iCAP 6000 Series
ICP-OES Spectrometer

User Guide

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Chapter 1
Introduction to the iCAP 6000 Series

Overview

The iCAP 6000 Series is a range of Inductively Coupled Argon Plasma Optical Emission Spectrometers (ICP-OES) which use an Echelle optical design and a Charge Injection Device (CID) solid-state detector to provide elemental analysis.

Most samples are liquids that are pumped through a nebuliser to produce a fine spray. The large droplets are removed by a spray chamber and the small droplets then pass through to the plasma. The solvent is evaporated and the residual sample decomposes to atoms and ions that become excited and emit characteristic light which is measured and corresponds to the concentration of each element type in the original sample.

Control of the spectrometer is provided by PC-based iTEVA software.

To avoid loss of analytical performance and compromising safety only Thermo Scientific specified parts should be used.

The iCAP 6000 spectrometer consists of several major components:

- plasma torch and sample introduction parts
- radio frequency power generator
- optical system
- CID detector with thermoelectric cooling

Warning: Before operating your iCAP ensure you read and understand all the safety information at the end of this manual. ▲

User Documentation

This user guide includes basic information required to get you started with operating your iCAP 6000. More advanced operating instructions can be found in the Hardware Manual, the Software Manual and directly from the iTEVA software's built-in Help. In addition, the Pre-Installation Manual details all the lab requirements for your instrument. These manuals are described below.

Pre-Installation Manual

The Pre-Installation Manual provides the details of the services and environment that must be available before an iCAP 6000 can be installed.

Hardware Manual

The Hardware Manual details the operation and maintenance of your instrument hardware. It also includes full information about the safety hazards involved in working with the spectrometer and its accessories, and the means by which such hazards can be minimised. This manual is supplied in Adobe PDF format on the Supplementary Information CD supplied with this User Guide.

Note: ensure you have read and understood all the safety instructions contained in the Hardware Manual before operating your iCAP.

iTEVA Software Manual

The iTEVA Software Manual describes the functions and features of the Data Station software. This manual is supplied in Adobe PDF format on the Supplementary Information CD.

iTEVA Help

The iTEVA Software has its own active Help system that describes features and functions of the software. This can be accessed by clicking on **Help Topics** from the **Help** dropdown menu (shown below) Relevant help topics for particular areas of the software can also be found by pressing the **F1** key at any time.

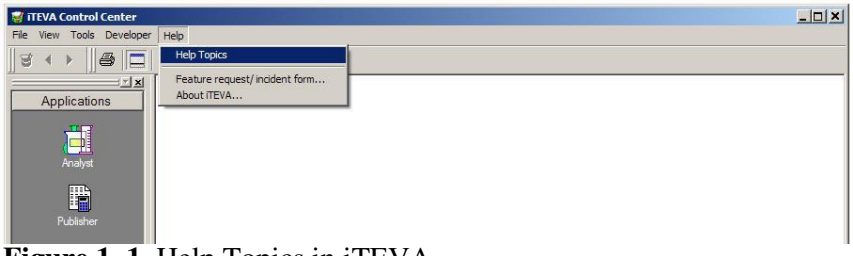


Figure 1–1. Help Topics in iTEVA

Chapter 2
Instrument Set-up

To comply with safety and warranty requirements, the iCAP 6000, accessories and associated equipment must be installed by a Thermo Scientific trained and certified engineer.

Pre-Installation Manual

Specific site requirements are required for the iCAP 6000. Please see the separate Pre-Installation Manual section.

Standard Sample Introduction Glassware Assembly

Warning: Appropriate care and safety procedures should be followed to avoid breaking any glassware and causing injury to the operator. Broken glassware should be handled with appropriate care. ▲

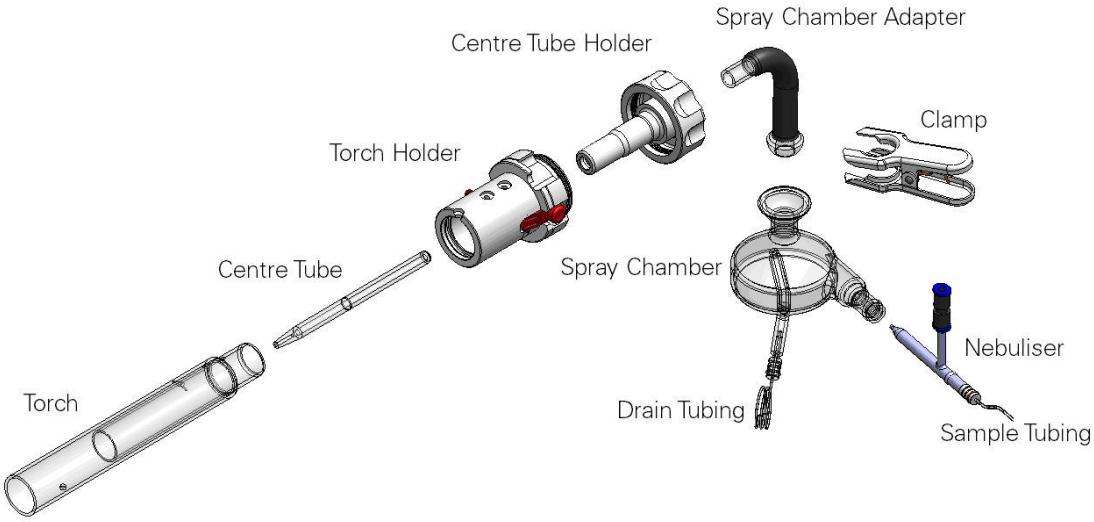


Figure 2–2. Glassware assembly

The sample introduction systems for an iCAP Duo instrument and a Radial instrument are put together in a similar way. The key differences are the length of the torch and the spray chamber adapter.

Assembling the Torch

Insert the torch into the torch holder by pushing it gently but firmly.

Note: Ensure that it is fully inserted and orientated in the correct way, as shown in the figure below.

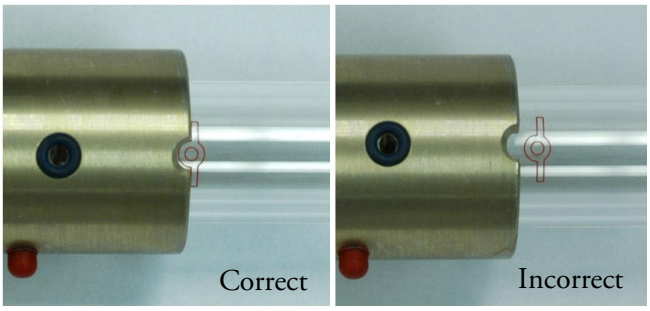


Figure 2–3. Torch assembly - torch body

Insert the centre tube as far as it will go into the plastic centre tube holder.

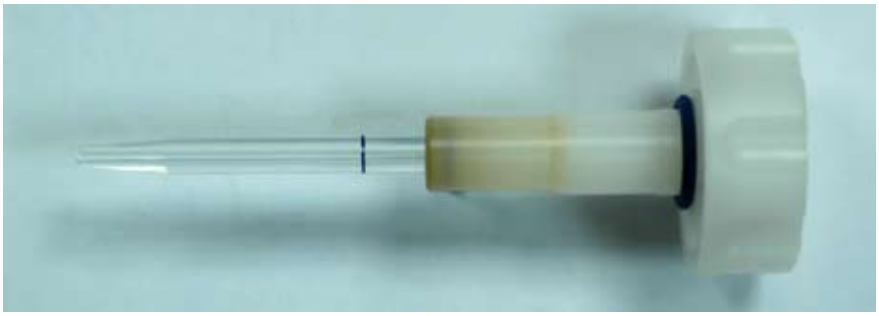


Figure 2–4. Torch assembly - centre tube

Note: The tip of the centre tube holder will discolour with use as shown in the figure above. This discoloration is normal and will not affect the performance of the torch holder assembly.

Once the centre tube is in the centre tube holder, carefully insert the centre tube assembly into the metal torch holder. Screw the centre tube holder assembly in a clockwise direction into the metal torch holder until the O-ring is compressed. Do not over tighten as this will reduce the lifetime of the O-ring seal.

Figure 2–5. Insertion of centre tube into torch assembly

Inserting the Torch and Centre Tube into the instrument.

Insert the torch holder into the torch box and turn the metal torch holder anticlockwise until the red orientation lock self locates in the torch box casting. Be sure to make sure you don't loosen the centre tube holder whilst doing this.

