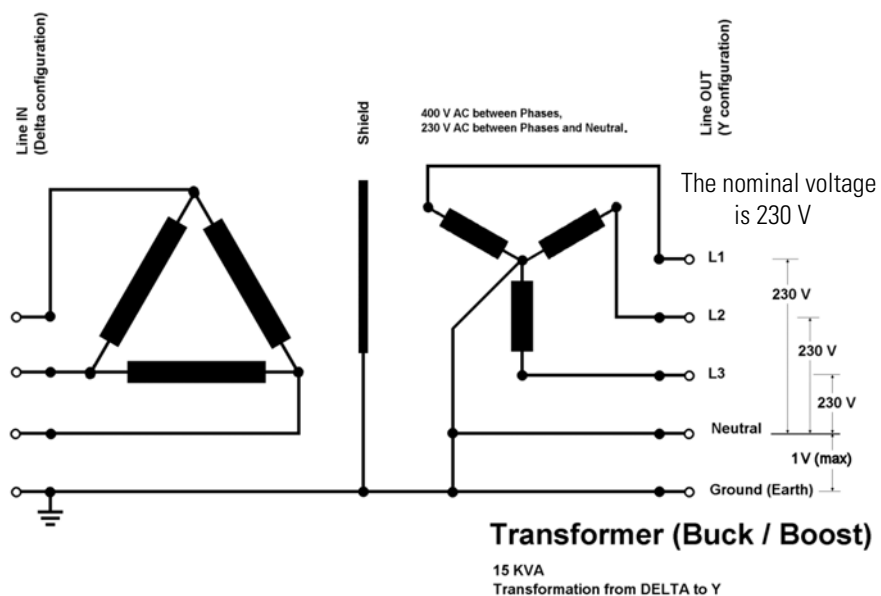
## Uninterruptible Power Supply

If your local area is susceptible to corrupted power or power disruptions, then an uninterruptible power supply (UPS) should be installed in your laboratory. Take the values listed in [Table 3-1](#) on [page 3-2](#) as guideline for dimensioning an UPS.

**Note** For compliance and safety, ensure that your uninterruptible power supply (UPS) devices are certified by recognized domestic and international organizations (for example, UL, CSA, TÜV, and VDE). ▲

## Delta-to-Y Conversion Transformer

In case of a Delta configuration in your location (ask the responsible electrician), an isolation transformer is required that steps up the three phases 120 V AC (Delta) to 230 V AC (Y) with respect to ground. A suitable transformer is available from Thermo Fisher Scientific. Line conditioners have beside other advantages the same capability.



**Figure 4-2.** Delta-to-Y conversion

**Note** In Y configuration, the nominal voltage 230 V AC must be measured phase to ground; between the phases 400 V AC is measured. ▲

## Technical Assistance

Occasionally, Thermo Fisher Scientific encounters line-voltage sources of unacceptable quality that adversely affect the operation of the mass spectrometer. Rectifying such power-supply problems is the user's responsibility. However, (upon request) Thermo Fisher Scientific will attempt to assist in diagnosis, but does not undertake to isolate and correct power-supply quality problems.

Contact your Thermo Fisher Scientific office for assistance in monitoring the line voltage in your laboratory, in selecting a line conditioner, or in locating a power consultant in your area.

Specifying power conditioning equipment is a complex task that is best handled by a company or consultant specializing in that field. A selection of such companies<sup>1</sup> is listed below:

General Electric Company  
(Worldwide distribution network)  
Internet: [www.ge.com](http://www.ge.com)

JOVYATLAS  
Groninger Str. 29-37  
26789 Leer / Ostfriesland  
Phone: +49 (491) 6002 0  
Fax: +49 (491) 6002 10  
Internet: [www.jovyatlas.de](http://www.jovyatlas.de)

OnLine Power, Inc.  
(Conform to all applicable standards, worldwide)  
Internet: [www.onlinepower.com](http://www.onlinepower.com)

POWERVER, INC.  
Internet: [www.powervar.com](http://www.powervar.com)

SOLA / HEVI-DUTY  
Internet: [www.sola-hevi-duty.com](http://www.sola-hevi-duty.com)

Warner Electric  
Motors and Controls division  
Internet: [www.warnernet.com](http://www.warnernet.com)

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<sup>1</sup> Thermo Fisher Scientific does not endorse any manufacturer, nor does it endorse products other than its own. Companies and products listed in this guide are given as examples only.

## Chapter 5 Consumables

Your instrument requires gases and solvents that must meet defined purity specifications. The Thermo Fisher Scientific field service engineer might also require certain solvents for the installation verification of your system.

