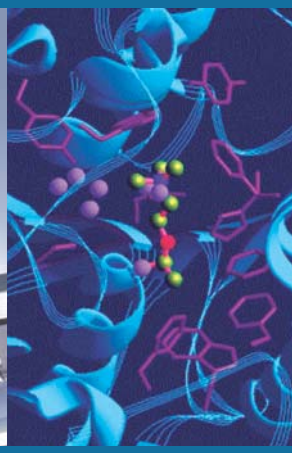
Thermo Fisher Scientific

iCAP Q

Preinstallation Requirements Guide

Revision A - 1288020



Thermo SCIENTIFIC

Original Operating Instructions

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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

Service contact details for customers are available under:

www.unitylabservice.com

Customer Information Service

The Customer Information Service site cis.thermo-bremen.com is aimed at providing instant access to latest software updates and manuals, application reports, and brochures.

Thermo Fisher Scientific recommends that you register with the site as soon as the instrument is installed. To register, visit 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.

Suggestions to the Manual

❖ **To suggest changes to this manual**

- Please send your comments (in German or English) 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

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

Contents

Chapter 1 Introduction

Information in this manual helps you to prepare a suitable site for installation of your system. The iCAP Q ICP-MS is designed to operate reliably under controlled environmental conditions described in this manual.

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.

The customer 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

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.

NOTICE 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 Requirements

To allow moving a packed iCAP Q instrument, the entrance to your facility and the width of all hallways, elevators, etc., should have a minimum width of 89 cm (35.1 in). Also allow additional room for maneuvering the system around corners, into elevators, or through doorways.

NOTICE 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. ▲

Dimensions and Weights

The iCAP Q system is shipped in a container. Other modules such as the fore vacuum pump are shipped in separate containers. For dimensions and weights see Table 2-1:

Table 2-1. Packing information of a typical iCAP Q system

Module	Weight Gross/Net [kg]	Dimensions L x W x H [cm]
Basic unit	186/141	132 x 89 x 117
Container (installation kit, computer, pump oil etc.)	126/116	120 x 80 x 128
Fore vacuum pump	58/52	80 x 60 x 52
Chiller (optional)	85/75	80 x 60 x 93
Total weight	**455/384**	
Storage Space	**3 m^2**	

NOTICE 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 Table 2-1. ▲

Additional weight and the dimensions of an auxiliary box might be added, depending on the equipment ordered.

The floor of your laboratory must be able to accommodate the weight of the instrument including all components and any options that are added to the system.

Figure 2-1 shows the external dimensions of the system without autosampler. All values are given in mm:

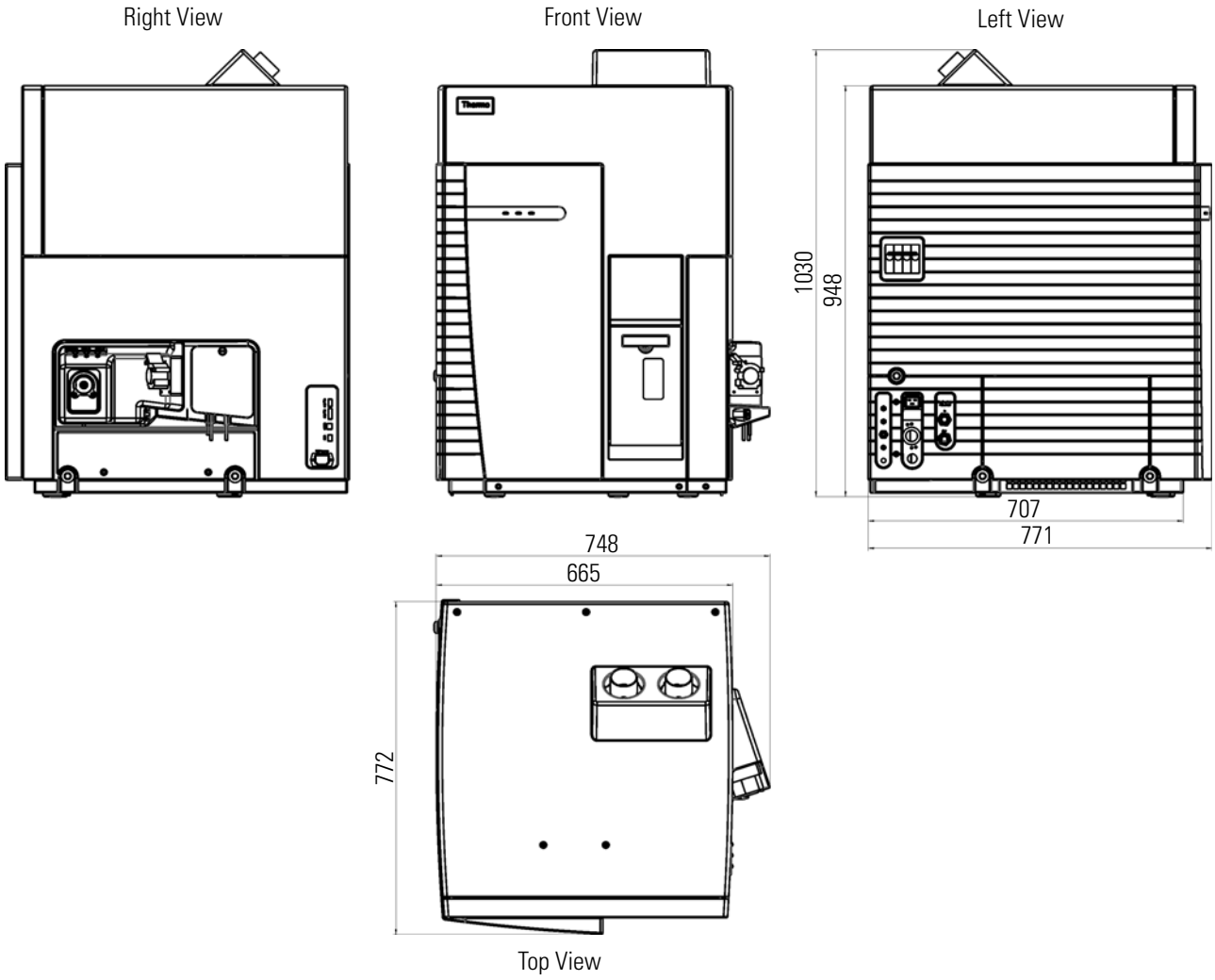


Figure 2-1. Dimensions of the iCAP Q system without autosampler

Figure 2-2 shows the external dimensions of the system with autosampler housing attached. All values are given in mm:

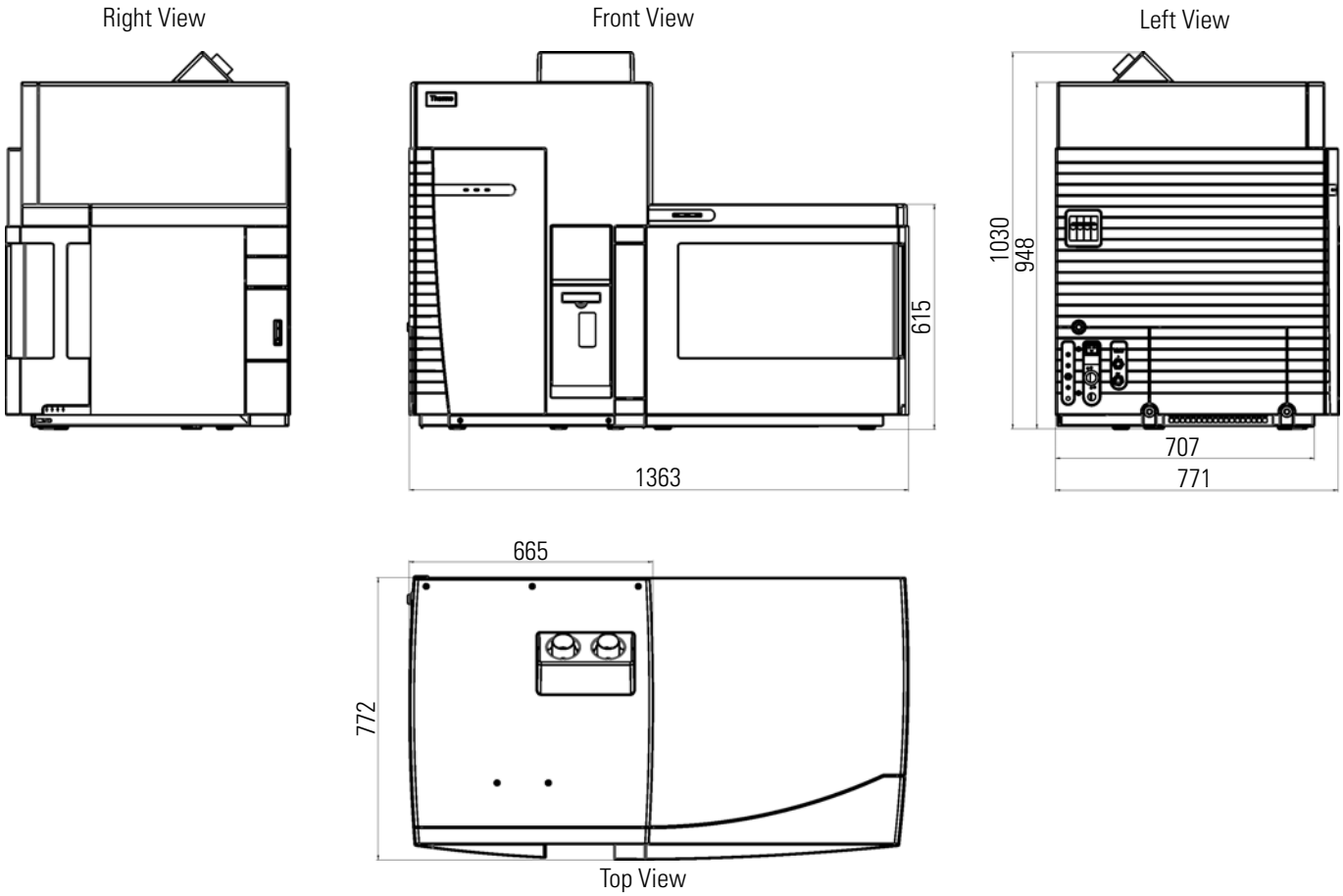


Figure 2-2. Dimensions of the iCAP Q system with autosampler

Ensure that the Thermo Fisher Scientific field service engineer has access to the left and right of the instrument.

Placing the MS System

The iCAP Q instrument is designed to be placed on a bench with its rear panel against a wall. The bench surface should ideally be 80 to 85 cm above the floor.

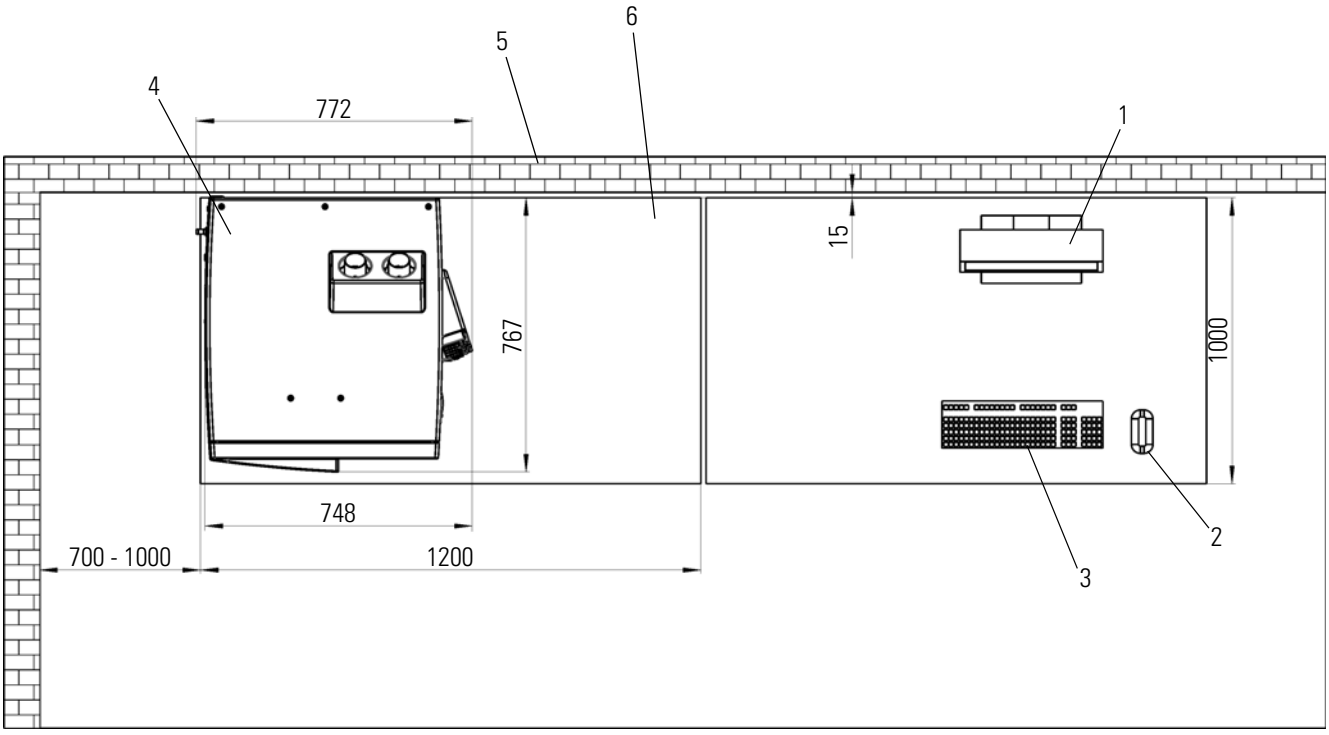
On the left side panel, free access to the mains switch and circuit breaker is needed to allow shutting off the instrument in an emergency at all times.

Allow at least 70 to 100 cm of clear space left of the system for clearance of the gas lines, electrical connections, as well as for the exhaust line and vacuum hose of the fore vacuum pump.

