LTQ Orbitrap™
Preinstallation Requirements Guide

118 8320 Revision B - December 2005

Thermo
ELECTRON CORPORATION

Technical information contained in this publication is for reference purposes only and is subject to change without notice. Every effort has been made to supply complete and accurate information; however, Thermo Electron Corporation assumes no responsibility and will not be liable for any errors, omissions, damage, or loss that might result from any use of this manual or the information contained therein (even if this information is properly followed and problems still arise).
This publication is not part of the Agreement of Sale between Thermo Electron Corporation and the purchaser of a Thermo Electron system. In the event of any conflict between the provisions of this document and those contained in Thermo Electron Corporation's Terms and Conditions, the provisions of the Terms and Conditions shall govern. System Configurations and Specifications supersede all previous information and are subject to change without notice.

Printing History: Revision B printed in December 2005.

LTQ Orbitrap Preinstallation Checklist

Please refer to the LTQ Orbitrap Preinstallation Requirements Guide (118 8320) 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. The floor is certified to meet the load requirements of the system (682 kg or 1500 lbs), refer to "Space and Load Requirements" on page 2-4?

2: **Yes** **No** Your LTQ Orbitrap has been delivered and is either in the laboratory or can be delivered immediately on the arrival of the installation engineer?

3: **Yes** **No** 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? Refer to "Entrance" on page 2-2.

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, refer to "Vibration" on page 3-4

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, refer to "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), refer to "Temperature" on page 3-2.

11: **Yes** **No** The key operator (refer to "Key Operator" on page 8-5) will be available during the installation period and 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 name for these individuals:

_____

12: **Yes** **No** The relative humidity is between 50% and 80%, with no condensation, refer to "Humidity" on page 3-3.

13: **Yes** **No** The system work area is free from magnetic disruption and electrostatic discharge, refer to "Electrostatic Discharge" on page 3-6.

14: **Yes** **No** All gases required are on site, gas lines are installed, and appropriate gas regulators are available, refer to "Gases" on page 5-3.

List gases and purtiy:_____

15: **Yes** **No** Is there a suitable exhaust system, refer to "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** Have any special acceptance specifications been agreed within the contract?
If **YES**, please attach full details of specification.

19: **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 Electron LTQ Orbitrap. 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 Electron will make every effort to reschedule an installation as soon as possible with the next available representative.

Signed: _____ Print Name: _____

Company name:_____

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 Electron Bremen Products

North America

Northeastern Region

255 Old New Brunswick Road, Suite N-40
Piscataway, NJ 08854
Phone ..... [1] (732) 981-0390
Fax ..... [1] (732) 981-0029

Southern Region

665 Molly Lane, Suite 140
Woodstock, GA 30189
Phone ..... [1] (770) 516-5589
Fax ..... [1] (770) 516-6916

Central Region

1201 E. Wiley Road, Suite 160
Schaumburg, IL 60173
Phone ..... [1] (847) 310-0140
Fax ..... [1] (847) 310-0145

Western Region

355 River Oaks Parkway
San Jose, CA 95134
Phone ..... [1] (408) 965-6000
Fax ..... [1] (408) 965-6123

Canada

5716 Coopers Avenue, Unit 1
Mississauga, Ontario, L4Z 2E8
Phone ..... [1] (905) 712-2258
Fax ..... [1] (905) 712-4203

Europe

Austria

Wehlistrasse 27b
1200 Wien, Austria
Phone ..... [43] (01) 333 50 34-0
Fax ..... [43] (01) 333 50 34-26

Belgium

Technologiestraat 47
1082 Brussels, Belgium
Phone ..... [32] (02) 482 30 30
Fax ..... [32] (02) 482 30 31

France

(also representing French speaking N. Africa, Algeria, Morocco, and Tunisia)

16 Avenue du Québec
Silic 765
Z.A. de Courtaboeuf
91963 Les Ulis Cédex, France
Phone ..... [33] (01) 60 92 48 00
Fax ..... [33] (01) 60 92 49 00

Germany

Im Steingrund 4-6
63303 Dreieich, Germany
Phone ..... [49] (06103) 408 0
Fax ..... [49] (06103) 408 1222

Italy

Strada Rivoltana
20090 Rodano (Milano), Italy
Phone ..... [39] (02) 95 059 1
Fax ..... [39] (02) 95 059 219

Netherlands

Takkebijsters 1
4817 BL Breda, Netherlands
Nederland
Phone ..... [31] (076) 587 8722
Fax ..... [31] (076) 571 4171

Spain

Sepulveda 7 A
28108 Alcobendas (Madrid), Spain
Phone ..... [34] (091) 657 4930
Fax ..... [34] (091) 657 4937

Notes: The country code is enclosed in square brackets [ ]. The city code or area code is enclosed in parenthesis ( ). For countries other than the U.S.A., when you are dialing from within the specified country, dial the 0 of the city code. For countries other than Italy, when you are dialing from outside the country, do not dial the 0 of the city code.