**Note** It is your responsibility as the user to provide correct gas and solvent supplies for the operation of your system. ▲

More information on each of the requirements is available under the following topics:

- “Fittings and Parts” on [page 5-2](#)
- “Gases” on [page 5-3](#)
- “Solvent Recommendations” on [page 5-7](#)
- “Cooling Water” on [page 5-8](#)
- “Cleaning Agents” on [page 5-9](#)

## Fittings and Parts

Table 5-1 lists the minimum parts that are required to connect your LTQ Orbitrap Series instrument to your gas delivery system. Your connections and gas delivery system might vary, and it is your responsibility to supply any fittings or connections necessary during installation.

**Table 5-1.** Gas connection hardware required

| Description  |  | LTQ Orbitrap Series P/N<br>(in Accessory kit P/N 97055-62003) |
|--|--|---|
| Nitrogen   | 6×1 mm OD Teflon™ hose (P/N 0690280)   | 2 m (6 ft) provided. You might require additional length.     |
|  | Connection for the opposite end of the Teflon hose to the nitrogen gas source  | <b>Not provided in kit. You supply these parts.</b>           |
| Helium <sup>a</sup>  | 1/8-in. OD copper tubing   | 2 m (6 ft) provided. You might require additional length.     |
|  | Brass Swagelok™-type 1/8-in. nut   | 00101-15500   |
|  | 2-piece brass 1/8-in. ID ferrule   | 00101-08500 (front)<br>00101-02500 (back)                     |
|  | Connection for the opposite end of the tubing to the helium gas source   | <b>Not provided in kit. You supply these parts.</b>           |
| <b>For LTQ Orbitrap Series instruments equipped with HCD collision cell:</b> |  |   |
| Collision gas  | Argon (optional): 6×1 mm OD Teflon hose  | <b>Not provided in kit. You supply this part.</b>             |
|  | Nitrogen: T-piece (P/N 1128140)  | provided  |
| <b>For LTQ Orbitrap Series instruments equipped with ETD system:</b>         |  |   |
| ETD reagent carrier gas  | One 10 ft. length of 1/8-in. OD pre-cleaned copper tubing is provided. Your installation might require an additional length of tubing. | 00301-22701   |
|  | Brass Swagelok-type 1/8-in. nut  | 00101-15500   |
|  | 2-piece brass 1/8-in. ID ferrule   | 00101-08500 (front)<br>00101-02500 (back)                     |
|  | Stainless steel Swagelok 1/8-in. ID nut  | 00101-07-00004  |
|  | 2-piece stainless steel 1/8-in. ID ferrule set   | 00101-08-00009  |
|  | Connection for the opposite end of the tubing to the UHP nitrogen gas source   | <b>Not provided in kit. You supply these parts.</b>           |

<sup>a</sup> For helium, it is recommended to use stainless steel tubing and stainless steel nut and ferrules, if available.

## Gases

Your system can use large amounts of gases during daily operations. It is essential that the gases be delivered with the necessary pressure and purity. See the following topics for information on the purity and pressure that your system requires:

- “Helium” on page 5-3
- “ETD Reagent Carrier Gas” on page 5-5
- “Nitrogen” on page 5-4
- “Argon” on page 5-6 (optionally for HCD collision gas)

**Caution** Contaminates introduced during the installation of house lines used for gas delivery can cause damage to the system. Ensure that all gas lines used with your system have been cleaned of all particulates and oils. You are responsible for any damage to the instrument caused by contaminants introduced from your gas delivery system. ▲

**Caution** Do not store gas cylinders where they can damage cables or gas lines, and secure them in accordance with standard safety practices. ▲

## Helium

The LTQ Orbitrap Series instrument uses helium as the collision gas for the linear trap. The helium supply must be ultra-high purity (99.999%) with less than 1.0 ppm each of water, oxygen, and total hydrocarbons. The required gas pressure is  $275 \pm 70$  kPa ( $2.75 \pm 0.7$  bar,  $40 \pm 10$  psi). Because particulate filters can be a source of contamination, Thermo Fisher Scientific does not recommend their use.

Helium can be dispensed from a tank containing 245 ft<sup>3</sup> of gas using Matheson regulator #3104C or equivalent tank and regulator.<sup>1</sup>

Gas lines for helium should be stainless steel. All gas lines should be free of oil and preferably flame dried. Helium gas supply lines should terminate with 1/8 inch, female, Swagelok™-type connectors.

**Note** Do not shut off the helium gas. A continuous flow of helium is required for the optimum performance of the mass spectrometer. Thermo Fisher Scientific recommends installing a separate helium supply for the LTQ Orbitrap Series instrument that is independent of a possibly available centralized supply. ▲

If you intend to use helium for sparging your LC solvents, a second tank and regulator is required.