It is recommended to leave sufficient space on the right of the iCAP Q instrument for the connections to the computer and peripheral devices.

Floor Space for the System

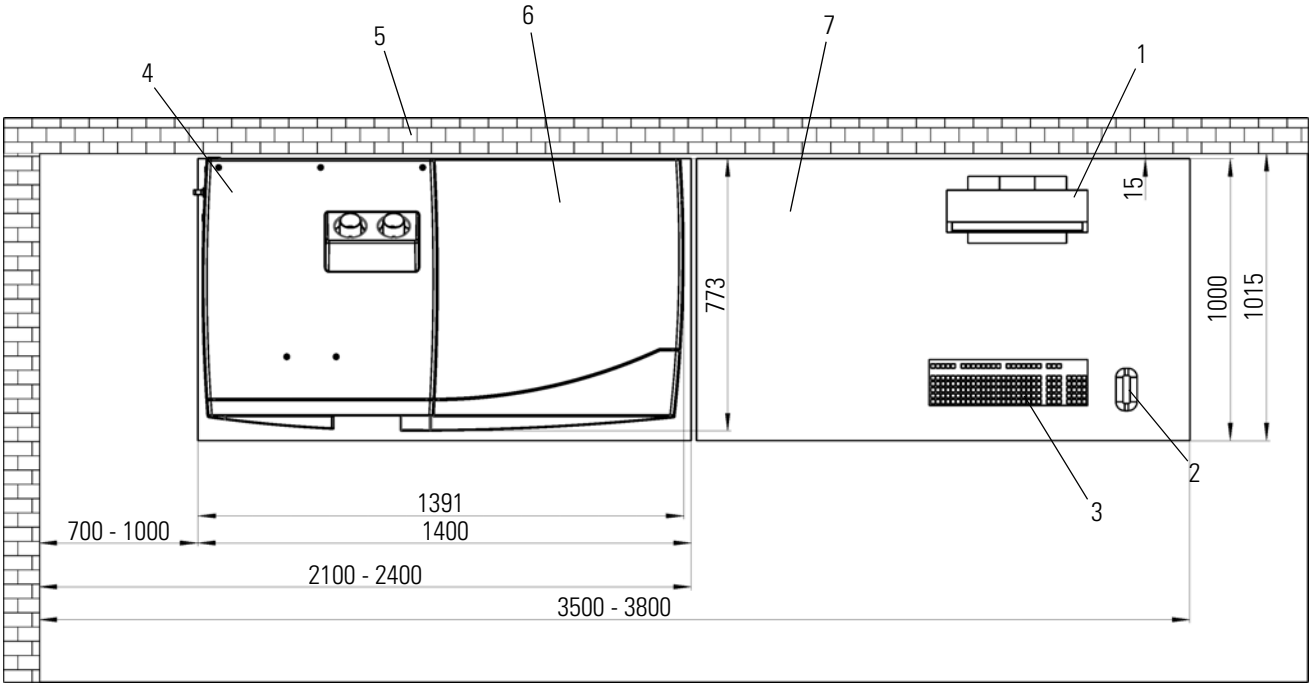
Figure 2-3 shows the typical required floor space for the system without autosampler. All values are given in mm:



Labeled Components: 1=monitor, 2=mouse, 3=keyboard, 4=the iCAP Q instrument, 5=wall, 6=standard workbench

Figure 2-3. Required floor space for the iCAP Q instrument without autosampler

Figure 2-4 shows the typical required floor space for the system with autosampler. All values are given in mm:



Labeled Components: 1=monitor, 2=mouse, 3=keyboard, 4=the iCAP Q instrument, 5=wall, 6=autosampler housing, 7=computer table

Figure 2-4. Required floor space for the iCAP Q instrument with autosampler

Placing the Fore Vacuum Pump

The iCAP Q system is delivered with a fore vacuum pump, optionally a noise reduction cover for the fore vacuum pump, a vacuum hose for connecting the instrument to the fore vacuum pump, and an exhaust hose for connecting the fore vacuum pump to the exhaust system.

Install the fore vacuum pump on the floor beneath the workbench, see Figure 2-5.

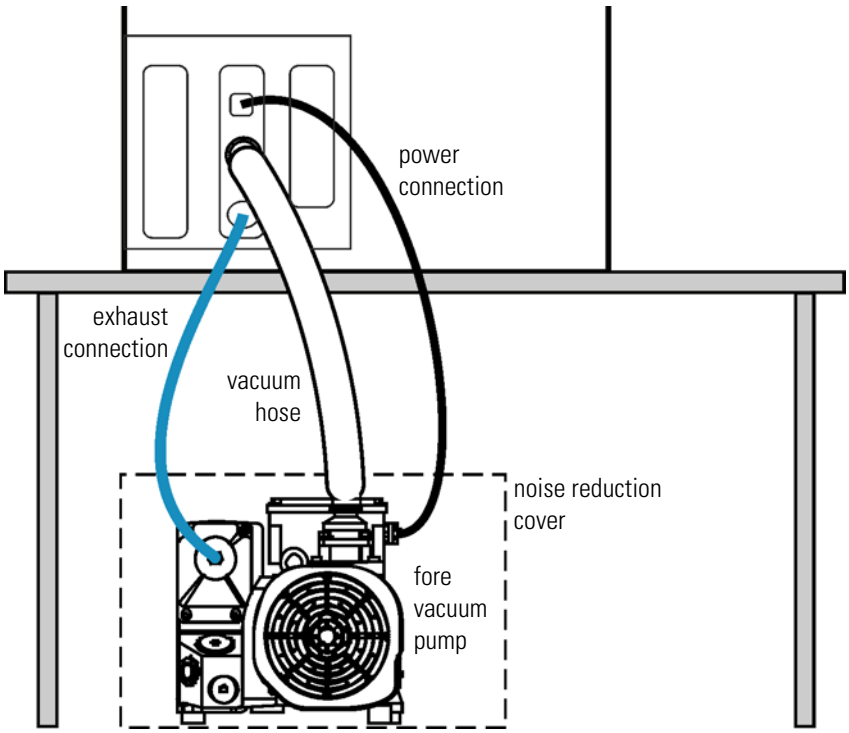


Figure 2-5. Connecting the fore vacuum pump

If no space for the pump is available beneath the workbench, you can place the pump near the left side of the bench. In this case, the left side of the MS ideally aligns with the left side of the workbench.

NOTICE Thermo Fisher Scientific recommends the use of the noise reduction cover when installing the fore vacuum pump. ▲

A stainless steel vacuum hose with a length of 2 m and an OD of 34 mm is delivered with the instrument. The flange diameter is 40 mm (Iso-KF 25). For the exhaust connection, tubing of 2.5 m length with an OD of 20 mm (ID 13 mm) is delivered with the instrument.

If you need a longer vacuum hose, contact Thermo Fisher Scientific. Because of the large bending radius of the hose, the actual reach of the vacuum hose is shorter than the given length. Either run the vacuum hose left of the workbench or make a cutout through the bench for it. The cutout must have minimum dimensions of 7 cm × 10 cm. Allow for room to run the power cord and the exhaust tubing from the fore vacuum pump through the cutout as well.