Offices for Thermo Electron Bremen Products - Continued

Europe - Continued

Spain

Acer 30-32
Edificio Sertram – Planta 2, Modulo 3
08038 Barcelona, Spain
Phone ..... [34] (093) 223 0918
Fax ..... [34] (093) 223 0982

Sweden

Pyramidbacken 3
141 75 Kungens Kurva (Stockholm), Sweden
Phone ..... [46] (08) 556 468 00
Fax ..... [46] (08) 556 468 08

United Kingdom

Stafford House
1 Boundary Park
Boundary Way
Hemel Hempstead
Hertfordshire HP2 7GE
United Kingdom
Phone ..... [44] (01442) 233 555
Fax ..... [44] (01442) 233 667

Australia and Asia

Australia

P.O. Box 239 Rydalmere
Unit 14, Metro Center
38 - 46 South Street
Rydalmere, N.S.W. 2116
Phone ..... [61] (02) 9898-9000
Fax ..... [61] (02) 9898-9800

Japan

C-2F, 3-9, Moriya-cho, Kanagawa-ku,
Yokohama-shi, Kanagawa,
221-0022 Japan
Phone ..... [81] (45) 453-9100
Fax ..... [81] (45) 453-9110

P.R. China

Room 912-916, Ping-an Mansion
No. 23, Jin Rong Street
Xi Cheng District
Beijing 100032
Phone ..... [86] (010) 6621 0839
Fax ..... [86] (010) 6621 0851

Übereinstimmungserklärung gemäß EN 45014

Declaration of conformity according to EN 45014
Dichiarazione di conformità alla EN 45014

Name des Herstellers:
manufacturers name
nome produttore

Thermo Electron (Bremen) GmbH

Adresse des Herstellers:
manufacturers address
indirizzo produttore

Hanna-Kunath-Strasse 11
28199 Bremen
Germany

erklärt, dass das Produkt
declares that the following product
dichiara che il seguente prodotto

LTQ Orbitrap

mit den folgenden Produktspezifikationen übereinstimmt:
complies with the following product specifications
rispetta le seguenti specifiche del prodotto

EMV (Störemissionen): EMC (emissions) 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)
EMV (Störfestigkeit): EMC (immunity) 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)
Elektrische Sicherheit: electrical safety sicurezza elettrica	EN 61010-1
Ergänzende Informationen: complementary information informazioni complementari	

Dieses Produkt erfüllt die EMV-Richtlinie 89/336/EWG und Niederspannungsrichtlinie 73/23/EWG.
This product complies with EMC directive 89/336/EEC and Low Voltage Directive 73/23/EEC.
Questo produtto rispetta la direttiva 89/336/EEC e la direttiva 73/23/EEC.

Bremen, Germany, 8/10/2005

Thermo
ELECTRON CORPORATION

Technischer Leiter:
Operations Manager
Direttore fabrizione

Thermo
ELECTRON CORPORATION

Notice on Lifting and Handling of Thermo Electron Bremen Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Electron Bremen 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 Electron Bremen Instruments

In compliance with international regulations: If this instrument is used in a manner not specified by Thermo Electron Bremen, the protection provided by the instrument could be impaired.

Read This First

Welcome to the Thermo Electron, LTQ Orbitrap system! The LTQ Orbitrap is a member of the Thermo Electron family of advanced mass spectrometer (MS) detectors.

This *LTQ Orbitrap Preinstallation Requirements Guide* provides you with information that will assist you in planning for and preparing your lab site prior to delivery and installation of your system.

The *LTQ Orbitrap 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 the MS detector 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 Service Engineer for installation of the system.

Changes to the Manual

To suggest changes to this manual, please send your comments to:

Editors, Technical Documentation
Thermo Electron (Bremen) GmbH
Advanced Mass Spectrometry
Hanna-Kunath-Str. 11

28199 Bremen

Germany

documentation@thermo-bremen.com

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

Typographical Conventions

Typographical conventions have been established for Thermo Electron manuals for the following:

- Data input
- Admonitions
- Topic headings

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 on **Close**".

Admonitions

Admonitions contain information that is important, but not part of the main flow of text.

Admonitions can be of the following types:

- **Note** – information that can affect the quality of your data. In addition, notes often contain information that you might need if you are having trouble.
- **Caution** – information necessary to protect your instrument from damage.
- **Warning** – hazards to human beings. Each Warning is accompanied by a Warning symbol.

Topic Headings

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

Chapter Name

The following headings appear in the left column of each page:

Second Level Topics

Third Level Topics

Fourth Level Topics

Safety and EMC Information

In accordance with our commitment to customer service and safety, these instruments have 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.

Caution 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. ▲

Identifying Safety Information

The *LTQ Orbitrap Preinstallation Requirements 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. The symbols appear throughout the manual, where applicable, and are defined in Table i.

Table i. Warning Symbols

Symbol	Description
	**General** This general symbol indicates that a hazard is present, which if not avoided, could result in injuries. The source of danger is described in the accompanying text. ▲
	**Electric Shock** 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 or repair work is performed. ▲
	**Noxious** This symbol alerts to hazards resulting from noxious fumes. ▲
	**Hot Surface / Heat** Allow heated components to cool down before servicing them! ▲
	**Poisonous Gases** This symbol points to possible danger because of poisonous gases and vapors. ▲

Instrument-Specific Hazards

Every instrument has specific hazards, so be sure to read and comply with the following precautions. They will help ensure the safe, long-term use of your system.

1. 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.

2. Only use fuses of the type and current rating specified. Do not use repaired fuses and do not short-circuit the fuse holder.

3. 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.

4. Do not change the external or internal grounding connections. Tampering with or disconnecting these connections could endanger you and/or damage the system.

Caution 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. ▲

5. Never run the system without the housing on. Permanent damage can occur.

6. 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 Service Representative 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.)