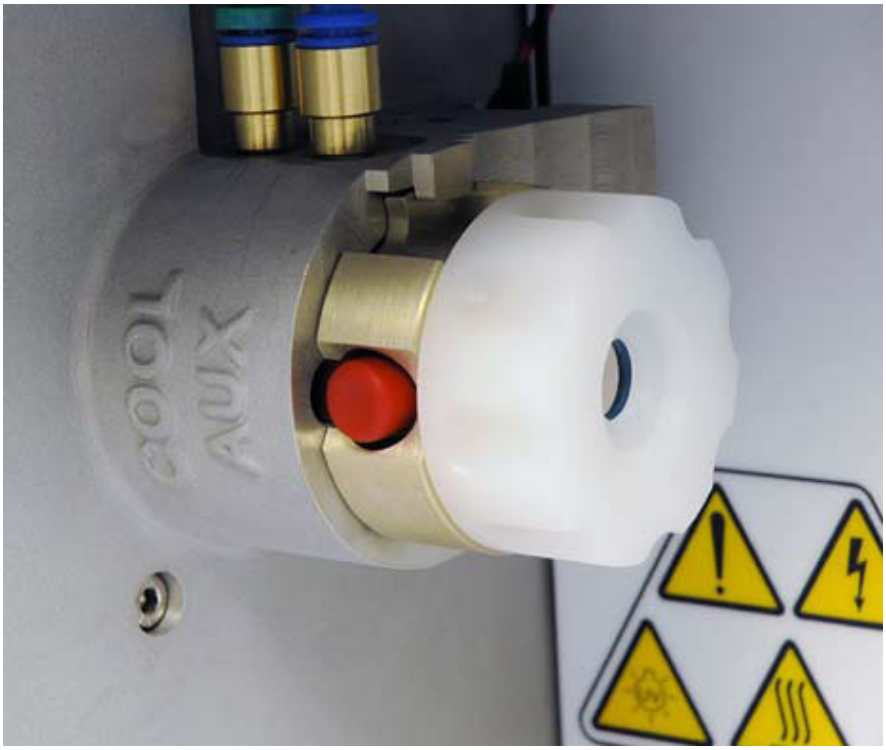


Figure 2–6. Insertion of the torch assembly into the box

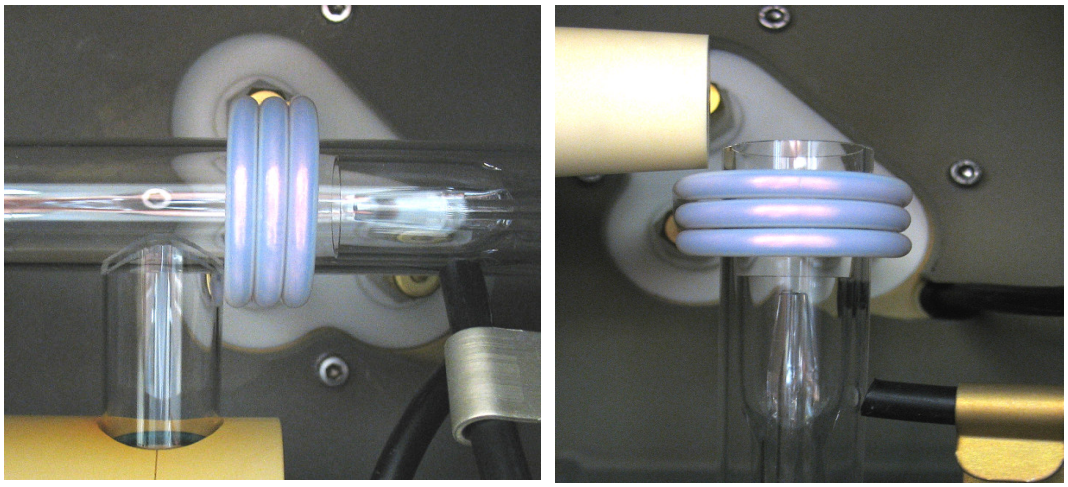


Figure 2–7. Relative coil and torch position on a Duo (left) and a Radial instrument

Ensure that the torch is centred in the coil, and on a Duo instrument that the radial view window is positioned close up against the torch.

Connecting the Spray Chamber and Nebuliser

Insert the white plastic tubing connector with wide bore tubing (0.79 mm internal diameter) into the spray chamber drain tube.

Liquid should be delivered to the nebuliser using an identical plastic tubing connector but with narrow bore tubing (0.50 mm internal diameter) relative to the spray chamber drain tubing. Push the white plastic tubing connector with the attached narrow bore sample tubing into the rear of the nebuliser as far as possible without exerting undue pressure.

Using a twisting motion, insert the nebuliser into the spray chamber. Two white plastic collars come with the nebuliser which can be used to aid to set a consistent insertion depth and aid reproducibility of results. To achieve best results the insertion depth of the nebuliser will need to be optimised by experimentation.

Note: The sample inlet connector has a **red** ring on it and the drain outlet connector has a **black** ring on it.

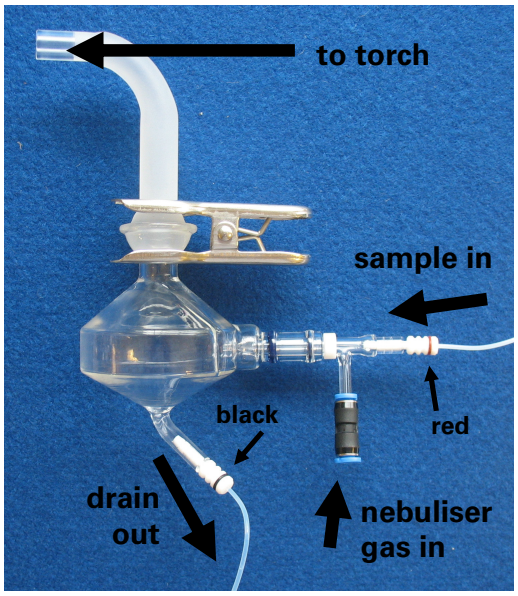


Figure 2–8. Spray chamber/adapter assembly

Attach the spray chamber adaptor to the spray chamber with the fitting clamp provided. The adaptor provided with the instrument is specially designed to prevent UV radiation from escaping from the torch box.

Note: A Duo configuration is shown in the above figure. A Radial instrument will be similar except for a straight spray chamber adapter.

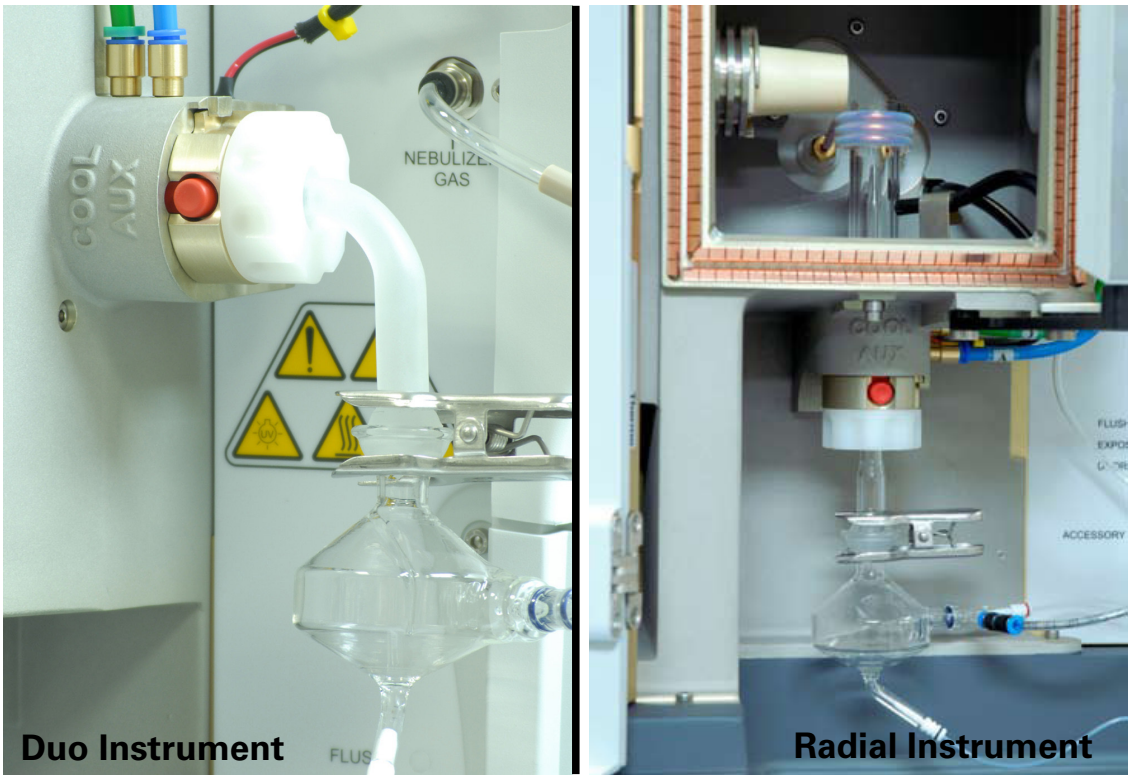


Figure 2–9. Spray chamber fitted to a Duo and a Radial iCAP

Insert spray chamber adaptor fitting into torch assembly as far as it will go and connect the Nebuliser gas supply to the push-fit fitting on the nebuliser.

After assembly of the sample introduction system and prior to ignition of the plasma a check should be made for correct assembly:

- **Make sure the torch is fully rotated and locked in place.**
- **Make sure the centre tube holder is fully rotated and screwed into the torch holder.**
- **Make sure the spray chamber adaptor is fully pushed into the torch assembly.**
- **Make sure the spray chamber is tightly clamped to the spray chamber adaptor.**

Problems in any of these areas may cause air leaks or disruption of the gas flows making the plasma difficult to ignite and may cause damage to the torch.