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<sup>1</sup> For more information, visit [www.mathesongas.com](http://www.mathesongas.com) or consult a regulator supplier of your choice.

## Nitrogen

LTQ Orbitrap Series instruments use nitrogen as the API sheath gas, API auxiliary/sweep gas, Orbitrap™ bath gas—and HCD collision gas for instruments equipped with an HCD collision cell.

MALDI LTQ Orbitrap Series systems use nitrogen gas to maintain the pressure in the upper sample chamber of the MALDI source at 75 mTorr. LTQ Orbitrap XL ETD, Orbitrap Velos Pro ETD, and Orbitrap Elite ETD use nitrogen gas for cooling the reagent vials when the reagent ion source is turned off. The nitrogen supply must be high purity (99%). The required gas pressure is  $690 \pm 140$  kPa ( $6.9 \pm 1.4$  bar,  $100 \pm 20$  psi).

The nitrogen gas supply line should terminate with a 6 mm (1/4-in.), female, Swagelok™-type connector. Because particulate filters can be a source of contamination, Thermo Fisher Scientific does not recommend them.

**Note** You must provide a regulator for the nitrogen supply that is adjustable over the specified pressure range.<sup>1</sup> ▲

Typical nitrogen gas consumption (nitrogen on 24 hours per day) of a LTQ Orbitrap Series instrument is 5560 L (200 ft<sup>3</sup>) per day. Using the MALDI source in MALDI LTQ Orbitrap Series systems will reduce the nitrogen consumption. In case you intend to use nitrogen as HCD collision gas for LTQ Orbitrap Series instruments equipped with HCD collision cell, add the gas consumption that is specified in “Argon” on page 5-6 to calculate the total nitrogen consumption.

Thermo Fisher Scientific recommends that nitrogen be supplied from one of the following sources:

- A large, sealed, thermally insulated cylinder containing liquid nitrogen, from which the nitrogen is boiled off. The 230 psi model is recommended. The 35 and 80 psi models do not provide sufficient gas pressure. A typical cylinder of size 240 L yields 143 850 L (5080 ft<sup>3</sup>) of gas. The replacement frequency is approximately once every month.

Liquid nitrogen conversion factors:

- 1.0 lb of liquid nitrogen = 0.5612 L
- 1.0 kg of liquid nitrogen = 1.237 L

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<sup>1</sup> For more information, visit [www.mathesonigas.com](http://www.mathesonigas.com) or consult a regulator supplier of your choice.

- A nitrogen generator with minimum capacity of 5 560 L (200 ft<sup>3</sup>) per day at 99% purity with 100 psi at the side panel. Worst case consumption of nitrogen gas is 30 L/min (56 Standard Cubic Feet per Hour). Nitrogen generators require an air compressor. Some models of air compressors are quite noisy; therefore, be careful to select a quiet compressor. A generator is a continuous source with no replacement required.

**Note** When you turn on the LTQ Orbitrap Series system, the initial nitrogen surge might exceed the capacity of the nitrogen generator. This sudden surge causes a flow rate drop that can trigger a low nitrogen warning from the LTQ Orbitrap Series system. If low nitrogen warnings happen frequently, call your Thermo Fisher Scientific field service engineer. ▲

## ETD Reagent Carrier Gas

The ETD Module requires an additional ultra high-purity reagent carrier gas that is connected to the triple (oxygen/water/hydrogen) gas filter supplied in the ETD Accessory Kit (P/N 98000-62002) and then to the rear of the ETD Module as shown in the *LTQ Series Getting Connected Guide*.

Thermo Fisher Scientific strongly recommends a mixture of 25% helium and 75% nitrogen. This gas mixture must be ultra high-purity (minimum purity 99.999%) with less than 3.0 ppm each of water, oxygen, and total hydrocarbons. The required gas pressure is  $690 \pm 140$  kPa ( $6.9 \pm 1.4$  bar,  $100 \pm 20$  psi). This mixture is available in the United States from Airgas (P/N X02NI75C200F464). Another supplier is Air Liquide.

The ETD Module consumes less than 1 mL per minute (1.5 L or 88 in.<sup>3</sup> per day) of reagent carrier gas (gas on 24 hours per day), so a standard large bottle (245 ft<sup>3</sup>) of gas lasts approximately two years.

The helium in this mixture serves as a tracer gas to enable leak checking of gas connections using conventional thermal conductivity-based leak detectors, which are widely used to check leaks in gas chromatography equipment.

If the helium/nitrogen mixture is not available, then use a nitrogen supply that is ultra high-purity (99.999%) with less than 3.0 ppm each of water, oxygen, and total hydrocarbons. The required gas pressure is  $690 \pm 140$  kPa ( $6.9 \pm 1.4$  bar,  $100 \pm 20$  psi).