7. Damage can also result if the instrument is stored for prolonged periods under unfavorable conditions (e.g. subjected to heat, water, etc.).

8. Always disconnect the power cord before attempting any type of maintenance.

9. Capacitors inside the instrument may still be charged even if the instrument is turned off.

10. Never try to repair or replace any component of the system that is not described in this manual without the assistance of your service representative.

Thermo
ELECTRON CORPORATION

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 Electron 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 Electron's compliance with these Directives, the recyclers in your country, and information on Thermo Electron products which may assist the detection of substances subject to the RoHS Directive are available at 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 Electron 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 Electron, die Verwerter und Hinweise die Ihnen nützlich sein können, die Thermo Electron Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden Sie unter www.thermo.com/WEEERoHS.

Thermo
ELECTRON CORPORATION

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 Electron 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 Electron à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Electron qui peuvent aider la détection des substances sujettes à la directive RoHS sont disponibles sur www.thermo.com/WEEERoHS.

Contents

Figures

Tables

Chapter 1 Introduction

Your LTQ Orbitrap instrument is on its way!

Information in this guidebook will help you to prepare a suitable site for installation of your system.

The LTQ Orbitrap MS detector is designed to operate reliably under carefully controlled environmental conditions.

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.

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.

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

Chapter 2 Site Preparation

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

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

Entrance

The entrance to your facility and the width of all hallways, elevators, etc., should have a minimum width of 89 cm (35 in).[1] However, additional room should be allowed for maneuvering the system around corners, into elevators, or through doorways.

The LTQ Orbitrap basic unit is shipped in a container with the following dimensions: *h* 162 cm (64 in), *w* 112 cm (44 in), *l* 174 cm (69 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 LTQ Orbitrap basic unit. They are given in Table 2-1.

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

*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 table.

[1]Your instrument is shipped in a shipping container, the smallest dimension of which is 112 cm (44 in). If the entrance to your laboratory will not accommodate a 112 cm container, you can remove the individual modules from the container before moving them into the room. If you remove the instrument from its shipping container before it is delivered to the lab site, be sure that all the contents of the container remain with the instrument.

Instrument Dimensions

The instrument has dimensions of ($l \times w \times h$) 1462.5 × 870 × 1414 mm (58 × 35 × 56 in). See Figure 2-1.