WARNING: It is extremely important that the correct Thermo Scientific part is used for the spray chamber adaptor. In addition, systems interlocks on the torch holder and elsewhere are there for safety reasons and must not be bypassed. Operators could be exposed to dangerous UV radiation and radio frequency radiation if alternate parts are used for the spray chamber adaptor. ▲

Connecting up the sample and drain pump tubing

Ensure there are no twists or bends in the nebuliser and drain tubing that may prevent flow of the sample.

Feed the sample capillary tubing from the rear of the nebuliser through the upper hole, as shown below, and towards the pump.

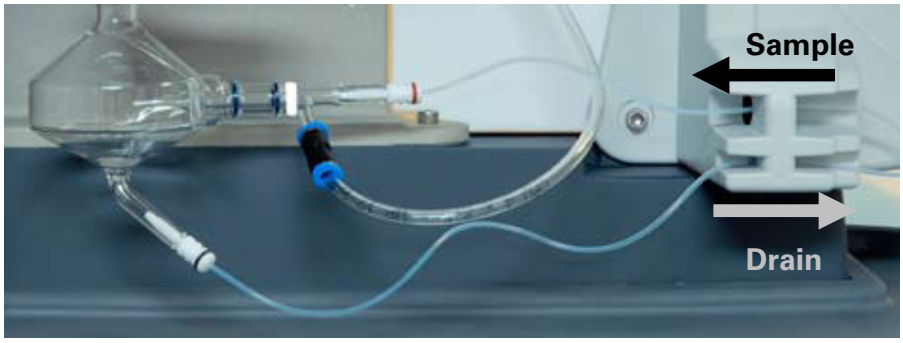


Figure 2–10. Sample and drain capillary tubing

Pass the drain capillary tubing through the lower hole and towards the pump. The lower hole contains a drain sensor that detects bubbles produced when the spray chamber is draining normally. The plasma and the pump will be switched off after two minutes if no bubbles are detected.

Insert the sample and drain tubing into their respective peristaltic pump tubes. Cut the capillary tubing at an angle with a sharp knife and insert as shown in the figure below.

Figure 2–11. Pump tubing connection

Note: The drain tubing should be connected correctly to the peristaltic pump to account for the anticlockwise flow. The direction of the rotation of the pump is shown in the figure below.

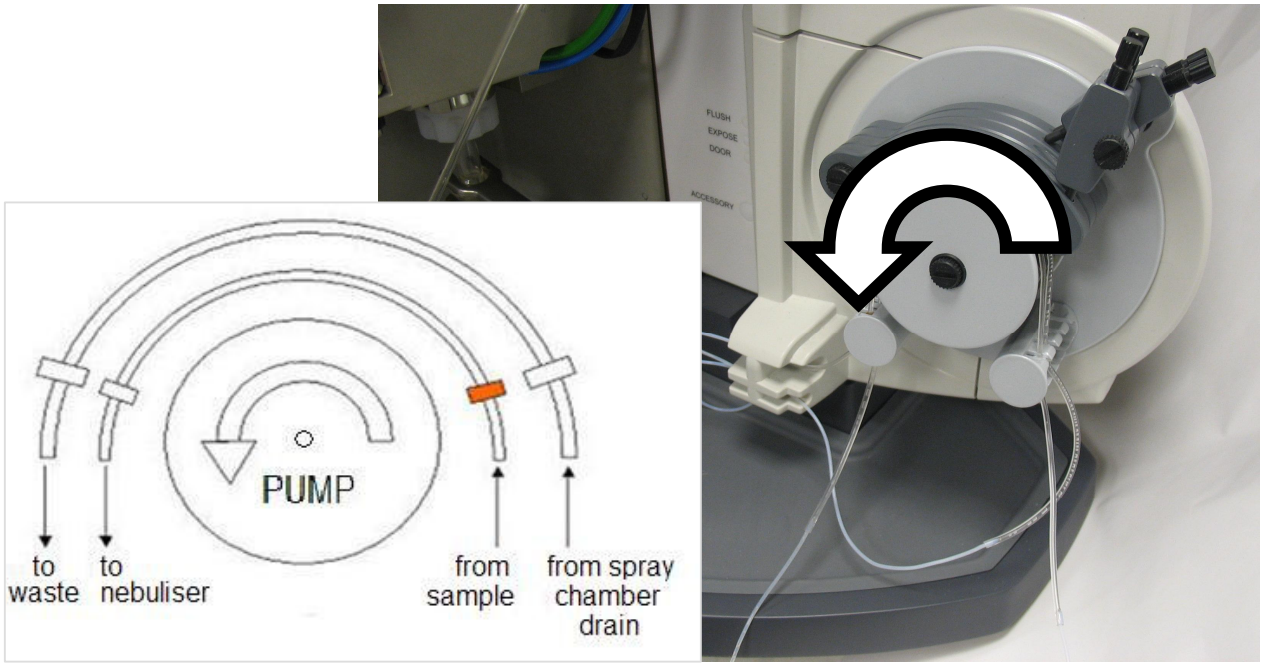


Figure 2–12. Pump tubing connected. Rotational direction of pump shown

Release the pump tubing clamps and locate the sample and drain pump tubing over the pump rollers, hooking the plastic bridges on the pump tubing into the left and right slots.

Connect both pump tubes to the capillary tubing as outlined above.

Pump tubing should be inspected before each analysis and should be replaced if there are indications of wear.

Figure 2–13. Pump tension adjustment

With a concentric nebuliser, the pump tension can be adjusted with the plasma running and the pump stopped. Lock the sample pump tubing

and clamp into position. Release the tension adjustment and allow the nebuliser to free aspirate. Tighten the tension adjustment until the flow just stops then tighten by one turn. Turn on the pump and, if necessary, tighten the tension until a smooth flow is produced.

Set the drain pump tubing tension to obtain an even and steady flow out of the spray chamber.

Do not over-tighten the pump clamps as it will result in excessive wear and tear of the pump tubing and require replacement tubing at more frequent intervals.

Torch Alignment

For maximum sensitivity and optimum results the alignment of the plasma image is critical. Whenever a torch has been removed or replaced in the instrument, or if the torch body or centre tube have been replaced, a torch alignment procedure should be carried out.

When the plasma is on and stabilised click on the **Instrument** menu and select **Torch Alignment**. The window below will be shown. Select **Aqueous** or **Organic** according to the matrix you are using and click on the **Run** button to start the routine. You will be prompted to aspirate a solution of 2 ppm zinc and this should be made up with either an aqueous or an organic matrix as required.

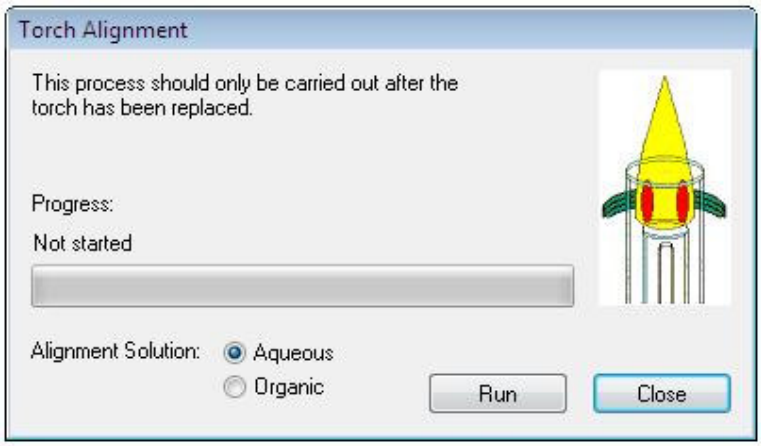


Figure 2–14. Torch alignment window

Auto Peak Adjust

For optimum performance it is important that the analyte wavelengths are correctly aligned in the centre of the subarray measurement window. The iCAP 6000 Series Spectrometer will automatically check a reference line each time the plasma is ignited to maintain wavelength accuracy.

Auto Peak only needs to be run whenever a new wavelength is used for analysis. The auto peak may also need to be run if the instrument has been switched off for an extended period of time.

To carry out an Auto Peak, allow the plasma to stabilise for 10 minutes and in iTEVA Analyst select **Perform Auto Peak…** from the **Instrument** menu.

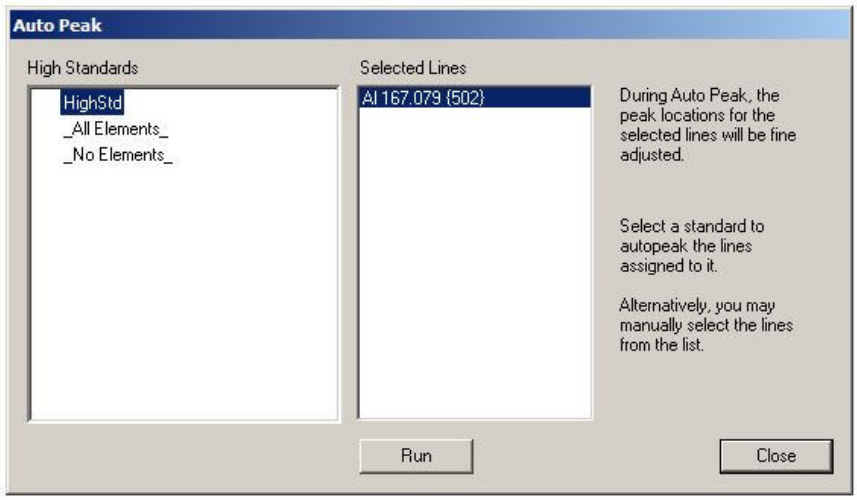


Figure 2–15. Auto Peak window

Select **HighStd** and aspirate this standard. Ensure you leave enough time for the sample to enter the plasma and then click **Run**. This procedure will set the default position for this line until the next Auto Peak takes place. If all elements are not in the same solution then multiple standards may be used.