**Note** A nitrogen generator does not produce nitrogen of a sufficient purity to be used as the ETD reagent carrier gas. ▲



The triple gas filter, when installed between the regulator on the gas source and the ETD Module, further ensures that the reagent carrier gas (either nitrogen or helium/nitrogen) is better than 99.999% pure with much less than 1 ppm of oxygen, water, and hydrocarbons.

Refer to the filter manufacturer's instructions for information about how to monitor the color changes in the filters that indicated when the filters need to be replaced, as well as information about where to order new filters. If there are no leaks in the reagent carrier gas plumbing, you can expect the filters to last a year or more. Thermo Fisher Scientific strongly recommends that a Thermo Fisher Scientific field service engineer replace the gas filters.

You must provide a regulator for either gas supply that is suitable for such ultra high-purity grade gas. Generally, a two-stage regulator with a machined brass body and an elastomer-free metal diaphragm is adequate. The regulator should be able to stably output the specified nominal pressure of  $100 \pm 20$  psig (relative to atmosphere) and have a 1/8 inch Swagelok-type compression fitting output connection. Your gas supplier should be able to recommend a suitable regulator that connects to the high pressure connection on their gas bottles. The ETD Accessory Kit contains pre-cleaned copper tubing to connect this carrier gas supply to the gas filter and the gas filter to the rear of the ETD Module. If your installation requires more copper tubing than is supplied in the kit, use only GC-cleaned copper tubing or flame dried stainless steel tubing.

**Note** Do not shut off the reagent carrier gas. Optimum performance of the LTQ Orbitrap Series mass spectrometer requires a continuous flow of reagent carrier gas. ▲

## Argon

LTQ Orbitrap XL instruments can optionally use argon as HCD collision gas. The argon supply should be high purity (99.99%). The required gas pressure is  $690 \pm 140$  kPa ( $6.9 \pm 1.4$  bar,  $100 \pm 20$  psi).

The argon gas supply line should terminate with a 6 mm (1/4-in.), female, Swagelok™-type connector. Particulate filters can be a source of contamination, they are not recommended.

Typical argon gas consumption (argon on 24 hours per day) is 30 L (1 ft<sup>3</sup>) per day.

## Solvent Recommendations

The solvents listed in [Table 5-2](#) are useful in operating and maintaining your LTQ Orbitrap Series instrument. Installation of the instrument requires LCMS grade methanol and water. Solvent modifiers might also be required during the installation of some systems.

Some solvent impurities are transparent to UV/VIS detectors. Therefore, some LCMS grade solvents might contain contaminants that interfere with the performance of the mass spectrometer. For operation of your LTQ Orbitrap Series instrument, choose high purity solvents with minimum contamination. You can order specific chemicals from Thermo Fisher Scientific, which are sold under its Fisher Chemical brand. As specified in [Table 5-2](#), use only LCMS grade chemicals for operating your LTQ Orbitrap Series system.

**Table 5-2.** Recommended solvents and reagents

| Solvent / Reagent      | Specifications  | Fisher Chemical P/N |
|------------------------|---|---------------------|
| Methanol               | LCMS grade  | A456-4              |
| Acetonitrile           | LCMS grade  | A955-4              |
| Water                  | LCMS grade  | W6-4                |
| Isopropyl alcohol      | LCMS grade  | A461-4              |
| Acetic acid (modifier) | LCMS grade  | A507-500 or A35-500 |
| Formic acid (modifier) | 99–100% (This acid must be supplied in a glass bottle.) | A117-50             |

For a complete selection of LCMS-grade consumables from Fisher Scientific, visit [www.FisherLCMS.com](http://www.FisherLCMS.com).

**Note** Do not filter solvents. Filtering solvents can introduce contamination. ▲

**Note** For some MALDI applications or high sensitivity analysis in MALDI, Thermo Fisher Scientific suggests using highest purity grade water stored in appropriate plastic bottles (no glass). ▲

Store and handle all chemicals in accordance with standard safety procedures.

## Cooling Water

LTQ Orbitrap Series instruments are shipped with a Thermo Scientific NESLAB ThermoFlex 900 recirculating chiller with closed circuit, cooled by a refrigerating device. The chiller makes the mass spectrometer independent from any cooling water supply.