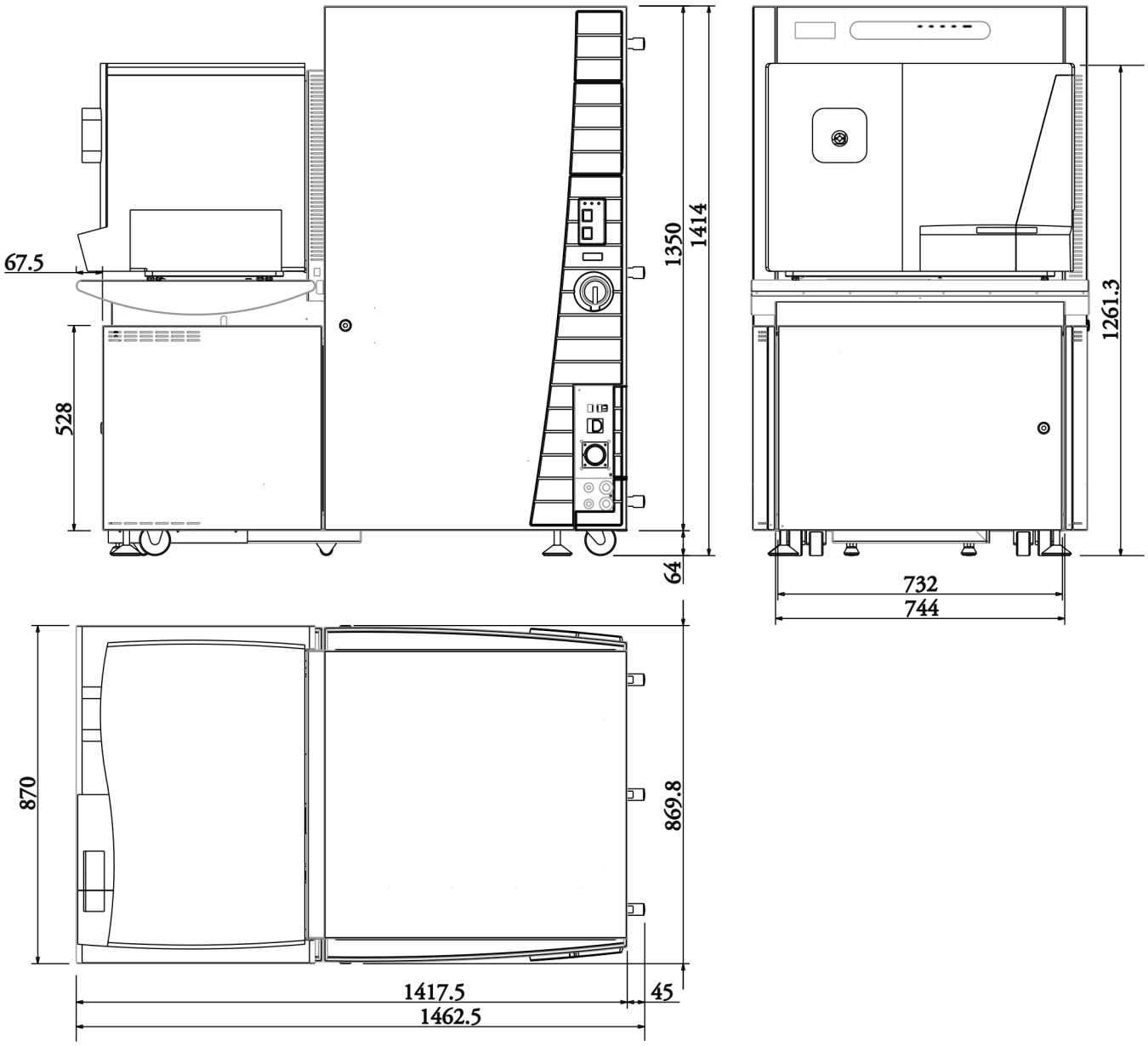

Figure 2-1. Instrument dimensions in mm

Space and Load Requirements

Minimum Floor Space

Wheels at the bottom side of the instrument facilitate positioning the LTQ Orbitrap 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.

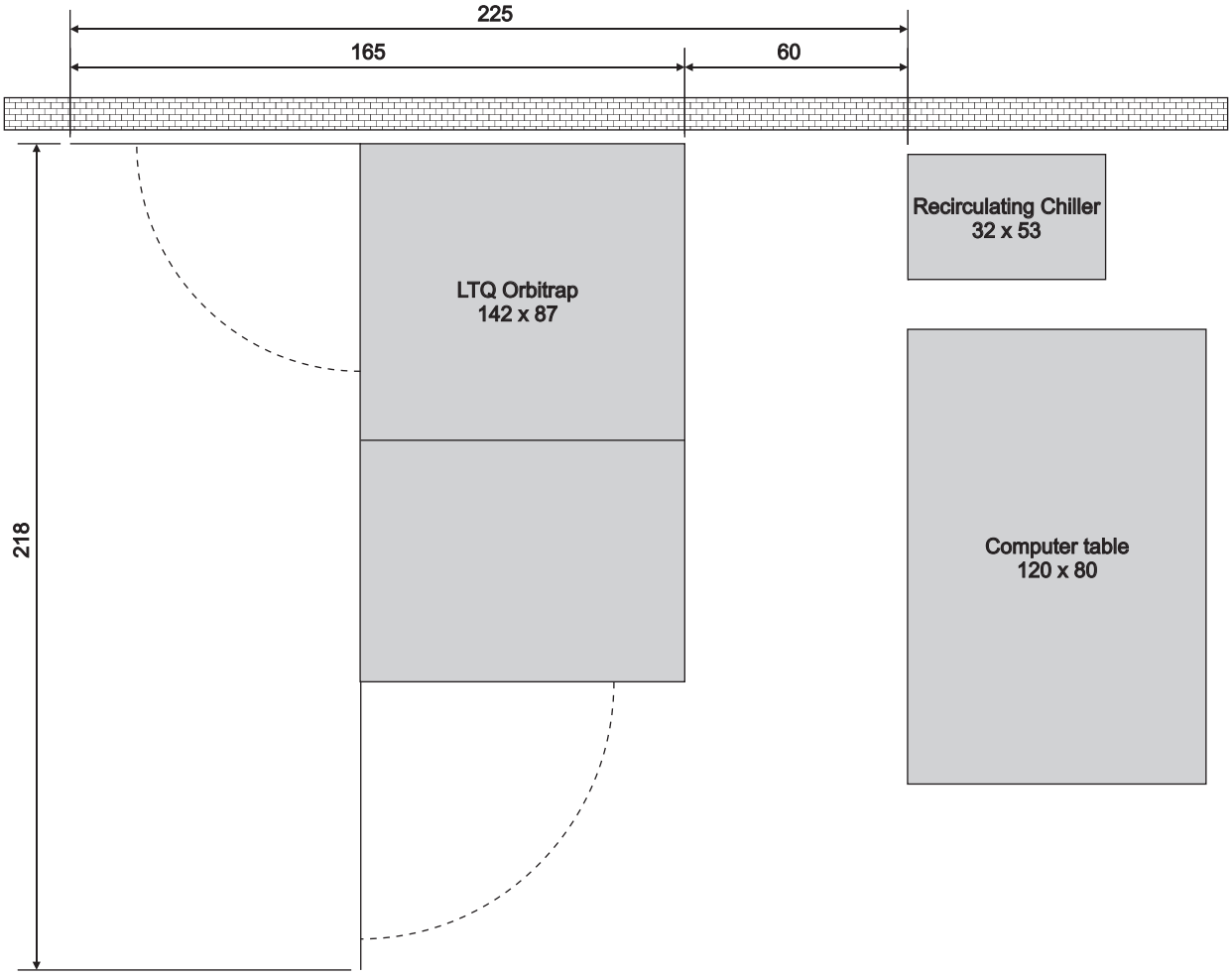

Figure 2-2. Space requirements for working with your LTQ Orbitrap system (dimensions in cm)

The footprint for the LTQ Orbitrap system is shown in Figure 2-2 on page 2-4. 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).

Load Distribution

The LTQ Orbitrap is supported by four height adjustable feet. The floor of your laboratory should be able to carry the weight of the installed LTQ Orbitrap with data system and recirculating chiller of approx. 682 kg (1500 lb). Also, consider the weight of any other option that is added to the system.

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 Electron Customer Service Engineer. The voice telephone outlet should be within 2 m (7 ft) of your system.