Select **Close** when the test is successfully completed. If there is an error message associated with the test highlight the element and select **Reason** to ascertain the cause of the failure. This is normally due to the solution not being aspirated for long enough before the test began, or a problem with the solution.

A warning may be given if the analyte peak is not within the expected region. In this case check the alignment in the subarray display. If necessary move the central examination position, click “update method” and then repeat the routine.

Sample Introduction System Set-up

When a sample is aspirated and a proportion of the aerosol generated by the nebuliser is passed to plasma through the torch assembly, it generates a load on the plasma. The RF generator, the plasma conditions and the sample introduction system should be optimised for the particular sample and solvent type being introduced.

Peristaltic Pump Tubing Options

The iCAP 6000 requires pump tubing with two clamping points (two bridges). Your instrument will be supplied with Tygon® tubing suitable for the aqueous installation tests.

A range of different tubing is available for different sample and matrix types. For full details of these, refer to the Hardware Manual on the Supplementary Information CD.

Internal Standards

An internal standard is a reference element that can be used to correct for changes in signal intensity caused external factors. By definition it should not occur naturally in the sample, but is added to compensate for sampling differences. It must behave the same as other elements requiring analysis in the sample.

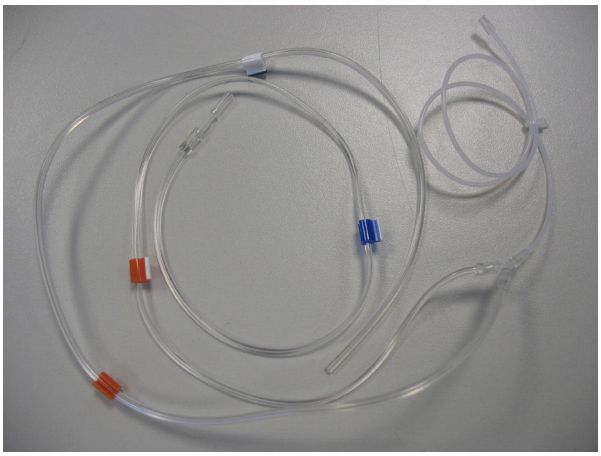


Figure 2–16. Internal Standards Mixing Kit

The use of internal standards is not required for all types of analysis but is typically employed where fluctuations in sample loading of the plasma occur. This is often caused by differing sample physical properties, for example viscosity, dissolved solids, surface tension or volatility.

Rather than adding an internal standard manually to all the solutions to be analysed it is possible to add it automatically on-line using the Internal Standards Mixing Kit.

To minimise sample dilution, the tubing for the internal standard solution has a smaller bore than that of the sample solution.

To ensure a thorough mixing of the internal standard with the sample, a mixing loop is provided after the Y-piece prior to connecting to the nebuliser.

Pump tubing for the Internal Standard Mixing Kit should be installed in a similar manner to the sample pump tube as previously described.

Application-Specific Hardware

Your iCAP 6000 Series instrument will be installed and tested with aqueous solutions. For applications involving organic solvents, high dissolved solid and HF samples, and hydride generation a slightly different configuration of sample introduction may be required. For example different spray chambers, centre tubes and nebulisers are available. Additional hardware accessories may also be required.

Full details of these can be found in the Hardware Manual on your supplementary CD.

Chapter 3
Databases

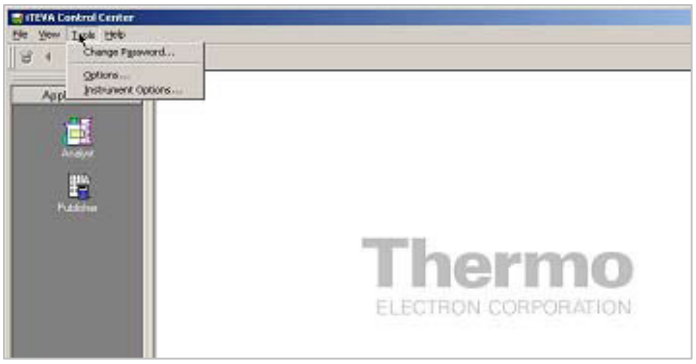
To store results from your iCAP you must create a databases, or databases, which can be held either locally or on a network. Local database management is done through iTEVA using the Applications Database options as shown below.

The steps outlined in this chapter explain how to create a new local database. For details on backing-up and managing your databases, and on remote database management, refer to the **Software Manual**.

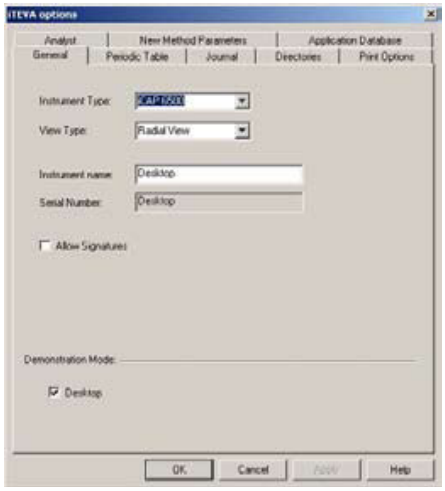
For iTEVA *Security* please refer to the separate iTEVA Security manuals.

Local Database Creation

To create a local database click on **Tools/Options** on iTEVA control panel.



Click on **Application Database** Tab.



Click on **Run database wizard** box.

Type **.\iTEVA** in Server Name box

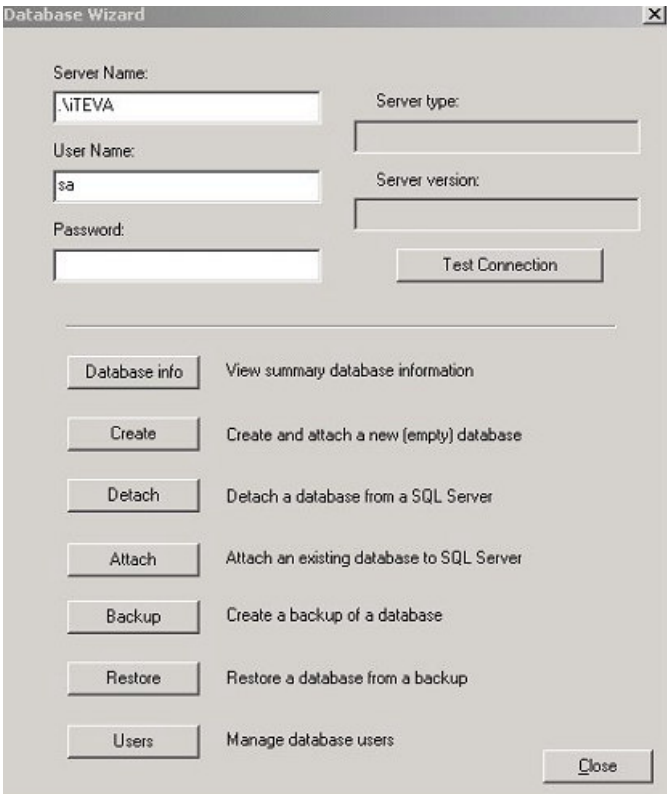
Type **sa** in User Name box

Type **teva** in Password box

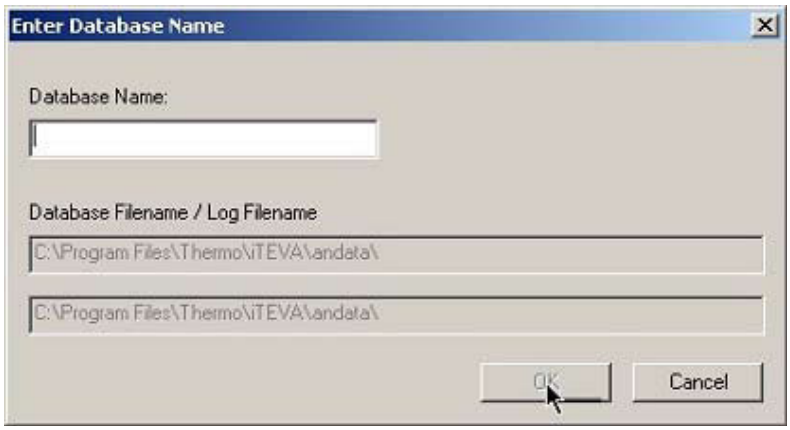
Click on **Test connection** box

This should fill in the Server type and Server version boxes.