### Technical Data of Recirculating Chiller

|   |  |
|---|--|
| Cooling capacity:                                   | 0.90 kW (60 Hz), 0.75 kW (50 Hz)   |
| Water temperature:                                  | 5–40 °C (41–104 °F)  |
| Stability of temperature regulation:                | ±0.1 °C (±32.2 °F)   |
| Unit dimensions ( <i>h</i> × <i>w</i> × <i>l</i> ): | 69.4 cm × 35.7 cm × 62.4 cm<br>(27 5/16 in. × 14 1/16 in. × 24 9/16 in.) |
| Unit weight:  | 57.2 kg (126 lb)   |

### Connecting the Chiller

Use a wall outlet to provide the electric power for the chiller. (See [Table 4-2](#) on [page 4-4](#) for specifications.) Two water hoses (black), internal diameter 9 mm, wall thickness 3 mm, length approximately 3 m (~10 ft) are shipped with the instrument. The hoses are connected to the ports at the right side of the MS.

### Water Conditions

The water temperature is not critical, but should be in the range of 20 to 25 °C (68 to 77 °F). Lower temperatures could lead to a condensation of atmospheric water vapor. It is recommended to use distilled water rather than de-ionized water due to lower concentration of bacteria and residual organic matter.

The water should be free of suspended matter to avoid clogging of the cooling circuit. In special cases, an in-line filter is recommended to guarantee consistent water quality.

The cooling water should meet the following requirements:

|                         |           |
|-------------------------|-----------|
| Hardness:               | <0.05 ppm |
| Resistivity:            | 1–3 MΩ/cm |
| Total dissolved solids: | <10 ppm   |
| pH:                     | 7–8       |

## Cleaning Agents

We recommend having the following cleaning agents available:

- A solvent like acetone (in accordance with your local safety practices).
- A detergent, for example RBS 50 (trade name of Messrs. Carl Roth, Karlsruhe, Germany).
- Several liters of distilled water.



## Chapter 6 Exhaust and Waste

The performance of your system can be affected by the waste and exhaust arrangements for the instrument. Vacuum and solvent wastes must be vented separately, and wastes must be collected and disposed of properly.

**Note** It is your responsibility as the user to provide proper waste and exhaust systems for the operation of your system. ▲

More information on each of the requirements is available under the following topics:

- “Exhaust System” on page 6-2
- “Solvent Waste” on page 6-4

## Exhaust System

Thermo Fisher Scientific strongly recommends connecting the forepumps to a fume exhaust system. The forepumps eventually exhaust much of what is introduced into the mass spectrometer, including the small amount of oil vapor that mechanical pumps can emit. It is your responsibility to provide an adequate exhaust system.

**Note** An efficient fume exhaust system is required for the proper operation of your forepumps. Most API applications contribute to the accumulation of solvents in the forepumps. These solvents must be purged from the mechanical pump oil periodically by opening the ballast valves located on the top of the pumps. When the ballast valves are opened, a large volume of volatile solvent waste might enter the fume exhaust system. Therefore, your fume exhaust system must be able to accommodate the periodic purging of the solvents. The frequency of the purging is dependent on the throughput of your system. ▲

The forepumps (also referred to as a mechanical, rotary-vane, roughing, or backing pumps) provide a vacuum for the API source and backing pressure for the turbomolecular pumps.

The exhaust port of the rotary pumps should be connected to an exhaust gas line leading out of the building or exhaust system. The inner diameter of the pipe should be at least 25 mm (1 in.). An exhaust hose for connecting the forepumps to the exhaust system comes with the system (P/N 0690720) and is 5 m (16 ft) long. It has dimensions of 13 mm (1/2 in.) ID and 20 mm (25/32 in.) OD. The exhaust system for the forepumps must be able to accommodate an initial inrush flow rate of 3 L/min and a continuous flow rate of 1 L/min.

**Note** Do not route exhaust tubing from the pumps vertically toward the ceiling. To maintain pump integrity, route the tubing from the exhaust port down to the floor. ▲

**Note** The exhaust hose should travel at floor level for a minimum of two meters (78.5 in.) before it reaches the external exhaust system. This tubing acts as a trap for exhaust fumes that would otherwise recondense in the forepump oil. ▲

## Ventilation

Most of the nitrogen that is introduced into the API source (about 5000 L or 180 ft<sup>3</sup> per day) escapes into the laboratory atmosphere. Therefore, provide for good air exchange to prevent accumulation of gaseous nitrogen in the laboratory.



**Warning** **Danger of Asphyxiation.** Accumulation of nitrogen gas could displace sufficient oxygen to suffocate personnel in the laboratory. Ensure that the laboratory is well ventilated. ▲



## Solvent Waste

Because the Ion Max API source can accommodate high flow rates, you must collect the waste solvent in a manner that avoids pressure buildup in the source. The Ion Max API source is fitted with a 25.4-mm (1.0-in) OD outlet for solvent drainage. A 25.4-mm to 12.7-mm (1-in to 0.5-in) reducing fitting (P/N 00101-03-00001) connects to a waste container (P/N 00301-57020), both of which come with the system. To avoid pressure buildup in the source, make sure that the 1-inch diameter hose from the API source drain to the reducing fitting (P/N 00101-03-00001) is as long as possible. The 25.4-mm (1-in) diameter Tygon™ tubing (P/N 00301-01-00020) that comes with the system is 1.52 m (5 ft) long.