For information about the exhaust system, see "Exhaust System" on page 3-3.

Placing the Data System

Thermo Fisher Scientific recommends using one workbench with minimum dimensions of 1.00 m × 1.20 m. The workbench must be capable of supporting the weight of the data system, and a printer, if applicable. A printer is not delivered with the instrument.

Figure 2-6 shows typical data system hardware components:

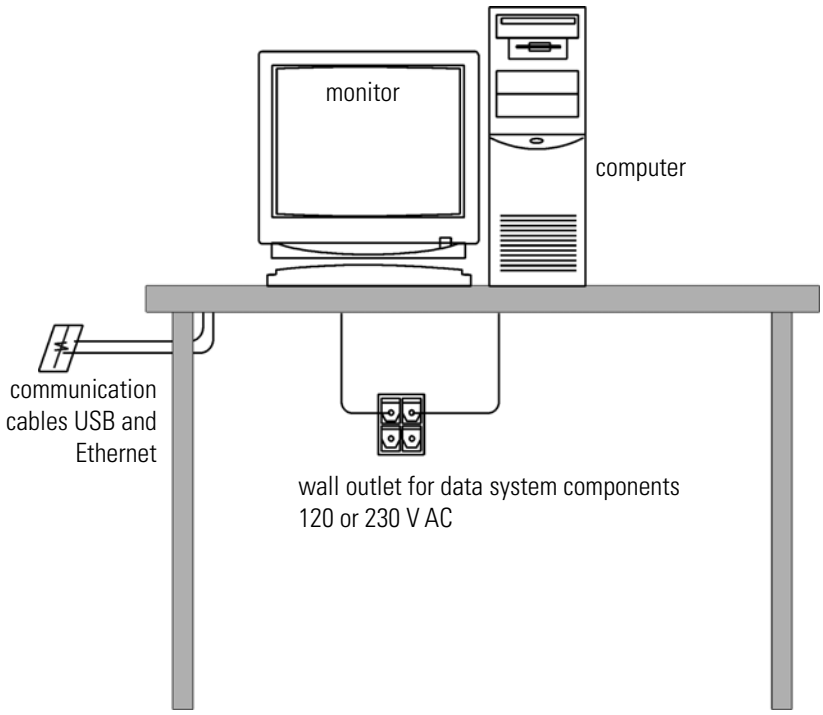


Figure 2-6. Typical data system workbench

The iCAP Q instrument is connected to the computer via USB cable.

Table 2-2 lists space requirements and weights of the typical data system hardware components. The actual values depend upon your equipment.

Table 2-2. Typical data system space and load requirements

Module	Height [cm]	Width [cm]	Length [cm]	Weight [kg]
Monitor	36	41	18	6
Minitower computer	48	18	43	14

The USB communication cables between the computer and the mass spectrometer must be no longer than 3 m each. The workbench that holds the data system must be located next to the workbench that holds the mass spectrometer. For a connection length of more than 3 m, an active hub must be placed between the instrument and the computer. The length of the USB cable between the iCAP Q instrument and the

hub is limited to 3 m, whereas between the hub and the computer a cable length of 5 m can be used. This hub must exclusively be used for the control of the iCAP Q instrument.

Chapter 3 Operating Environment

Fulfilling the described the operating environment requirements ensures continued high performance of your iCAP Q system. The air conditioning must be capable of maintaining a constant temperature in the immediate vicinity of the system without producing excessive draft.

NOTICE It is your responsibility as operator to provide an acceptable operating environment. ▲

Operating environment includes the following:

Temperature

NOTICE After arrival the iCAP Q instrument must be stored as packed by Thermo Fisher Scientific for at least 24 hours at an environmental condition of 15 to 35 °C and a relative humidity of 20 to 80% before connecting to power supply. ▲

The mass spectrometer is designed to operate at the temperatures specified in Table 3-1:

Table 3-1. Temperature requirements for the iCAP Q instrument

Specification	Value
Laboratory temperature	15 to 35 °C
Optimum operation temperature	18 to 21 °C

NOTICE As the laboratory temperature increases, system reliability decreases. All electronic components generate heat while operating. ▲

Exhaust System

An exhaust system is needed for the instrument to remove gases that may contain ozone and other noxious substances. Two exhaust ports are situated at the top of the instrument, see Figure 3-1.

Labeled Components: 1=plasma exhaust, 2=heat exhaust

Figure 3-1. Exhausts of the iCAP Q instrument

The plasma exhaust **1** in Figure 3-1 is used to remove gases and heat generated by the plasma. A flexible exhaust duct must be connected during operation of the instrument.

The second port (**2** in Figure 3-1) is used to remove heat generated by the electronics of the instrument. At this port the connection of an exhaust duct is optional, but recommended if there is, for example, no air conditioning in the laboratory or in cleanroom laboratories.

NOTICE Thermo Fisher Scientific will only install your iCAP Q system when an adequate exhaust system is present and functioning. Exhaust gas venting must comply with all local environmental codes. ▲

NOTICE It is possible to use a T-piece to connect both exhaust ducts before entry to the exhaust system of the laboratory. The T-piece must be at least at a distance of 1 m from the exhaust ports of the instrument. ▲

The exhaust ports at the iCAP Q instrument have an outer diameter of 60.3 mm for both the plasma exhaust and the optional heat exhaust. A flexible duct with 63 mm ID is recommended for connection to the exhaust port. Thermo Fisher Scientific delivers such an exhaust duct with a length of 6 m.

The velocity v at the end of the duct with an inner diameter (d) of 63 mm connected to the exhaust port of the iCAP Q instrument can be measured with an anemometer (values in m/s) and can then be converted to an exhaust flow f (m^3/h) by the following equation:

$$f = \pi \cdot \left(\frac{d}{2}\right)^2 \cdot v \cdot 3600$$

Example: Velocity measured with an anemometer v = 6 m/s, duct diameter d = 63 mm = 0.063 m

$$f = 3.14 \cdot \left(\frac{0.063\ \text{m}}{2}\right)^2 \cdot 6 \cdot \frac{\text{m}}{\text{s}} \cdot 3600 \approx 67 \frac{\text{m}^3}{\text{h}}$$

The velocity v at the end of a flexible duct with an inner diameter of 63 mm and thus the flow rate should meet the specifications given in Table 3-2:

Table 3-2. Specifications for the iCAP Q exhaust

Exhaust type	Duct ID [mm]	Exhaust velocity [m/s]	Exhaust flow [m^3/h]
Plasma	63	6 to 8	67 to 90
Heat (optional)	63	4 to 6	45 to 67

NOTICE The extraction system must be tested for leakage before you connect it to the iCAP Q instrument. ▲

Heat Generation and Dissipation of System

Heat generation and heat dissipation of the system depend on the equipment employed. However, the iCAP Q system must always be operated with active plasma exhaust. For a description of the exhaust system, see "Exhaust System" on page 3-3.

For estimated values for the average heat generation of the mass spectrometer and other heat sources during analysis, see Table 3-3.