Click on **Create** box

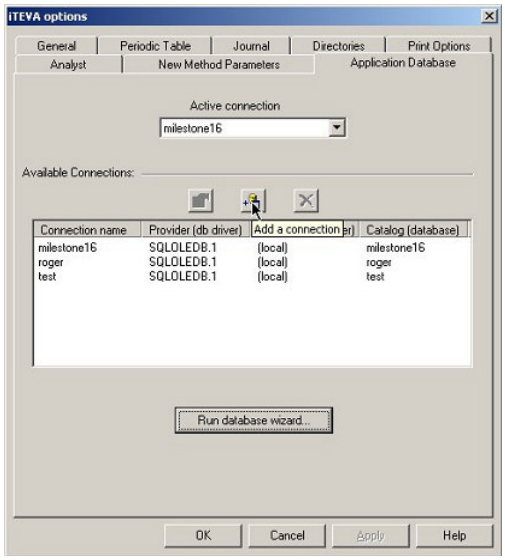


Enter required name for Database click **OK** and click on **close** box



Creating a Database Connection

Click on the **add a connection** box as shown



Type **.\iTEVA** in server name box

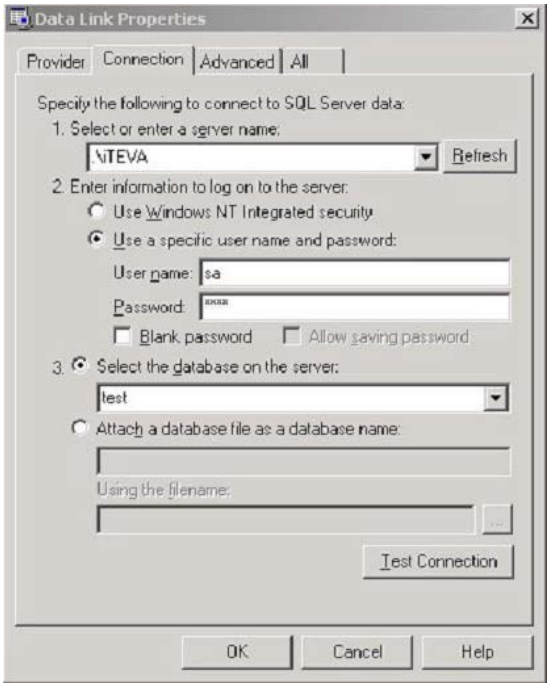
Type **sa** in User name box

Type **teva** in Password box

From the **Select the database on the server** box choose the Database required

Click on **Test Connection**

Click **OK**

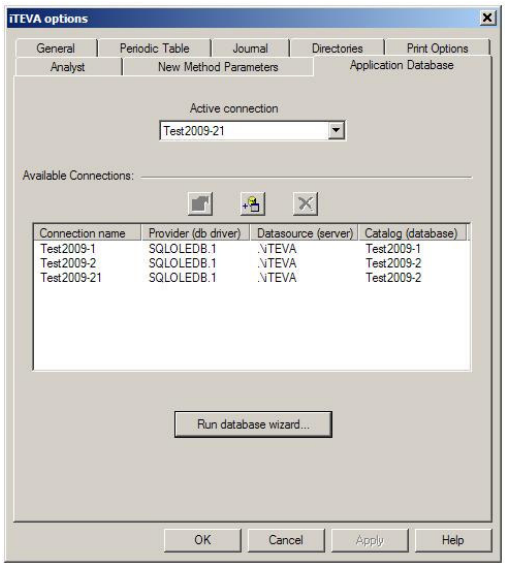


Follow instructions on box shown and fill in an appropriate name. Click OK.

The newly created database will now appear in the list of connections.

Select the created database form the **Active connection** drop down box and click on **OK**.

This will now make the new database active and your analytical data will be stored here.



Chapter 4
Using the iCAP

Preparing the System for Use

The iCAP 6000 is designed to be constantly powered up and the optical system continuously purged.

The instrument is powered via an on/off switch at the rear of the left side. If the instrument power is switched off, allow at least two hours after restoring power to thermally stabilise the instrument.

If the gas supplies have been switched off, the optical components should be purged for at least two hours before turning on the water chiller and running samples. Even then, if the purge gas has been off for sometime signals in the low wavelength range may only be acceptable after several hours.

Warning: Do not turn on the water chiller until the instrument has been purging with gas for at least two hours. Doing so can seriously damage the CID detector. ▲

Deionised water (or organic solvent if using an organics kit) should be aspirated for twenty minutes to allow the instrument to fully stabilise before analysis.

Instrument Shut-down

After an analysis is finished a blank sample should be aspirated for five minutes to ensure the sample introduction components have been rinsed of sample. To remove the blank sample, deionised or distilled water should be aspirated for a further minute.

When organic solvent based samples are being analysed the final rinse should be the pure solvent. Air should be aspirated for one minute to remove organic solvent from the sample lines and to remove organic vapours.

After completing the above the plasma should be turned off. The optical components will move to a parked position after about thirty seconds.

After switching off the plasma, allow two minutes before switching off the water chiller and gas supplies.

Allow five minutes after switching off the instrument, or accessories, before disconnecting the electrical power or other supplies.

Analytical Operation

The iCAP 6000 will require optimisation that is dependent on the sample being analysed and the method requirements.

It is important that the method development verifies the data produced by the method.

It is also important that a suitable quality control regime is established that verifies the continuing validity of data.

Training courses are available through a local Thermo Scientific Sales Office; contact details are available on www.thermo.com.

Method Optimisation

The following parameters can all affect the data obtained and should be optimised. Usually a default setting will give data that is satisfactory, but may not be optimal for the analysis requirements.

- Nebuliser Gas flow
- Plasma viewing height
- RF Power
- Pump speed
- Auxiliary gas flow
- Coolant gas
- Integration times

Running the iCAP

Once the iCAP has been on and the optics have been purged for a sufficient time using argon or nitrogen, you can begin to use your instrument for analysis.

Note: Gas pressures, details of power supplies and water chillers, etc. can be found on the Pre-Installation guide on your supplementary CD. It is critical to the instrument's operation that these specifications are followed.

Sequence of operation

1. Power to the instrument and purge gas on for at least two hours.

2. Switch the water chiller on after the instrument has purged for at least two hours.

3. Check that your sample introduction system is connected and that the pump tubing is secured in the pump and that the sample uptake tubing is placed in a blank solution.

4. Ensure that the drain tubing is safely placed in a plastic open-neck vessel at a level below the instrument.

5. Open the **iTEVA** software on your PC.

6. If not connected to a database you will be prompted to do so at this stage. Details of this can be found in the **Database** chapter in this User Guide.

7. Click on the **plasma icon** in the bottom right of the iTEVA window. This will open the **Plasma Status** window as shown below.

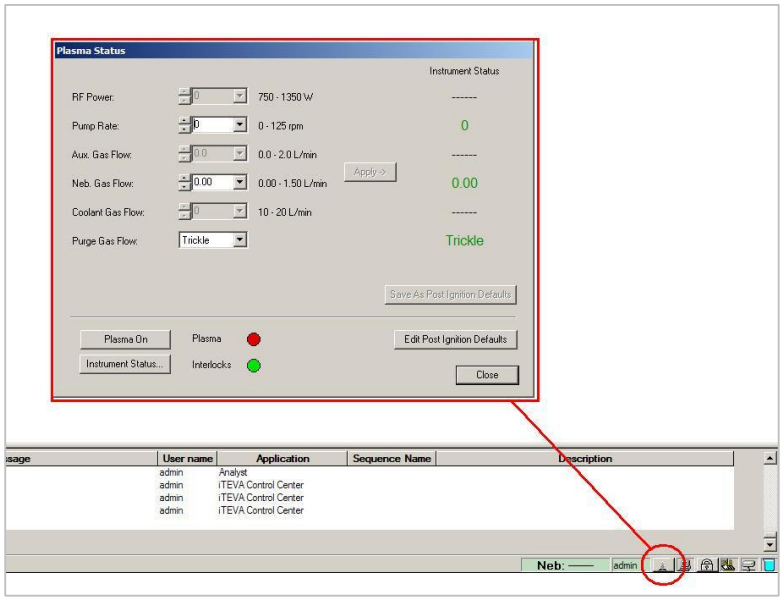


Figure 4–17. Plasma Status Window

8. Clicking on the **Instrument Status** button shows the interlocks and instrument temperatures. If any interlock is red then the plasma will not light. Check temperatures as shown in the diagram below.