**Warning Health Hazard.** The interior of the Ion Max API source housing contains parts that might be at high temperatures or high voltages. To prevent users from inadvertently touching such parts, always operate the Ion Max API source with the drain tubing assembly mounted to the source housing drain. ▲

**Caution** Do **not** vent the drain tubing (or any vent tubing connected to the waste container) to the same fume exhaust system to which you have connected the forepump. ▲

## Chapter 7 Instrument Arrival

When your lab site preparation is completed, the “[LTQ Orbitrap Series Installation Request Form](#)” has been mailed or faxed to your Thermo Fisher Scientific office, and the system is delivered, please call your Thermo Fisher Scientific office to arrange for an installation date. Refer to the Installation Request Form at the beginning of this guide. Telephone and fax numbers for Thermo Fisher Scientific offices are listed immediately following the Installation Request Form.

LTQ Orbitrap Series instruments are transported either by carriers who specialize in the handling of delicate machinery, or for long distance shipment by airfreight. Occasionally, however, equipment inadvertently does get damaged in transit.

Please take the following precautions when receiving material:

- Check carefully for obvious damage or evidence of rough handling.
- If external damage is apparent, take photographs, note this fact on all copies of the receiving documents and describe briefly the extent of the damage. The driver should sign (or initial) next to your comments to signify agreement with your observations.
- Contact the appropriate local Thermo Fisher Scientific office to report the damage and—please—let the Thermo Fisher Scientific people check for further damage.

**Note** Freight insurance requires that obvious damage be noted on the receiving documents. Thermo Fisher Scientific will not accept liability for damage if materials are received with obvious damage and the damage is not recorded on the receiving documents. ▲

When your system arrives, move it to a protected location indoors, preferably the installation site. Take the specifications described in “[Temperature](#)” on [page 3-2](#) as a guideline for the temperature in the storage room. If you have questions about moving your system, contact your local Thermo Fisher Scientific office.

## **Transportation Risk**

Transportation risk depends on the terms of delivery agreed. The terms of shipment determine who has responsibility for filing a claim against the carrier if the system is damaged in transit.

## Chapter 8 Installation

Prior to installation, make sure that all preparations described in the previous chapters are complete.

**Note** If the instrument shipping container, ShockWatch™, or other indicator shows any evidence of damage or mishandling during shipment, do NOT open the container. Call your Thermo Fisher Scientific representative for instructions on what to do. If the system arrives safely, proceed with the following instructions. ▲

When your lab site preparation is completed, the “[LTQ Orbitrap Series Installation Request Form](#)” has been mailed or faxed to your local office for Thermo Scientific products, and the system is delivered, please call your Thermo Fisher Scientific office to arrange for an installation date. Refer to the Installation Request Form at the beginning of this guide. Telephone and fax numbers for offices for Thermo Scientific products are listed immediately following the Installation Request Form.

More information on each of the requirements is available under the following topics:

- “[Preparing the Installation](#)” on [page 8-2](#)
- “[Advanced Training Courses](#)” on [page 8-7](#)
- “[Preventive Maintenance](#)” on [page 8-8](#)

## Preparing the Installation

This topic provides advice for preparing the installation of the instrument.

**Caution** Store the instrument in a protected location indoors. Take the specifications described in “Temperature” on page 3-2 as a guideline for the temperature in the storage room. ▲

## Chemicals Needed for Installation

The chemicals listed in Table 8-1 are needed for installation. They are not contained in the LTQ Orbitrap Series package but will be shipped in a separate package as part of the Preinstallation Kit.

**Note** The installation will not begin until the arrival of all chemicals listed in Table 8-1! ▲

**Table 8-1.** Calibration compounds for LTQ Orbitrap Series instruments

| Calibrant  | Instruments  | Product Number |
|--|--|----------------|
| Pierce LTQ ESI Positive Ion Calibration Solution       | LTQ Orbitrap, LTQ Orbitrap Discovery, LTQ Orbitrap XL  | 88322          |
| Pierce LTQ Velos ESI Positive Ion Calibration Solution | LTQ Orbitrap Velos, Orbitrap Velos Pro, Orbitrap Elite | 88323          |
| Pierce ESI Negative Ion Calibration Solution           | All LTQ Orbitrap Series instruments                    | 88324          |

You can order ready-to-use calibration solutions from [www.thermo.com/pierce](http://www.thermo.com/pierce) or [www.fishersci.com](http://www.fishersci.com). The prepared calibration solutions are shipped at ambient temperature and stable at 2–8 °C for 1.5 years.