Chapter 3 Operating Environment

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

Attention to the operating environment will insure continued high performance of your LTQ Orbitrap 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.

Operating environment includes the following:

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 (available e.g. from Landis & Gyr, Polygyr RWX…, see www.landisgyr.com). This ensures temperature drifts within the limits given above.

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

The air conditioning load for a basic LTQ Orbitrap system (with recirculating chiller and a typical LC) is approximately 6.1 kW (21000 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 the LTQ Orbitrap MS detector, an LC, and the data system (with printer)

Module	Heat output in Watts	Heat output in BTU/h
LTQ Orbitrap MS detector	2800	9550
Liquid chromatograph	1080*	3690
Recirculating Chiller	1150	3920
Monitor	240	820
Computer	470	1640
Laser printer	350*	1230
Total	**6110**	**20850**

* 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 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. We encourage you to contact Emile de Leeuw at Emile.deLeeuw@Thermo.com if you have questions or concerns about your laboratory.

Thermo Electron has made vibration measurements of an environment where the LTQ Orbitrap is successfully operated. For your information, the data are listed in Table 3-2.[1]

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

[1]The relation between frequency, velocity and acceleration is given by the following equation:

Velocity [mm/s] = Acceleration [mm/s^2] / 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 MS detector 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 100000 particles per cubic foot in excess of 5 µm.

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 system is able to withstand electromagnetic fields of 10 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 Emile de Leeuw at Emile.deLeeuw@Thermo.com for advise. Because of the complexity of such influences, no general suggestion can be given in this booklet.

Electrostatic Discharge

Electrostatic discharge (ESD) can damage the electronic components of your LTQ Orbitrap system.

Thermo Electron instruments are designed to withstand electrostatic discharges (ESD) up to 1 kV (air discharge) and 8 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 a variety of 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 35000 V of electrostatic potential can be generated on the surface of your body. A similar trip 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, the following precautions are recommended, 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.
- Do not place Styrofoam cups or packing materials on the instrument.

Chapter 4 Line Power

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

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

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

Available Outlets

The LTQ Orbitrap is 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 ±10%."

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

- Nominal voltage of 230 V ac, ±10%, frequency of 50/60 Hz
- Three phases, 5-wire system in Y configuration (neutral wire connected to earth). Please refer to section "Delta-to-Y Conversion Transformer" on page 4-8 for further information.
- A wall receptacle, each phase fused with 16 A.
- Additional single-phase wall outlets (for computer, monitor and printer) Nominal voltage 230 V±10%, 50 or 60 Hz ac, fused with 10 A

Note The LTQ Orbitrap system must have an earth ground hard-wired to the main panel. The interconnected power outlets for the LTQ Orbitrap 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 system should remain on and pumping continuously for optimum performance. ▲

Power Cables, Connectors

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

The LTQ Orbitrap is 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 on page 4-3. The right photo in Figure 4-1 shows the wall receptacle required for the LTQ Orbitrap (IP 44; 5 poles; 380 Volt; 50/60 Hz; red; CEE-Norm IEC 309.1 and 309.2). The receptacle is provided by Thermo Electron.

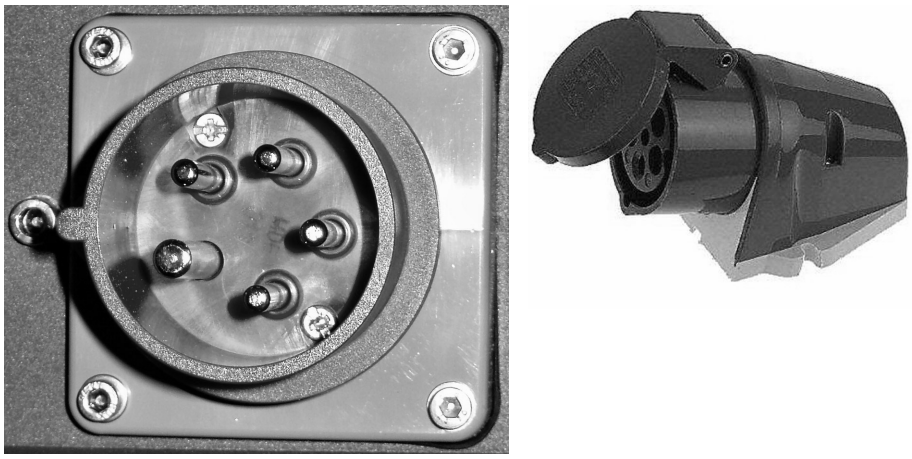

Figure 4-1. Connector and wall receptacle for the LTQ Orbitrap

Local codes in your area may require another type of plug and receptacle be installed. The Thermo Electron Field Engineer for your country will provide the appropriate power plugs.

Connecting the LTQ Orbitrap, LC, and other Modules to Wall Outlets

Take care to ensure that the wall outlet specifications are not exceeded. The LTQ Orbitrap 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.

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

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.

The linear ion trap, the liquid chromatograph, and the recirculating chiller are connected to the instrument. For all other additional devices, please use a wall outlet instead.

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

The specifications on the module might vary from those in this guidebook. The power specifications on the module always supersede those in the guidebook.

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

Quality of Power

The quality of power supplied to your LTQ Orbitrap system is very important. The quality of line voltage must be stable and within the specifications listed in this manual. 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. 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 µs and 2 s.
- **Transients** (or impulses) are brief voltage excursions of up to several thousand volts with durations of less than 50 µs.