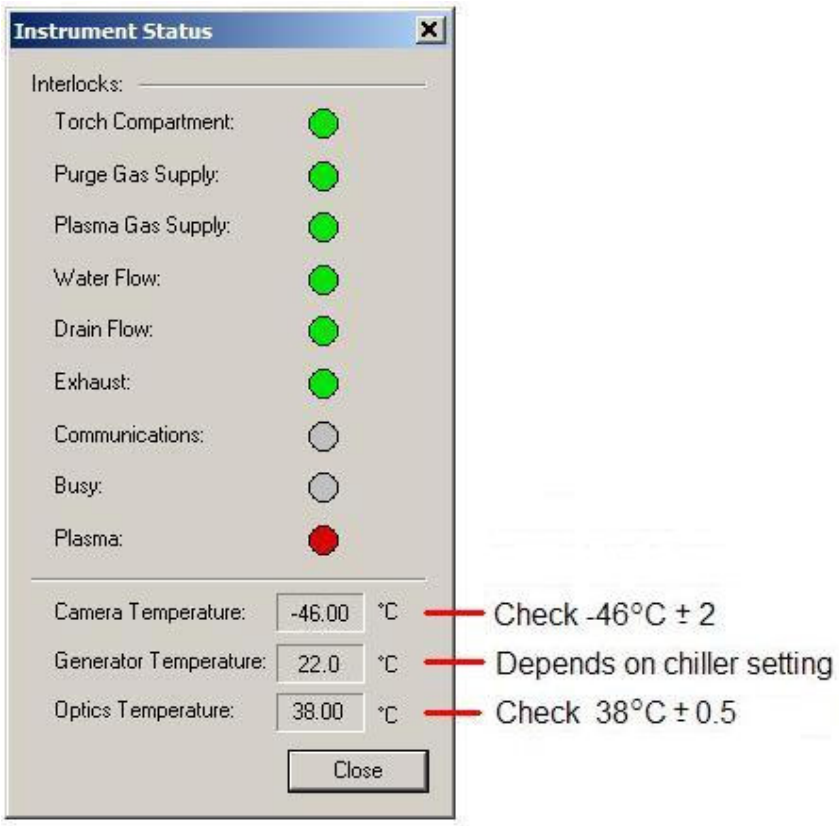


Figure 4–18. Instrument Status Window

9. If all the interlocks are **green** the **Instrument Status** light will be **green** in the **Plasma Status** window. Click **Plasma On** to light the plasma. Once the plasma is lit, the instrument will initialise and this will may take a few moments.

10. Allow the plasma to stabilise for at least twenty minutes whilst aspirating your blank solution.

Once the plasma has stabilised you can begin to use your instrument for analysis.

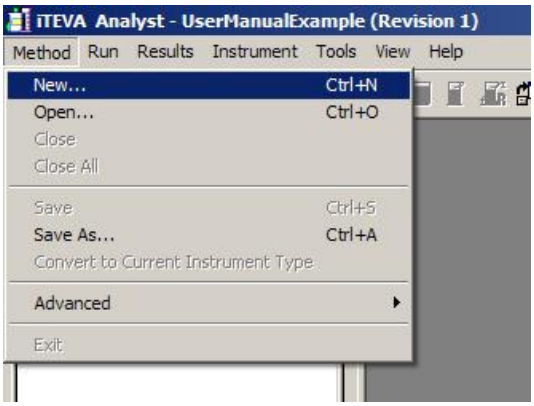
How to Run an Analysis

Below is an example of a simple analysis for determining concentrations of an element in some unknown samples. A blank and one standard will be used for calibration.

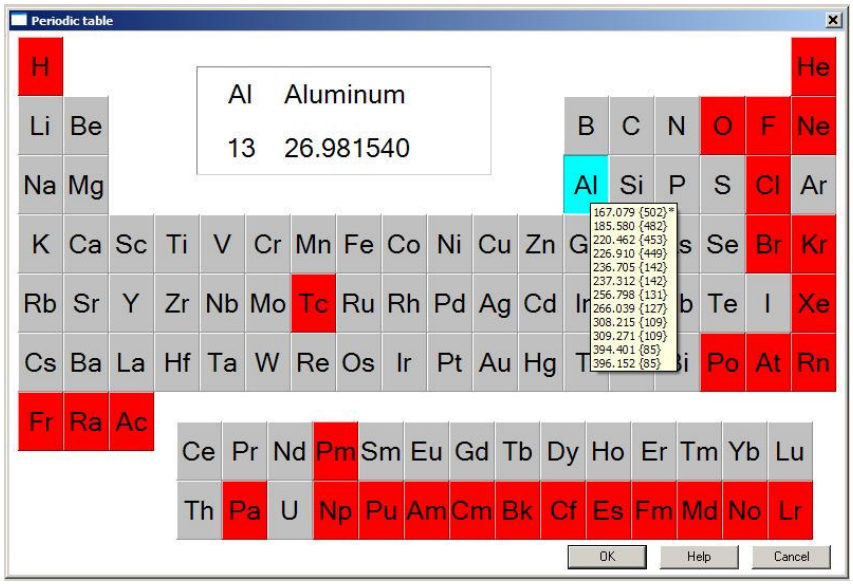
The first step is to create a new method for the analysis which uses the default parameters within iTEVA. This method setup procedure should be adequate for setting up a basic analysis. It is recommended that the user reads the iCAP Software Manual for more advanced use of the system.

Creating a Method

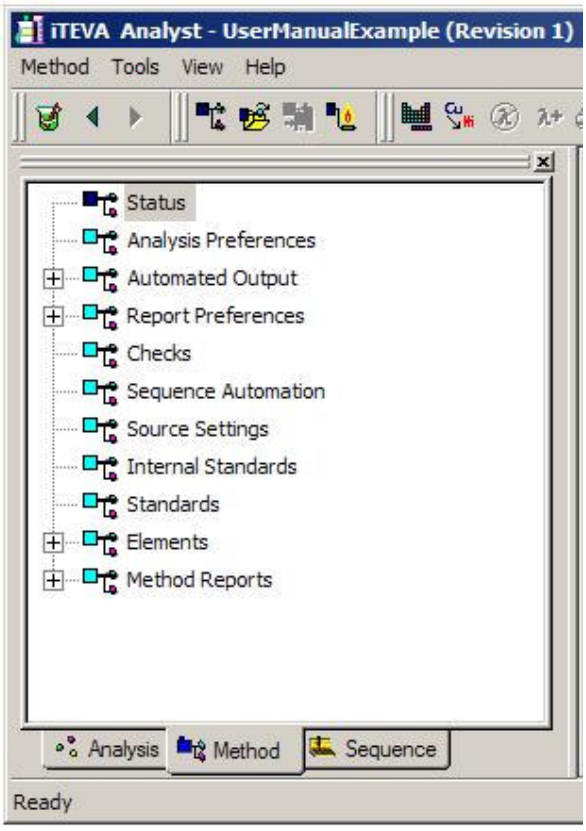
In the iTEVA Analyst software select **New…** from the **Method** menu.



Firstly, you will be prompted to choose the elements you are analysing. In this case you will click on **Al** and accept the default line by clicking **OK**. Once you have chosen your element(s) click **OK** and you can set up your method.



Select the **Method** tab at the bottom left of your iTEVA window.



Working down the options from **Status** through to **Method Reports**, the method can be developed. For this example leave all settings at default. For more information about each of these windows use the **F1** key to bring up **Help topics** on each one.

Note that when clicking on **Standards**, there is by default one blank and one high standard with a concentration of 10ppm, and one blank. For this example use these standards, but further standards of varying concentrations can be added.

Running the Analysis

Now that you have created a method, you must return to the **Analysis** tab (on the bottom left of the iTEVA window).

Before you can run an analysis you must save the method by selecting **Save** in the **Method** menu.

Spectrometer Optimise

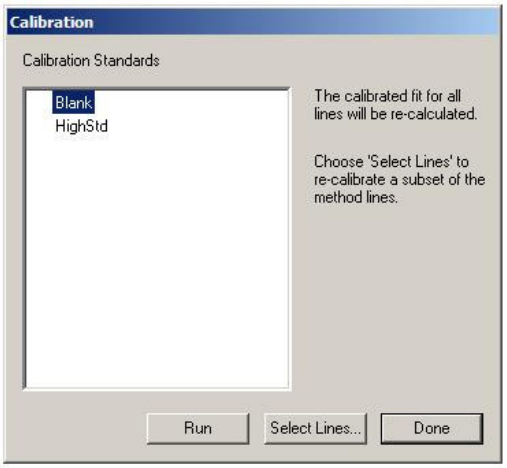
The first thing to do is to perform a Spectrometer Optimisation. This ensures that all the lines in your method are correctly positioned on the CID detector.

To perform a Spectrometer Optimisation select **Optimise Spectrometer** from the **Instrument** menu. The status bar at the bottom of the screen will indicate progress. Once this is complete the instrument is ready to run an analysis.

Note: When using an autosampler, an optimise spectrometer action is added to the start of a sequence by default.

Calibration

To calibrate the method select **Calibration…** from the **Run** menu.