## Chemical Kits, Equipment, and Consumables for the MALDI Source

If your LTQ Orbitrap Series instrument is equipped with the MALDI source, ensure that you have these items available before your system is installed. The equipment and materials listed in this topic are also required for many routine operational tasks.

## Required Chemical and Accessory Kits for MALDI

The required chemical and accessory kits are the following:

- ProteoMass™ Calibration Kit available from Thermo Fisher Scientific (P/N HAZMAT-01-0033) or Sigma-Aldrich™ (P/N MSCAL4, call 1-800-325-5832), which contains the chemicals needed to tune and calibrate the instrument in the MALDI mode. The MALDI Preinstallation material checklist contains ordering information.

**Note** Because the kit contains protein mixes that require refrigeration, make sure that you specify a shipping location where the appropriate personnel are available to receive the kit. ▲

- MALDI Accessory Kit (P/N 97155-62025), which contains laser protective eye wear, tools, swabs, gloves, and other items and is shipped with the MALDI system.

## Optional Kits for MALDI

The following kits may be required for installing optional devices for the LTQ Orbitrap Series/MALDI system:

- Tissue Imaging Kit for the LTQ Orbitrap Series/MALDI system
- API Kit for the LTQ Orbitrap Series/MALDI system (P/N 97155-97123), which contains the necessary parts to convert the system to the API mode.

## Equipment for MALDI

The following equipment is required for installing the LTQ Orbitrap Series/MALDI system:

- Sonication bath large enough to hold 1 L beaker
- Microcentrifuge<sup>1</sup>
- Vortexer<sup>1</sup>
- Pipettors (2.5 µL, 200 µL, and 1000 µL recommended; additional sizes may be useful.)<sup>1</sup>
- Analytical balance
- Refrigerator for storing the ProteoMass Calibration Kit

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<sup>1</sup> Available from Thermo Fisher Scientific, see [www.thermoscientific.com](http://www.thermoscientific.com).

## Consumables for MALDI

The following consumables are required for installing the LTQ Orbitrap Series/MALDI system:

- Microcentrifuge tubes (500 µL)
- Disposable tips for pipettors<sup>1</sup>
- Optical lens wipes or soft clean room wipes
- Can of compressed difluoroethane (sold as “compressed air” for dust removal)
- Amber vials to store light sensitive chemicals

## Chemicals and Solvents for MALDI

The following chemicals and solvents are required for installing the LTQ Orbitrap Series/MALDI system:

- Water
- Isopropyl alcohol
- Methanol
- Acetonitrile
- Acetone
- Trifluoroacetic acid (TFA)
- 28 to 30% Ammonium hydroxide solution

**Note** All chemicals and solvents should be HPLC grade or better. ▲

## ETD Kits

The following chemicals and solvents are required for installing the LTQ Orbitrap Series ETD system:

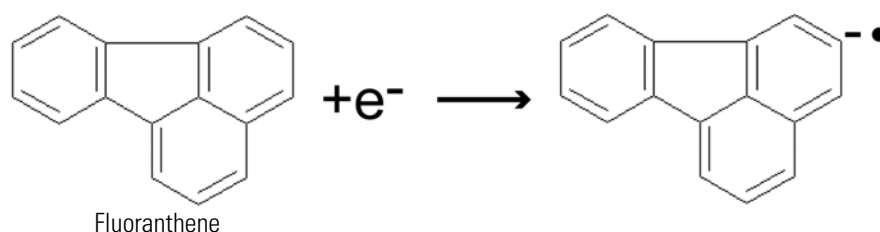
- ETD Accessory Kit for the ETD Module (P/N 98000-62002), which contains filaments and other items as well as the gas filter kit, pre-cleaned copper tubing, and fittings to connect it to the ETD Module and the reagent carrier gas supply.
- ETD Ship Kit for the ETD Module (P/N 98000-620004)
- Reagent Kit for the ETD Module (P/N 98000-62008)

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<sup>1</sup> Available from Thermo Fisher Scientific, see [www.thermoscientific.com](http://www.thermoscientific.com).

## Fluoranthene

Fluoranthene is used as the Electron Transfer Dissociation (ETD) reagent in the ETD Module portion of an LTQ Orbitrap Series ETD system. The fluoranthene radical anion is generated according to the reaction shown in Figure 8-1.



**Figure 8-1.** ETD Reagent (fluoranthene radical anion) generation from fluoranthene

Fluoranthene is potentially hazardous. Use it in accordance with its MSDS.