Table 3-3. Heat generation for a typical iCAP Q system

Module	Heat generation [W] at 50 Hz
iCAP Q instrument, without plasma or heat exhaust port connected	approx. 2400
Fore vacuum pump	approx. 1100
Recirculating chiller	2200 (2500 at 60 Hz)
Monitor	35
Computer	470
Total	**approx. 6.2 kW (6.5 kW at 60 Hz)**

NOTICE Water-cooled chillers minimize the heat dissipation into the laboratory environment. ▲

Heat Dissipation of Complete System

Estimated values for the average heat dissipation of the mass spectrometer and other heat sources into the laboratory during analysis are given in Table 3-4. The actual values depend on your equipment.

Table 3-4. Heat dissipation for a typical iCAP Q system and chiller

Module	Heat dissipation [W] at 50 Hz
iCAP Q instrument, with active plasma exhaust removal	800
iCAP Q instrument, with active plasma and heat exhaust removal	450
Fore vacuum pump	approx. 1100
Recirculating chiller	2200 (2500 at 60 Hz)
Monitor	35
Computer	470
Total with active plasma exhaust removal	**approx. 4.6 kW (4.9 kW at 60 Hz)**
Total with active plasma and heat exhaust removal	**approx. 4.3 kW (4.6 kW at 60 Hz)**

Heat Dissipation without Chiller

If the chiller is connected to the house water supply or not placed in the laboratory, the heat dissipation of the mass spectrometer and other heat sources into the laboratory during analysis is further reduced, see Table 3-5. The actual values depend on your equipment.

Table 3-5. Heat dissipation with house water supply or chiller not placed in laboratory

Module	Heat dissipation [W] at 50 Hz
iCAP Q instrument, with active plasma exhaust removal	800
iCAP Q instrument, with active plasma and heat exhaust removal	450
(chiller connected to house water supply or not placed in laboratory)	-
Fore vacuum pump	approx. 1100
Monitor	35
Computer	470
Total with active plasma exhaust removal	**approx. 2.4 kW**
Total with active plasma and heat exhaust removal	**approx. 2.1 kW**

Heat Dissipation without Chiller and Fore Vacuum Pump

You can additionally remove the fore vacuum pump to outside the laboratory for minimal heat dissipation of the complete system, see Table 3-6:

Table 3-6. Heat dissipation of the iCAP Q instrument and computer only

Module	Heat dissipation [W] at 50 Hz
iCAP Q instrument, with active plasma exhaust removal	800
iCAP Q instrument, with active plasma and heat exhaust removal	450
(chiller connected to house water supply or not placed in laboratory)	-
(fore vacuum pump not in laboratory)	-
Monitor	35
Computer	470
Total with active plasma exhaust removal	**approx. 1.3 kW**
Total with active plasma and heat exhaust removal	**approx. 1.0 kW**

Air Conditioning

The air conditioning system must be capable of maintaining a constant temperature as specified in "Temperature" on page 3-2 in the immediate vicinity of the system.

For the approximate load for the air conditioning in a room containing one instrument see "Heat Generation and Dissipation of System" on page 3-5.

Thermo Fisher Scientific recommends the installation of an air conditioner if the specified limits are exceeded due to unfavorable climatic conditions. For reliable operation of the iCAP Q system, a stability of the room temperature < 2 °C/h is required.

NOTICE Do not locate the iCAP Q instrument under an air duct, near windows, or near heating and cooling sources. ▲

Humidity

The relative humidity of the operating environment must be between 20 and 80%, with non-condensing and non-corrosive atmosphere. It is recommended that your laboratory be equipped with a temperature and humidity monitor to insure that your laboratory is always within the required temperature and humidity specifications.

NOTICE Operating an iCAP Q 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. ▲

Altitude

The iCAP Q instrument is designed for indoor use at an altitude of up to 2000 m (6562 ft) above sea level. For altitudes above 2000 m contact Thermo Fisher Scientific.

Vibration

Floors must be free of vibration caused, for example, by equipment in adjoining locations.

NOTICE The fore vacuum pump must not have any mechanical contact to the mass spectrometer with exception of the vacuum hose during operation. The vibration of the fore vacuum pump might impede the performance of the instrument. Install the fore vacuum pump on the floor beneath the mass spectrometer. Do not install the fore vacuum pump near the system on the workbench. ▲

Airborne Noise Emission

The emission sound measurement has been performed for the iCAP Q instrument according to DIN 45636-01-KL2.

The mean value for the emission sound pressure level of the iCAP Q instrument with and without noise reduction cover on the fore vacuum pump are listed in Table 3-7:

Table 3-7. Mean values for emission sound pressure of the iCAP Q instrument

Emission sound specification of the iCAP Q instrument	Mean value
Fore vacuum pump without noise reduction cover	55.9 dB(A)
Fore vacuum pump with noise reduction cover	53.1 dB(A)

Radio Frequencies

The iCAP Q system withstands the electric fields and frequency ranges listed in Table 3-8 without any influence to operation:

Table 3-8. Electric fields and frequencies

Electric field	Frequency range
1 V/m	80 MHz - 1 GHz
1 V/m	1 GHz - 2.7 GHz

If strong radio transmitters are operating close to your laboratory, you should contact your local Thermo Fisher Scientific office for advice.

Magnetic Fields

The instrument site must be free of interfering magnetic fields. The maximum acceptable field amplitude (AC) for any frequency is 5×10^{-6} T.

NOTICE Sources of disturbing fields are, for example, other analytical instruments such as NMR systems or Zeeman AAS, train, tram, subway, high power cables crossing the ceiling, large electric motors (elevators), radio stations nearby. ▲

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 is not damaged by line power fluctuations, verify that you comply with all power quality requirements listed in this manual.

NOTICE 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:

Electrical Power Requirements

The basic power requirements for the iCAP Q instrument are listed in Table 4-1:

Table 4-1. Basic power requirements for the iCAP Q instrument

Specification	Value
Nominal voltage	230 V AC ±10%, 50/60 Hz AC
Wire	Three-phase, 5-wire system in Y configuration (neutral wire must be connected to earth)
Fuse	Following the regulation in Germany, Thermo Fisher Scientific recommends fusing each phase with 16 A

The iCAP Q instrument must have a separate “clean” line leading to a main fuse to guarantee disturbance-free operation.

The components of the data system (computer, monitor) require wall outlets at a nominal voltage of 230 V AC or 120 V AC, 50/60 Hz.

Delta-To-Y Conversion Transformer

In case of a Δ (Delta) configuration at your location (ask the responsible technician), an isolation transformer is required which steps up the three phases 120 V AC (Delta) to 230 V AC (Y) with respect to ground (see Figure 4-1). For a suitable transformer contact your local Thermo Fisher Scientific office.