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 system is installed.

Power Monitoring Devices

A variety of devices is 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 topic "Technical Assistance" on page 4-9). If necessary, your local Thermo Electron 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 both transient and regulation problems, then power conditioners, which can control both of these problems, should be considered.

When nominal voltage is free from voltage sags, surges and impulses but more than ±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 also available from Thermo Electron.

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

Note For compliance and safety, ensure that your power conditioning devices are certified by recognized domestic and international organizations, such as, UL, CSA, TUV, VDE, etc. ▲

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.

Delta-to-Y Conversion Transformer

In case of a Y configuration in your location (ask the responsible electrician), an isolation transformer is required which 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 Electron. Line conditioners have beside other advantages the same capability.

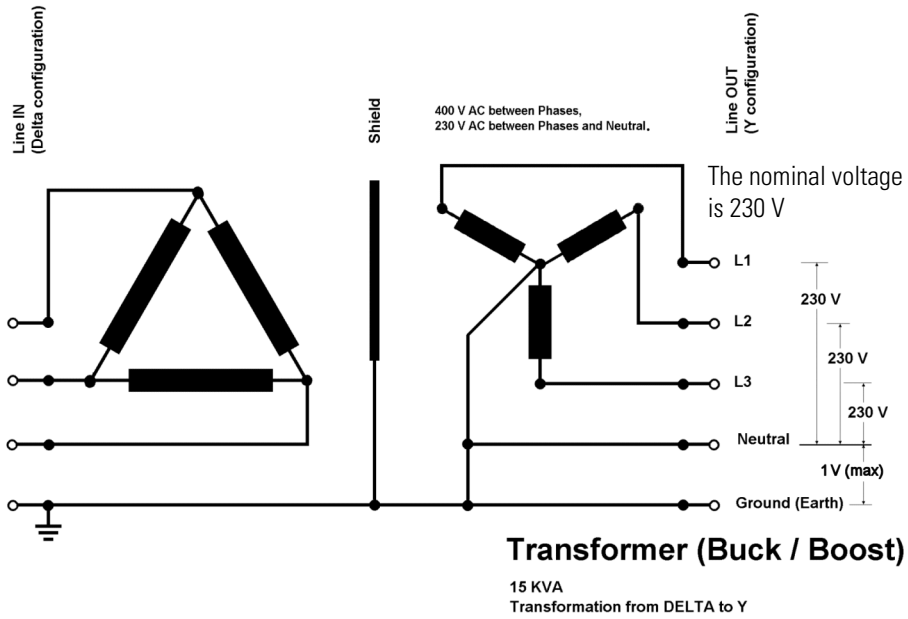

Figure 4-2. Delta-to-Y conversion

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 Electron 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 Electron will attempt to assist in diagnosis, but does not undertake to isolate and correct power-supply quality problems.

Contact your Thermo Electron 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[1] is listed below:

General Electric Company
(Worldwide distribution network)
Internet: 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

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

POWERVAR, INC.
Internet: www.powervar.com

SOLA / HEVI-DUTY
Internet: www.sola-hevi-duty.com

Warner Electric
Motors and Controls division
Internet: www.warnernet.com

[1]Thermo Electron Corporation 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

It is your responsibility as the user to provide correct gas supplies for the operation of your system.

Your instrument requires high purity gases. The Service Engineer might also require certain solvents for the installation verification of your system.

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

Fittings and Parts

Table 5-1 lists the minimum parts that are required to connect your LTQ Orbitrap 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 P/N (in Accessory kit P/N 97055-62003)
Nitrogen	6×1 mm OD Teflon® hose	2 m (6 ft) provided. You might require additional length.
	Connection for the opposite end of the Teflon hose to the nitrogen gas source	**Not provided in kit. You supply these parts.**
*Helium	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) 00101-02500 (back)
	Connection for the opposite end of the tubing to the helium gas source	**Not provided in kit. You supply these parts.**

*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. Refer to the following topics for information on the purity and pressure that your system requires:

- Helium
- Nitrogen

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 contaminates 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 for the Linear Trap

Helium for the linear trap of the LTQ Orbitrap MS detector collision gas 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 ± 70 kPa (2.75 ± 0.7 bar, 40 ±10 psi). Particulate filters can be a source of contamination, they are not recommended.

Helium can be dispensed from a tank containing 245 ft^3 of gas using Matheson regulator #3104C or equivalent tank and regulator.

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-in, 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 MS detector.
We recommend installing a separate helium supply for the LTQ Orbitrap 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.

Nitrogen

The nitrogen for the API sheath gas, API auxiliary/sweep gas, and orbitrap bath gas should be high purity (99%). The required gas pressure is 690 ± 140 kPa (6.9 ± 1.4 bar, 100 ± 20 psi).

The nitrogen gas supply line should terminate with a 6 mm, female, Swagelok®-type connector. Particulate filters can be a source of contamination, they are not recommended.

Typical nitrogen gas consumption (nitrogen on 24 hours per day) is 5560 L (200 ft^3) per day. Therefore, it is recommended that nitrogen be supplied from one of the following sources:

- A large nitrogen gas cylinder size 1A (250 ft^3). The replacement frequency is approximately once every two days.

- 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 143850 L (5080 ft^3) 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

- A nitrogen generator with minimum capacity of 5560 L (200 ft^3) 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 compressor are quite noisy; therefore, be careful to select a quiet compressor. This is a continuous source with no replacement required.