**Note** Store and handle all chemicals in accordance with standard safety procedures. The Material Safety Data Sheet (MSDS) describing the chemicals being used should be freely available to lab personnel for them to examine at any time. Material Safety Data Sheets (MSDSs) provide summarized information on the hazard and toxicity of specific chemical compounds. The MSDS also provides information on the proper handling of compounds, first aid for accidental exposure, and procedures for cleaning spills or dealing with leaks. Producers and suppliers of chemical compounds are required by law to provide their customers with the most current health and safety information in the form of an MSDS. Read the MSDS for each chemical you use. Dispose of all laboratory reagents in the appropriate way (see the MSDS). ▲

The fluoranthene contained in the ETD Reagent Kit (P/N 98000-62008) is Sigma/Aldrich Supelco #48535. The fluoranthene MSDS is obtained from the MSDS link at:

[www.sigmaaldrich.com/catalog/search/ProductDetail/SUPELCO/48535](http://www.sigmaaldrich.com/catalog/search/ProductDetail/SUPELCO/48535)

Thermo Fisher Scientific supplies fluoranthene as a two vial kit. One vial contains 150 mg of fluoranthene and the other is the required empty vial.



## Unpacking the System

It is the policy of Thermo Fisher Scientific that the customer should not unpack the system or accessory items prior to installation of the system.

Two exceptions to this policy are as follows:

- You are encouraged to locate the Operating Manuals and to begin to become familiar with the operation of the instrument.
- Where buck / boost transformers or power conditioning units are supplied, it is the customers responsibility to have these units installed by an electrician prior to instrument installation.

## Installing the System

When your new LTQ Orbitrap Series system is on site and ready for installation, a Thermo Fisher Scientific field service engineer will install it.

During the installation, the service engineer will demonstrate the following:

- The basics of equipment operation and routine maintenance.
- The marketing specifications that are in force at the time of the purchase of the system.

To receive maximum benefit from this on-site training opportunity, the key operator should be available during the entire installation process.

**Note** Consumables sent with the system are intended for use by the service engineer during the installation. It is the responsibility of the customer to replace any consumables used during the installation. ▲

Do not plan to use your new system for sample analysis until the installation is complete and you have signed the Acceptance Form.

## Key Operator

Experience has shown that the maximum benefit can be derived from a scientific instrument if there is one person, a key operator, who has major responsibility for that instrument. It is recommended that you designate a key operator to oversee the operation and maintenance of the system in your laboratory. This person will also be the key figure in the communication between your laboratory and Thermo Fisher Scientific.

## Advanced Training Courses

Thermo Fisher Scientific provides both introductory and advanced training courses in analytical techniques, together with specialized operation and maintenance courses for Thermo Scientific products.

It is also recommended that some months after your LTQ Orbitrap Series system has been installed, the key operator receive an advanced training for the operation and maintenance of the system from Thermo Fisher Scientific. After this training, the key operator can conduct an in-house training program on your site for your own people and certify others to operate the instrument.

For information concerning course schedules and fees, please contact the following address or your local Thermo Fisher Scientific office:

Thermo Fisher Scientific  
Hanna-Kunath-Str. 11  
28199 Bremen

Germany

Phone: +49 (0) 421 - 54 93 0

Fax: +49 (0) 421 - 54 93 426

E-mail: [training.bremen@thermo.com](mailto:training.bremen@thermo.com)

## MALDI Training Courses

In case you have your LTQ Orbitrap Series instrument equipped with a MALDI source, it is recommended to receive a MALDI training first and then to get a LTQ Orbitrap Series instrument training.

For information concerning course schedules and fees for MALDI training courses, please contact the following address or your local Thermo Fisher Scientific office:

Thermo Fisher Scientific  
355 River Oaks Parkway  
San Jose, California  
95134

USA

## Preventive Maintenance

Routine and preventive maintenance of LTQ Orbitrap Series mass spectrometer and data system is in the user's responsibility. Included in this category are exchange of pump oil, replacement of filters, and alike on a regular basis. Please refer also to the manufacturers manuals shipped with the instrument—especially for the maintenance of mechanical pumps and turbopumps.

Regular preventative maintenance is essential. Regular preventive maintenance will increase the life of the system, result in maximum uptime of your system, and provide you with optimum system performance. Maintenance techniques are covered in the following manuals:

- *LTQ Orbitrap XL Hardware Manual, LTQ Orbitrap XL ETD Hardware Manual, LTQ Orbitrap Velos Hardware Manual, or Orbitrap Elite Hardware Manual*
- *LTQ XL Hardware Manual or Velos Pro Hardware Manual*
- Manuals that come with your data system computer and other modules of your system

In case your instrument is equipped with the MALDI source, see also the following manuals for maintenance advice:

- *MALDI Source Hardware Manual*
- *MALDI Source Getting Started*

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