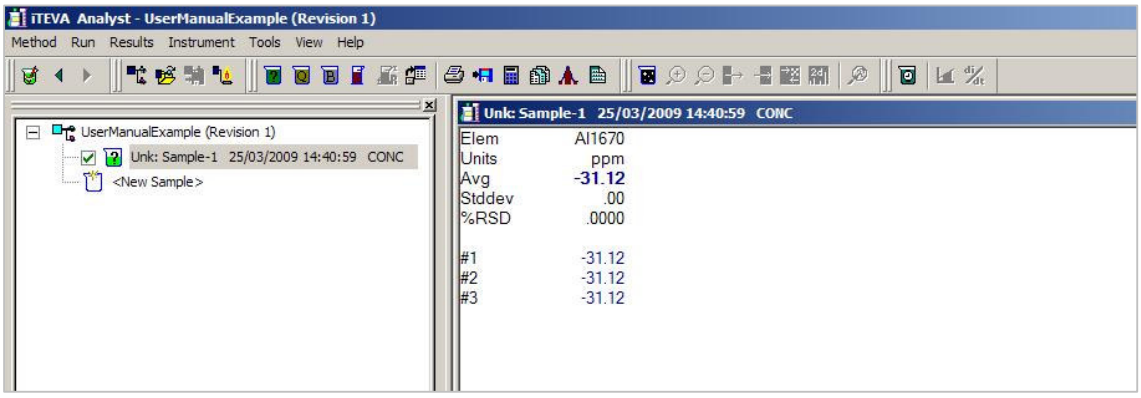
When Blank is highlighted, aspirate your blank standard and click **Run**. Then repeat for the high standard. When finished click **Done**.

Analysing Unknowns

Now that the method is calibrated you can analyse unknown samples by selecting **Unknown…** from the **Run** menu.

In the **Run Unknown** window you can name your unknown sample and select various settings such how many repeats you want to run. When you have named your sample click **Run**.

The results of the analysis of your unknown sample will now be shown on the screen when you click on the sample name under your method on the left pane of the iTEVA Analysis software.



Shutting Down the System

Place the sample tube in Deionised water and let it pump through the system for 3 to 5 minutes.

Click on the **plasma icon** and then click on **Plasma Off**.

Release the tension on the sample pump platen.

Switch off water chiller.

Chapter 5
Maintenance

The iCAP 6000 has been designed for minimum maintenance. However, it is critical that the sample introduction components be checked regularly for contamination and wear. Failure to do so could result in loss of instrument performance.

Therefore, routine user maintenance of the iCAP 6000 is mainly concerned with keeping the instrument clean.

Instrument Cleaning

Note: The iCAP 6000 instrument covers are made of ABS plastic which can be damaged by solvents and concentrated acids. ▲

Any spillage on the external covers or within the sample introduction areas should be cleaned up immediately, using appropriate safety precautions.

Stains and marks on the covers should be removed with a soft cloth moistened with a mild detergent solution. Do not use any solvent based cleaners.

Sample Introduction System Cleaning and Decontamination

Failure to maintain the sample introduction system can result in erroneous results, poor precision, poor detection limits and blockages.

After use, the instrument shut down procedures from earlier in this manual should be followed. Components contaminated with sample residues should be cleaned.

It is recommended that several spares for each part are available as blockages, sample contamination and breakages often happen at critical moments during analysis.

Suitable protective clothing, glasses and gloves should be worn.

Torch Cleaning

Reverse the torch assembly process detailed previously.

The O-rings in the metal torch mount (3 internal & 2 external) should be inspected and replaced if any wear or damage is visible.

Warning: Allow at least 10 minutes for any hot components to cool before removing them from the torch compartment. Care should be taken to remove any broken glass from the Duo radial POP window, if a breakage occurs in the torch box. ▲

To remove **salt deposits** soak the torch in a dilute analytical-grade surfactant for five minutes.

To remove **metallic deposits** from the tip, separate the torch quartz section, immerse the tip of the torch in acid (a mixture of nitric and hydrochloric similar to Aqua Regia is suitable).

After cleaning, rinse the torch with de-ionised water and place in a drying oven at 95°C until it is dry. Rinsing with a volatile zero residue organic solvent (propanol is suitable) will aid drying.

To clean the torch of **carbon deposits**, place the torch in a muffle furnace and heat to 750°C. Open the door for a few seconds to allow air to enter, close and allow the oven to reach 750°C again. Repeat this several times to remove all the carbon. Allow the furnace to cool over several hours, as this will prevent stress building up in the quartz.

Spray Chamber Cleaning

Reverse the spray chamber assembly process detailed previously.

If the spray chamber becomes greasy and droplets form on the inside soak the torch in a dilute analytical-grade surfactant for five minutes.

If the spray chamber becomes dirty or deposits form inside it, soak the spray chamber in cold acid for two hours (a mixture of nitric and hydrochloric similar to Aqua Regia is suitable). After cleaning rinse the spray chamber in deionised water.

Nebuliser Cleaning

Reverse the nebuliser assembly process detailed previously.

Rinse it with deionised water or the organic solvent at the end of each day, or aspirate a cleaning solution through. If it is blocked, use an Eluo or similar to get rid of the blockage.

Warning: Do not put the concentric nebuliser in an ultrasonic bath or heat it in an oven. ▲

Purged Optical Path Window Cleaning

Before attempting to clean the Purged Optical Path (POP) window (note: there is also one below the torch on a Duo configuration instrument) turn off the plasma and allow thirty minutes for any hot areas to cool down.

Open the small access door next to the sample compartment door and withdraw the POP window assembly. Clean the POP window using a lint free cloth and clean water. Repeat the cleaning process using methanol then, when dry, re-insert the POP window into the fore optic assembly.

Warning: Do not open this access door when the plasma is running, there is a potential UV radiation hazard. All mirrors in the optical system are coated so be sure not to touch the mirror below the radial view POP window in the Duo configuration. ▲

If further cleaning is necessary, remove the quartz window from the POP and soak in cold acid for two hours (a mixture of nitric and hydrochloric similar to Aqua Regia is suitable). After acid soaking rinse in de-ionised water, then with a volatile zero residue organic solvent (propanol is suitable) to aid drying.

Preventive Maintenance

Although minimum user maintenance is required, periodic checking of performance is required by many laboratories. This is particularly important for customers subject to external standards and regulations (for example ISO9000, EPA or NAMAS). Details of these options are available from a local Thermo Fisher Office.

All electrical supplies, gas supplies and extraction must be checked to ensure local health and safety guidelines and regulations are complied with. The gas and cooling water should be checked for leaks at regular intervals.

Water Chiller

It is important that the cooling fluid used for your iCAP is made up correctly as specified in the Pre Installation Manual.

An effective maintenance plan would include replacing the cooling fluid with new fluid periodically depending on the usage of your instrument, and also to ensure that any air filters and water filters a kept clean. Refer to your chiller documentation for more information.

Gas Filters

Gas filters fitted to your purge and plasma gas inlets must be checked for cleanliness to prevent loss of instrument performance. If the filters appear dirty, replace them and check the quality of your gas supplies.

Chapter 6
Safety

iCAP 6000 Safety

Read this chapter carefully before installing and operating the instrument and its accessories. The safety standards contained in this manual comply with the requirements of the Health and Safety at Work Act 1974[1] as published by the United Kingdom Health & Safety Executive (HSE).

Introduction

The instrument and accessories described in this manual are designed to be used by properly trained personnel only. Any adjustment and repair of this equipment must only be carried out by a Thermo Scientific certified field service engineer who is aware of the hazards involved.

[1] www.hse.gov.uk/legislation/hswa.htm

Safety Precautions

For the correct and safe use of the instrument and its accessories it is essential that the operating and service personnel follow generally accepted safety procedures in addition to the specific precautions specified in this manual. Specific warning and caution statements and symbols are included in the relevant sections of this manual.

Warning and caution statements and symbols are marked on the apparatus where appropriate. The symbols are described in the table below:

Yellow/black or Red/white WARNING: the operator must refer to an explanation in the User Documentation.▲

White/black/moulded Protective earth (ground) terminal▲

Yellow/black Surfaces which may be hot▲

Yellow/black Hazardous voltages present. Handle by insulation only. Do not touch terminal points.▲

Yellow/black Radio Frequency Radiation, Specific safety details in user manuals.▲

Yellow/black UV Radiation, Specific safety details in user manuals.▲

Yellow/black Do not remove covers or open. No User Serviceable parts inside. ▲

Unless otherwise stated in this manual, the covers of the instrument and accessories should only be removed by qualified, appropriately trained service personnel.

All spare parts and consumables items must be approved by Thermo Scientific.

Some of the chemicals used in spectrometry are corrosive and/or flammable, and samples maybe radioactive, toxic or potentially infective.

Normal laboratory procedures and regulations for handling such materials should be followed.

Electrical Safety

All mains powered equipment is designed for operation with a fully earthed mains supply. The mains earth connection to the equipment must be connected, otherwise safety may be impaired.

Where reference is made to electrical safety the national regulations for the country of use when fitting the power cord plugs should followed. A qualified electrician should be consulted for all electrical connections. If liquid is spilled on, or adjacent, to the instrument immediately isolate the instrument and accessories from the electrical supply, by turning off the power remote to the instrumentation.

Equipment Cleaning and Decontamination

It is the user's responsibility to carry out appropriate cleaning and decontamination of the equipment if hazardous material is spilt on or inside the equipment. Cleaning and decontamination are specified in the relevant sections of this manual. Before using any other procedures, users should check with the manufacturers that the proposed method will not damage the equipment.

Impaired Safety Protection

Whenever Safety Protection has been impaired the instrument and accessories must be made inoperative and secured against any unintended operation. The matter should then be referred to the local Thermo Scientific service organisation. Safety protection is likely to be impaired if the instrument fails to operate normally, or shows visible damage. If the equipment is used in a manner not specified by the manufacturer the safety protection provided by the equipment may be impaired.