Solvent Recommendations

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

Note Some solvent impurities are transparent to UV/VIS detectors. Therefore, some HPLC grade solvents might contain contaminants that interfere with the performance of the mass spectrometer. For operation of your LTQ Orbitrap, choose high purity solvents with minimum contamination. ▲

Table 5-2. Solvents and reagents and modifiers

Solvents / Reagent	Specifications
Methanol	HPLC grade
Acetonitrile	HPLC grade
Water	HPLC grade
Isopropyl alcohol	HPLC grade
Acetic acid (modifier)	A.C.S. reagent

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

Note It is recommended that solvents from the following manufactures are used: Merck, Mallinckrodt, or Burdick & Jackson. ▲

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

Cooling Water

A Neslab Merlin M 25 recirculating chiller (P/N 118 6320) with closed circuit, cooled by a refrigerating device, is delivered with the instrument, making the LTQ Orbitrap independent from any cooling water supply.

Technical Data Recirculating Chiller

Cooling capacity:	0.81 kW (60 Hz), 0.725 (50 Hz)
Water temperature:	5–35° C (41–95° F),
Stability of temperature regulation:	± 0.1° C (± 32.2° F),
Unit dimensions:	59.7 cm × 32.1 cm × 53.0 cm (23.5 in × 12.6 in x 20.9 in)
Unit weight:	54 kg (118 lb)

The LTQ Orbitrap provides the electric power for the chiller; the power cord of the recirculating chiller is connected to the right side of the LTQ Orbitrap. Two water hoses (black), internal diameter 9 mm, wall thickness 3 mm, length approx. 3 m (~10 ft) are delivered with the instrument. The hoses are connected to the ports at the right side of the LTQ Orbitrap.

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 MW/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, e.g. RBS 50 (trade name of Messrs. Carl Roth, Karlsruhe, Germany).
- Several liters of distilled water.

Chapter 6 Exhaust and Waste

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

The proper 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.

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

Exhaust System

It is your responsibility as the user to provide an adequate exhaust system.

Much of what is introduced into the LTQ Orbitrap is eventually exhausted from the forepumps, along with the small amount of oil vapor that these pumps characteristically emit. Therefore, the pumps should be connected to a fume 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 have two functions: (1) providing a vacuum for the capillary skimmer of the API source, (2) providing backing pressure for the turbomolecular pumps.

The exhaust port of the rotary pump 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.). The exhaust system for the forepumps must be able to accommodate a flow rate of 1 L/min.

Solvent Waste

The API source can accommodate high flow rates. Therefore, provisions must be made to collect the waste solvent. The API source is fitted with a 12 mm (0.5 in) ID connector for solvent drainage. A 12 mm (0.5 in) PVC drain tube, which is provided with the system, is connected from the API source to the collection container supplied with the system (P/N 00301-57022).

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

Chapter 7 Instrument Arrival

When your lab site preparation is completed, the Thermo LTQ Orbitrap Installation Request Form has been mailed or faxed to your Thermo Electron office, and the system is delivered, please call your Thermo Electron office to arrange for an installation date. Refer to the Installation Request Form at the front of this manual. Telephone and fax numbers for Thermo Electron offices are listed in the "Read This First" chapter of this manual and immediately following the Installation Request Form.

LTQ Orbitrap 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 Electron office to report the damage and – please – let the Thermo Electron people check for further damage.

Note Freight insurance requires that obvious damage be noted on the receiving documents. Thermo Electron 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. See topic "Temperature" on page 3-2 for details on the temperature limits of the storage room. If you have questions about moving your system, contact your local Thermo Electron Office. Telephone and fax numbers for the offices are listed in the "Read This First" chapter of this manual.

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.

When your lab site preparation is completed, the"LTQ Orbitrap Preinstallation Checklist" has been mailed or faxed to your local office for Thermo Electron products, and the system is delivered, please call your Thermo Electron office to arrange for an installation date. Refer to the Installation Request Form at the front of this guide. Telephone and fax numbers for offices for Thermo Electron products are listed in the "Read This First" chapter of this guide and immediately following the Preinstallation Checklist.

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

Preinstallation Survey

Verify that your lab meets the following list of preinstallation requirements before your instrument is installed. Use the "LTQ Orbitrap Preinstallation Checklist" at the front of this booklet to check off each item as it is completed or verified.

Note Your instrument is shipped in a shipping container, the smallest dimension of which is 112 cm (44 in). If the entrance to your laboratory will not accommodate a 44 in. container, you can remove the individual modules from the container before moving them into the room. If you remove the instrument from its shipping container before it is delivered to the lab site, be sure that all the contents of the container remain with the instrument. ▲

Checklist

1. All laboratory remodeling has been completed and the space available is sufficient to meet the minimum requirements for the configuration ordered. The floor is certified to meet the load requirements of the system (682 kg and 1500 lbs).

2. Your LTQ Orbitrap is on site.

3. Doorways, hallways, etc. are a minimum width of 89 cm (35 in). Please note width of laboratory entrance: _____

4. Storage and bench space are sufficient and lighting is adequate.

5. Floor vibrations and electromagnetic interferences are below the specified levels.

6. Main power is installed and is in compliance with local electrical codes.

7. Power outlets are of the correct configuration.

8. Voltage of power outlet has been measured. Please note measured voltage: _____

9. Power is free from fluctuations due to slow changes in the average voltage or changes due to surges, sags, or transients.