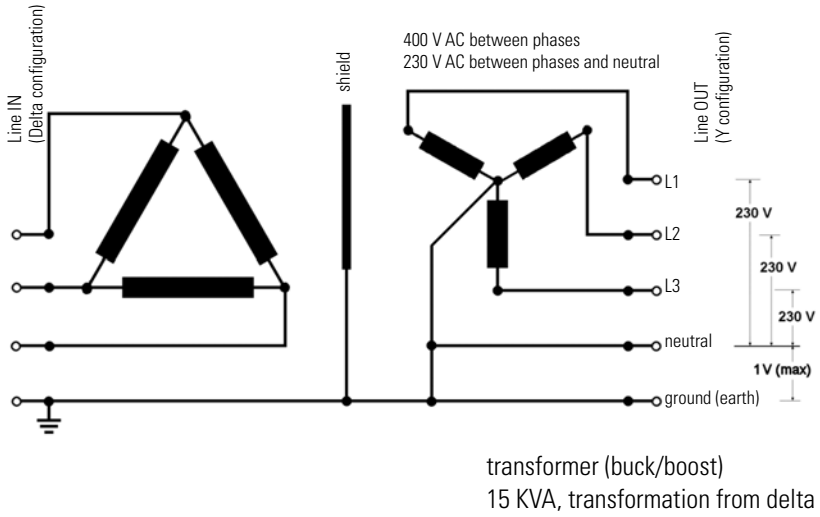


Figure 4-1. Delta-to-Y conversion

NOTICE In Y configuration, the nominal voltage of 230 V AC must be measured phase to ground. Between the phases 400 V AC is measured. ▲

Power Connections

The electrical wall outlet for the main power of the iCAP Q instrument should be located at the wall near the intended location of the instrument, ideally at the left side of the instrument.

The mains power cable for the iCAP Q mass spectrometer is a 5-wire cable, length 5 m. A CECON plug, 5 poles, certified for 400 V, 16 A, is mounted to the cable, see lower right photo in Figure 4-2. This power cable and plug is already mounted to the instrument.

The lower left photo in Figure 4-2 shows the wall receptacle required for the iCAP Q instrument. The receptacle is provided by Thermo Fisher Scientific as part of the Preinstallation Kit.

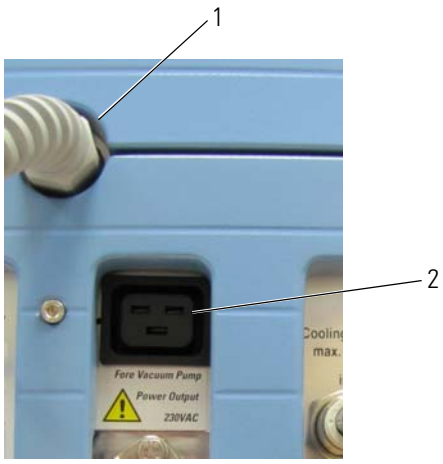
Figure 4-2. Wall mounting of receptacle and plug of mains power cable

Local codes in your area may require another type of plug and receptacle to be installed. The local Thermo Fisher Scientific organization (or authorized dealer) will help you with further questions.

Power cables and connectors for the options are standard equipment delivered by the manufacturers.

The iCAP Q instrument provides a power output socket for the fore vacuum pump and a power output socket for the optionally shipped the autosampler.

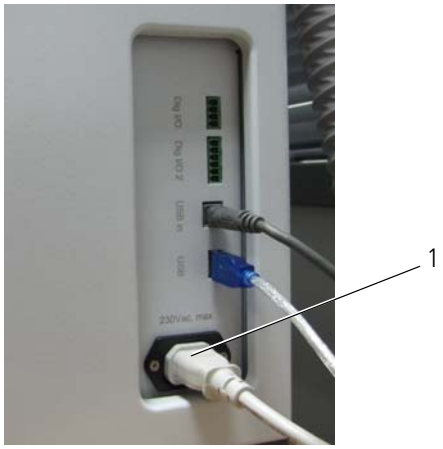
At the left side, the iCAP Q instrument provides a power output socket for the fore vacuum pump of the instrument, see **2** in Figure 4-3:



Labeled Components: 1=mains power connection of the iCAP Q instrument, 2=power connection to fore vacuum pump

Figure 4-3. Electric power supply for fore vacuum pump

At the right side, the iCAP Q instrument provides a power output socket to be solely used for the optional autosampler housing, see **1** in Figure 4-4:



Labeled Components: 1=power connection for autosampler housing

Figure 4-4. Electric supply for autosampler housing (optionally shipped)

Power cables and connectors for the options are standard equipment delivered by the manufacturers.

For connecting additional devices such as recirculating chillers, see "Auxiliary Wall Outlets" on page 4-6.

Auxiliary Wall Outlets

Additional single-phase 230 V (or 120 V) AC outlets are needed for additional parts such as computer and water chiller. Thermo Fisher Scientific recommends at least three spare 230 V (120 V) outlets in the near vicinity of the left of the system and three close to the workbench space within the your laboratory.

The NESLAB ThermoFlex 2500 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 2500

Option	Voltage [V AC]	Frequency [Hz]	Phase	Receptacle Rating [A]
1	208 to 230	60	1 Ø	20
2	230	50	1 Ø	13 to 16 country specific, refer to the manual of the manufacturer

NOTICE Single-phase auxiliary wall outlets should use the same ground as the instrument. ▲

NOTICE Thermo Fisher Scientific recommends connecting computer, monitor and printer via a separated and filtered power line, and the use of uninterruptible power supply (UPS) equipment. ▲

Quality of Power

The iCAP Q instrument complies with the requirements listed in Table 4-3:

Table 4-3. Immunity compliance of the iCAP Q instrument

Description	Requirement
Immunity to Electrical Fast Transient/Burst	DIN EN 61326-1, DIN EN 61000-4-4
Immunity to Electrical Slow Transient/Surge	DIN EN 61326-1, DIN EN 61000-4-5
Immunity to Conducted RF Voltage	DIN EN 61326-1, DIN EN 61000-4-6
Immunity to Voltage Dips, Short Interruptions and Voltage Variation	DIN EN 61326-1, DIN EN 61000-4-11

See "General Preinstallation Information" on page 8-1 for details on the required quality of power.

Chapter 5 Cooling Water

For operation of the iCAP Q system, cooling of some components, for example, the interface and the RF generator, is required. The cooling water should be free of suspended matter to avoid clogging of the cooling circuit. An in-line filter is supplied with the instrument to guarantee consistent water quality. See Table 5-1 for the cooling water specifications:

Table 5-1. Cooling water specifications

Cooling water specifications	Specification
Supply rate	> 5.5 L/min
Temperature	15 to 25 °C, optimum at 21 °C
Pressure	0.25 to 0.55 MPa (2.5 to 5.5 bar)
Solid residual	< 50 µm particle size
pH	7 to 8
Fluid	distilled water

The water temperature should be in the range specified in Table 5-1. Lower temperatures could lead to a condensation of atmospheric water vapor. It is mandatory to use distilled water due to lower concentration of bacteria and residual organic matter.