10. 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).

11. Key operator will be available during the installation / certification period.

12. Relative humidity is between 50% and 80% with no condensation.

13. System work area is free from magnetic disruption and electrostatic discharge.

14. All gases required (helium and nitrogen) are on site, gas lines are installed, and appropriate gas regulators are available. Please list gases and purity: _____

15. There is a suitable exhaust system.

16. One voice telephone line is installed near the system.

17. All relevant safety regulations are complied with.

Preparing the Installation

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

Caution Store the instrument in a protected location indoors. See topic "Temperature" on page 3-2 for details on the temperature limits of the storage room. ▲

Unpacking the System

It is the policy of Thermo Electron 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 system is on site, ready for installation, a Thermo Electron Field Service Engineer will install it.

During the installation, the Field 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.

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. ▲

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. He/she will also be the key figure in the communication between your laboratory and Thermo Electron.

Note Do not plan to use your new system for sample analysis until the installation is complete and the Acceptance Form has been signed. ▲

Advanced Training Courses

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

It is also recommended that some months after your LTQ Orbitrap system has been installed, the key operator receive an advanced training for the operation and maintenance of the system from Thermo Electron. 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 Electron office:

Thermo Electron (Bremen) GmbH
Advanced Mass Spectrometry
Hanna-Kunath-Str. 11
28199 Bremen

Germany

Phone: +49 (0) 421 - 54 93 0
Fax: +49 (0) 421 - 54 93 426
E-mail: training@thermo-bremen.com

Preventive Maintenance

Routine and preventive maintenance of LTQ Orbitrap MS detector and data system is in the user's responsibility. Included in this category is exchange of pump oil, replacement of filters, etc. on a regular basis. Please refer also to the manufacturers manuals delivered 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 Hardware Manual*
- *LTQ Hardware Manual*
- Manuals that come with your LTQ Orbitrap computer and other modules of your system

Glossary

The following abbreviations and terms are used in this manual.

A ampere

ac alternating current

ADC analog-to-digital converter

AGC automatic gain control

AP acquisition processor

APCI atmospheric pressure chemical ionization

API atmospheric pressure ionization

ASCII American Standard Code for Information Interchange

b bit

B byte (8 b)

baud rate data transmission speed in events per second

°C degrees Celsius

cfm cubic feet per minute

CI chemical ionization

CLT curved linear trap

cm centimeter

cm^3 cubic centimeter

CPU central processing unit (of a computer)

CRC cyclic redundancy check

CRM consecutive reaction monitoring

<Ctrl> control key on the terminal keyboard

d depth

Da dalton

DAC digital-to-analog converter

dc direct current

DDS direct digital synthesizer

DEP™ direct exposure probe

DS data system

DSP digital signal processor

EI electron ionization

EMBL European Molecular Biology Laboratory

<Enter> Enter key on the terminal keyboard

ESD electrostatic discharge

ESI electrospray ionization

eV electron volt

f femto (10^{-15})

°F degrees Fahrenheit

***.fasta* file** extension of a SEQUEST search database file

ft foot

FFT Fast Fourier transformation

FT Fourier Transformation

FTMS Fourier Transformation Mass Spectroscopy

FTP file transfer protocol

FWHM Full Width at Half Maximum

g gram

G Gauss; giga (10^9)

GC gas chromatograph; gas chromatography

GC/MS gas chromatograph / mass spectrometer

GUI graphical user interface

h hour

h height

HPLC high-performance liquid chromatograph

HV high voltage

Hz hertz (cycles per second)

ICIS™ Interactive Chemical Information System

ICL™ Instrument Control Language™

ID inside diameter

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

in inch

I/O input/output

k kilo (10^3, 1000)

K kilo (2^{10}, 1024)

KEGG Kyoto Encyclopedia of Genes and Genomes

kg kilogram

l length

L liter

LAN local area network

lb pound

LC liquid chromatograph; liquid chromatography

LC/MS liquid chromatograph / mass spectrometer

LED light-emitting diode

m micro (10^{-6})

m meter

m milli (10^{-3})

M mega (10^6)

M^+ molecular ion

MB Megabyte (1 048 576 bytes)

MH^+ protonated molecular ion

min minute

ml milliliter

mm millimeter

MS mass spectrometer; mass spectrometry

MS MS^n power: where n = 1

MS/MS MS^n power: where n = 2

MS^n MS^n power: where n = 1 through 10

m/z mass-to-charge ratio

n nano (10^{-9})

NCBI National Center for Biotechnology Information (USA)

NIST National Institute of Standards and Technology (USA)

OD outside diameter

Ω ohm

p pico (10^{-12})

Pa pascal

PCB printed circuit board

PE protective earth

PID proportional / integral / differential

P/N part number

P/P peak-to-peak voltage

ppm parts per million

psig pounds per square inch, gauge

RAM random access memory

RF radio frequency

RMS root mean square

ROM read-only memory

RS-232 industry standard for serial communications

s second

SIM selected ion monitoring

SPI Serial Peripheral Interface

SRM selected reaction monitoring

TCP/IP transmission control protocol / Internet protocol

TIC total ion current

Torr torr

u atomic mass unit

UHV ultra high vacuum

V volt

V ac volts alternating current

V dc volts direct current

vol volume

w width

W watt

Index

Numerics

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

Y