A water hose (black) with an OD of 12 mm (ID 8 mm) and a length of 10 m is delivered with the instrument. The cooling water connections to the iCAP Q system are shown in Figure 5-1:

Figure 5-1. Cooling water connections at the left of the iCAP Q system

Technical Data Recirculating Chiller

The iCAP Q instrument is optionally delivered with the recirculating chiller NESLAB ThermoFlex 2500 with closed circuit, cooled by a refrigerating device. A schematic of the water-circulation is shown in Figure 5-2:

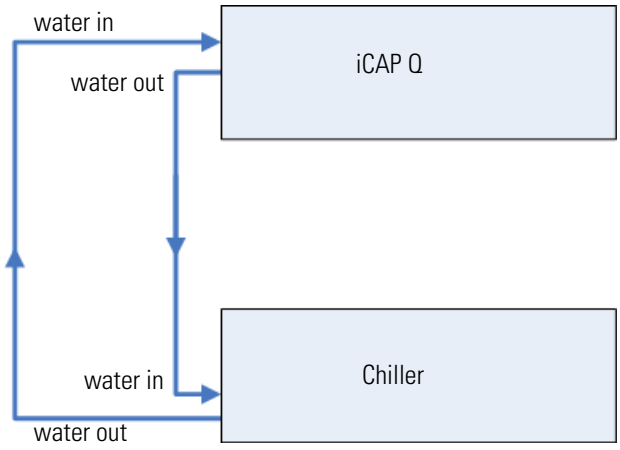


Figure 5-2. Cooling circuit with recirculating water chiller

Table 5-2 lists the technical specifications for the NESLAB ThermoFlex 2500 recirculation chiller optionally shipped with the iCAP Q system:

Table 5-2. Chiller specifications

Chiller component	Specification
Cooling capacity (at 20 °C ambient temperature)	2.2 kW (50 Hz), 2.5 kW (60 Hz)
Ambient Temperature	10 to 40 °C
Water temperature	5 to 40 °C
Stability of temperature regulation	±0.1 °C
Reservoir Volume	7.2 L
Flow rate	
Turbine pump (60 Hz) Turbine pump (50 Hz)	13.2 L/min at 0.41 MPa (4.1 bar) 9.5 L/min at 0.41 MPa (4.1 bar)
Unit dimensions (H × W × L)	73.6 cm × 43.6 cm × 67.3 cm
Unit weight	79.6 kg

NOTICE For information on the chiller's power supply see "Auxiliary Wall Outlets" on page 4-6. ▲

Chapter 6 Gas Supply

The iCAP Q system requires argon gas to generate the inductively coupled plasma and for controlling internal functions with the aid of pneumatics. Additional gases might be required depending on the type of analysis planned.

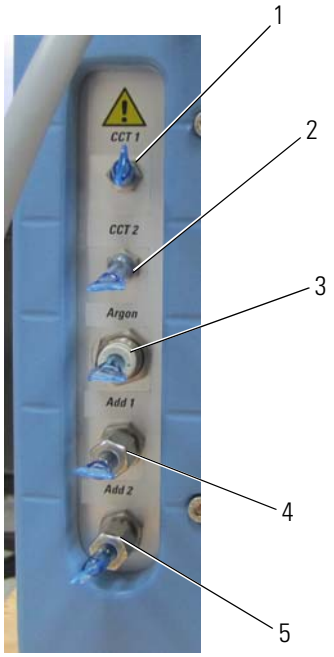
The iCAP Q system uses approx. 17 L/min (max. 24 L/min) of argon. It is essential that the gases be delivered with the necessary pressure and purity. For information on gas connections, gas purity and gas pressure that your system requires, see:

- "Gas Supply Connections" on page 6-2
- "Plasma and Cooling Gas" on page 6-3
- "CCT Gas" on page 6-4
- "Additional Gas" on page 6-6

NOTICE All gas flow rates given relate to standard conditions. ▲

Gas Supply Connections

For the CCT gases, stainless steel capillaries are installed inside the iCAP Q instrument from the connector to the optional CCT mass flow controller. Two stainless steel capillaries of 3 m length for the connection to **1** and **2** in Figure 6-1 are supplied with the models iCAP Q Qc and iCAP Q Qs.



Labeled Components: 1=CCT 1 gas inlets (for example for standard CCT gas He), 2=CCT 2 gas inlets (for example H_2/He), 3=argon in, 4=additional gas 1 inlet, 5=additional gas 2 inlet

Figure 6-1. Gas connection at the left of the iCAP Q instrument

Argon gas is connected at **3** in Figure 6-1. A rigid plastic tubing (polyurethane) of 3 m length for the connection of argon is supplied with the instrument.

Additional gases can be added to the aerosol formed in the spray chamber. Inside the iCAP Q instrument, tubes are already installed from the connector to the optional mass flow controller. The connectors for additional gases are also situated on the left side of the iCAP Q instrument, see **4** and **5** in Figure 6-1.

Table 6-2 lists the connectors for the gases to be provided by the customer:

Table 6-1. Gas tubings to be provided by the customer

Gas	Connector	Tubing
Argon	push-in fitting	6 mm OD
CCT 1	Swagelok™	1/16 in OD
CCT 2	Swagelok	1/16 in OD
Add 1	SERTO™	6 mm OD
Add 2	SERTO	6 mm OD

Plasma and Cooling Gas

Table 6-2 details the argon gas requirements:

Table 6-2. Argon gas requirements for the iCAP Q instrument

Gas requirements	Specification
Purity	99.996% or better
Maximum water content	< 5 ppmv
Supply rate	max. 24 L/min
Pressure	0.6 MPa (6 bar)

It is important that the argon supply to the iCAP Q system is stable. A high quality 2-stage regulator at the source is recommended. See Table 6-4 for suppliers.

Connection of the laboratory argon supply to the iCAP Q instrument is made via a push-in fitting. A recommended set-up for the argon supply is shown in Figure 6-2:

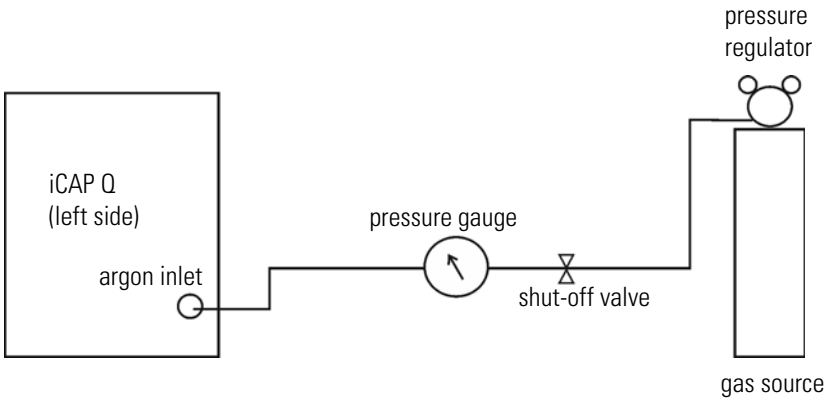


Figure 6-2. Argon connection of the iCAP Q instrument

NOTICE The polyurethane tubing supplied with your iCAP Q system should not be used between the gas source and the pressure regulator because polyurethane is not specified for pressure approx. above 0.8 MPa (8 bar). ▲

CCT Gas

Collision Cell Technology (CCT) allows the selective removal of polyatomic interferences. If an iCAP Q model including CCT is ordered (iCAP Q Qc or iCAP Q Qs), CCT operation at the system is possible. Thermo Fisher Scientific supplies 2 × 3 meters of gas tubing with the iCAP Q model including CCT.

NOTICE The CCT gas outlet should be located within 2 to 3 meters to the left of the iCAP Q instrument. ▲

The following services must be supplied by the customer:

- gas
- two-stage pressure regulator

Helium

For the iCAP Q model including CCT, a CCT installation test is performed with helium gas to pressurize the CCT cell. See Table 6-3 for details of the helium gas requirements:

Table 6-3. CCT gas requirements for helium

Gas requirements	Specification
Purity	99.999% or better
Maximum water content	2 ppmv
Supply rate	max. 10 mL/min
Pressure	0.1 MPa (1 bar)

Two-stage Gas Pressure Regulator

The quality of the gas regulator is critical to ensure optimum performance. A high quality two-stage pressure regulator is absolutely essential.The plasma gas regulator should have a specification of 20 MPa (200 bar) primary pressure and 1 MPa (10 bar) outlet pressure. The CCT gas regulator should have a specification of 20 MPa (200 bar) primary pressure and 0.3 MPa (3 bar) outlet pressure.

Each country has a different standard outlet fitting for its gas supplies and therefore each country will require a different regulator. Examples for regulators are given by region in Table 6-4. If your region is not listed, contact your local Thermo Fisher Scientific service office for advice.

Table 6-4. Regulator suppliers

Country	Manufacturer	Reference Code	Gas Application
Europe	Linde	C 106/2	Plasma
	Linde	C 202/2	CCT
	Linde	C 200hv/2	CCT
	Spectrolab	LM62	Plasma
US	Matheson	3810-CGA580	CCT
	BOC	HP1700 (CGA580)	CCT

Thermo Fisher Scientific supplies the 1/16-inch to 1/4-inch adapter for the optional iCAP Q model including CCT, to connect this CCT gas tubing to the gas bottle regulator. If the outlet from your regulator is not 1/4 inch you will need to provide a suitable adapter.

Additional Gas

Depending on the application, a variety of additional gases may be employed. The use of mass flow controllers is required when working with additional gases.

Oxygen

For the analysis of organic solvents the use of oxygen may be required. The gas requirements are detailed in Table 6-5.

Table 6-5. Additional gas requirements for oxygen

Gas Requirements	Specification
Purity	99.996%
Maximum water content	< 5 ppmv
Supply rate	max. 1 L/min
Pressure regulator output	0.6 MPa (6 bar)

NOTICE Temperature down to -10 °C will be required for the analysis of organic solvents. This is controlled via the Peltier cooler. ▲

Helium

For laser ablation analysis, helium gas may be needed. The gas requirements are detailed in Table 6-6.

Table 6-6. Additional gas requirements for helium

Gas Requirements	Specification
Purity	99.996%
Maximum water content	< 5 ppmv
Supply rate	max. 1 L/min
Pressure regulator output	0.6 MPa (6 bar)

Argon

For some applications, the use of additional argon gas is beneficial. The gas requirements are detailed in Table 6-7.

Table 6-7. Additional gas requirements for argon

Gas Requirements	Specification
Purity	99.996%
Maximum water content	< 5 ppmv
Supply rate	max. 1 L/min
Pressure regulator output	0.6 MPa (6 bar)

Chapter 7 Cleaning Agents

We recommend having the following cleaning agents available:

- A solvent like isopropanol or ethanol (in accordance with your local safety practices).
- Several liters of distilled water.

Chapter 8 General Preinstallation Information

This chapter provides general preinstallation information for your MS system:

Instrument Arrival

When your lab site preparation is completed, and the system is delivered, call your local Thermo Fisher Scientific office to arrange for an installation date.

Thermo Fisher Scientific 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.

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 your Thermo Fisher Scientific office to report the damage and – please – let the Thermo Fisher Scientific people check for further damage.

NOTICE If the instrument shipping container, Shock Watch™, 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. ▲

NOTICE 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 the chapters "Temperature" on page 3-2 and "Humidity" on page 3-9 of this guide as a guideline for the temperature and humidity 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.

Installation

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.

NOTICE Where buck/boost transformers or power conditioning units are supplied, it is the responsibility of the customer to have these units installed by an electrician prior to instrument installation. ▲

NOTICE A forklift or a palette-jack will be of great benefit for unpacking and inhouse transportation of the instrument components. ▲

Installing the System

When your new mass spectrometer system is on site, ready for installation, a Thermo Fisher Scientific field service engineer will install it.

During the installation, the Thermo Fisher Scientific field service engineer will demonstrate the following:

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

NOTICE Consumables sent with the system are intended for use by the Thermo Fisher Scientific field service engineer 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. This person will also be the key figure in the communication between your laboratory and Thermo Fisher Scientific.

NOTICE 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 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 mass spectrometer 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

Preventive Maintenance

Routine and preventive maintenance of mass spectrometer is in the responsibility of the customer. Included in this category are replacement of the cone, exchange of pump oil, replacement of filters, etc. on a regular basis. 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 Operating Manual and manuals that come with your data system computer and other modules of your system.

Operating Environment

These general specifications for your the operating environment help ensuring continued high performance of the system.

Particulate Matter

Particulate matter may contaminate the samples and the ion source and may limit the background level of the instrument.

The air in your laboratory must not have excessive dust, smoke, or other particulate matter. For reference, the air should contain fewer than 3500000 particles per cubic meter (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.

Quality of Power

The quality of power supplied to your 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 mass spectrometer 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 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.

Thermo Fisher Scientific recommends using power monitoring and conditioning devices. Contact your local Thermo Fisher Scientific office and see "Technical Assistance" on page 8-6 for electrical equipment suppliers.

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.

NOTICE 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). ▲

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 responsibility of the operator. 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 is listed in Table 8-1:

Table 8-1. Companies specifying power conditioning equipment

Company	Address or comment	Internet
General Electric Company	Worldwide distribution network	www.ge.com
JOVYATLAS Elektrische Umformtechnik GmbH	Groninger Straße 29-37 26789 Leer, Germany Phone: +49 (491) 6002 0 Fax: +49 (491) 6002 48	www.jovyatlas.info
Junge Störschutz Nord GmbH	Zum Steenshoop 17 27412 Tarmstedt, Germany Phone: +49 (4283) 9303-0	—
OnLine Power, Inc.	Conform to all applicable standards, worldwide	www.onlinepower.com
POWERVAR, Inc.		www.powervar.com
Sola/ Hevi-Duty		www.sola-hevi-duty.com
Warner Electric, Inc.	Motors and Controls division	www.warnernet.com

Electrostatic Discharge

Electrostatic discharge (ESD) can damage the electronic components of your MS 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 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. 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.
- Do not place Styrofoam cups or packing materials on the instrument.

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Thermo Fisher Scientific Inc.
81 Wyman Street
P.O. Box 9046
Waltham, Massachussetts 02454-9046
United States

www.thermoscientific.com