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 symbol:

Thermo Scientific has contracted with one or more recycling/disposal companies in each EU Member State and this product should be disposed of or recycled through them. Further information on the compliance of Thermo Scientific with these directives, the recyclers in your country and information on Thermo Scientific products which may assist the directive are available at www.thermo.com/WEEERoHS.

Regulatory Notices

The iCAP 6000 spectrometer and accessories are CE marked, indicating compliance with the following European Directives:

89/336/EEC Electromagnetic Compatibility Directive (EMC Directive)

72/23/EEC Electrical Equipment designed for use within certain voltage limits (Low Voltage Directive).

For further details, refer to the regulatory notice for the iCAP 6000 spectrometers and accessories, which is reproduced below.

iCAP 6000 Sicherheit

Lesen sie dieten desonders sorgfályig vor der installation und dem gebrauch des gerätes.

Elnführung

Die hier beschriebenen Garäte erfordern gründlich ausgebildetes Bedienungspersonal. Spezielle justierungen, Wartungen und Reparaturen am geöffneten Gerät dürfen nur von autorisierten Personendurchgeführt warden.

Allgemeine richtlinien zur sicheren handhabung des Gerätes

Für die korrekte und sichere Handhabung des Gerätes und des entsprecheden Zubehörs ist es unbedingt erforderlich, daß das Bedienungs und Service-Personal den in der Bedienungsanleitung angegebenen richtlinien Folge leistet.

Spezielle Vorsichts- und Warnungshinweise finden Sie der Bedienungsanleitung besonders vermerkt

Gelb/Schwarz oder Rot/weiss WARNUNG: muss das entsprechende kapitel der bedienungsanleitung.▲

Gelb/Schwarz Masse/ schutzkontakt▲

Gelb/Schwarz Heisse oberflache▲

Gelb/Schwarz Gefährliche hochspannung. Nur an der isolierung berühren. Niemals knotakte anfassen.▲

Gelb/Schwarz Radiofrequenzbestrahlung, Spezifische Sicherheit schildert genau in Benutzerhandbuchn.▲

Gelb/Schwarz UV Bestrahlung, Spezifische Sicherheit schildert genau in Benutzerhandbuchn. ▲

Gelb/Schwarz Nehmen Sie Decken oder offen, Keine vom Benutzer Haltbaren Teile hinein nicht heraus.▲

Außderdem befinden sich am Gerät, wo erforderlich, Hinweisschilder. Die Geräteabdeckung sollte ausschließlich durch einen qualifizierten Thermo Scientific Service-Ingenieur enfernt warden. Alle Ersazteile und verbrauchbaren benutzten Einzelteile müssen Thermo Scientific genehmigt warden.

Einige der in der Spektroskopie zur Anwendung kommenden Chemikalien sind corrosive, leight entzūdbar, radioactive, infektiōs oder toxisch.

Daher muß dafür Sorge getraden warden daß die normalen Laborrichtlinien zur Handhabung dieser Chemikaline zur Anwendung kommen.

Elektrische Sicherheit

Vom Netz gespeiste Geräte sind so entwickelt das seine Masseverbindung vorhanden sein sollte. Diese Masseverbindung sollte vorheinden sein da sonst die elektrische Sicherheit beeinflusst warden könnte.

Im Hinblick auf die elektrische Sichrheit müssen die folgenden Punkte beachtet warden.

Die elektrische Installation muß den jeweiligen Bestimmungen des Landes durch qualifiziertes Fachpersonal erfolgen.

Verschūttete Flüssigkeiten: Das Gerät und/oder Zubehör sofort ausschalten.

Reinigung und Dekontamination der Geräte

Es liegt in der direkten Verantwortung des ANWENDER und nicht des Gerāteherstellers, eine Dekontamination des Gerätes durchzuführen, falls sich toxische Substanzen im oder dem System befinde.

Reinigungs- und Dekontaminationsarbiten sind in der Bedienungsanleitung beschrieben.

Bevor Sie eine Reinigungs-bzw. Dekontaminierungsmethode einsetzen, die nicht vom Hersteller empfoohlem wird (vgl. Wartungshinweise dieser Bedienungsanleitung), sollten zusammen mit demhersteller sicherstellen, daß diese Vorgehensweise da Systemnicht beschädigt.

Beeinträchtigung der Sicherheitseintichtungen

Immer dann, wenn eine Beinträchtigung der Sicherheit vorliegt, muß dafür Sorge getragen warden, daß keine weitere unbefugte Bedienung des Gerātes oder des Zubehörs erfolgen kann unde der autoisierte Service-Ingenieur informiert wird.

Eine Sicherheitsbeinträchtigung liegt z.B. dann vor, wenn nicht mehr die erwarteten Ergebnisse oder eine sichtbare Beschādigung vorliegen.

Wenn das Gerāt nicht gemass Spezifikationen des Herstellers eingesetzt, könnte die Sicherheit beeinträchtigt werden.

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 Scientific hat Vereinbarungen getroffen mit Verwertungs-/Entsorgungsanlagen in allen EU-Mitgliederstaaten und dieses Produkt muss durch diese Firmen wiederverwertet oder entsorgt warden. Mehr Informationen über die Einhaltung dieser Anweisungen durch Thermo Scientific, die Verwerter und Hinweise die Ihnen nūtzlich sein kōnnen, die Thermo Scientific Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden Sie unter www.thermo.com/WEEERoHS.

Übereinstimmung mit Regularien

Alle Spektrometer der iCAP 6000 tragen das CE Zeichen undentsprechen damit den europäischen Regelwerken.

89/336/EEC Electromagnetische Kompatibilität (EMC)

72/23/EEC Elekrische Geräte, die für denEinsatz innerhalb bestimmter Spannungsgrenzen konsipert sind (Regularien zur minimalspannung)

Weitere Angaben über die oben genannten Standards finden Sie auf der nächstenSeite im Auszug aus den Regelwerken für die specktrometer der iCAP 6000.

Sécurité pour iCAP 6000

Lire attentivement cette page avant d'installer et d'utiliser l'instrument et ses accessoires. Les normes de sécurité continues dans ce manuel sont conformes aux recommandations du «Health and security at work act 1974».

Introduction

L'instrument et les accessoires décrient dans ce manuel sont conçus pour être utiliser uniquement par un personnel proprement qualifié.

Le réglage, la maintenance et les réparations de l'équipement doivent être seulement réalisés par des ingénieurs de maintenance qualifiés qui connaissent les risques encourus.

Précautions de Sécurité

Pour un usage correct et sûr de I'instrument et de ses accessoires, il est essentiel que les utilisateurs et le personnel de maintenance suivent les procédures de sécurité généralement acceptées en plus des précautions spécifiques indiquées dans ce manuel.

Les indications et les symboles spécifiques de mis en garde et de précaution sont incluses dans les sections appropriées de ce manuel.

Les indications et les symboles de mis en garde et de precaution sont marqués sur l'instrument où cela est approprié. Ces symboles sont décris dans le tableau suivant:

Jaune/Noir ou Rouge/Blanc AVERTISSEMENT: l'opérateur doit se référer à une explication dans la Documentation d'utilisateur.▲

Blanc/Noir Terminaison de mise à la terre (masse). ▲

Jaune/Noir Surfaces pouvant être brûlantes▲

Jaune/Noir Présence de tensions dangereuses. Manipuler uniquement par l'isolation. Ne pas toucher les extrémités.▲

Jaune/Noir Rayonnement de Radiofréquence, détails spécifiques de sûreté dans le manuel de l'utilisateur.▲

Jaune/Noir Le rayonnement ULTRAVIOLET, détails spécifiques de sûreté dans le manuel de l'utilisateur.▲

Jaune/Noir Ne pas retirer les panneaux de l'instrument ou l'ouvrir.Aucune pièce requière maintenance à l'intérieur.▲

Sauf indication contraire dans ce manuel, les panneaux de l'instrument et des accessoires doivent être seulement retirés par un ingénieur de maintenance proprement qualifié de Thermo Scientific. Toutes les pièces de rechange et les articles consommables utilisés doivent être approuvés par Thermo Scientific. Certains produits chimiques utilises en spectrométrie sont corrosifs et/ou inflammables, et les échantillons peuvent être radioactifs, toxiques ou potentiellement contagieux. Les procédures et règlements normaux de laboratoire pour la manipulation de tels matériels doivent être observés.

Sécurité Electrique

Tous les équipements alimentés par un courant électrique sont conçus pour fonctionner avec une alimentation électrique avec prise de terre. L'équipement doit être raccorder à la terre, dans le cas contraire, la sécurité peut être compromise.

Suivre les règlements nationaux du pays d'utilisation lors de l'installation électrique. Un électricien qualifié doit être consulté.

Si un liquide est renversé ou est à proximité de I'instrument, isoler immédiatement l'instrument et les accessoires de l'alimentation électrique.

Nettoyage et Décontamination de l'Equipement

C'est la responsabilité de l'utilisateur de procéder au nettoyage et à la décontamination appropriés de l'équipement si des matériaux dangereux ont été renversés sur, ou dans, l'équipement.

Les procédures de nettoyage et de décontamination sont spécifiées dans les sections appropriées de ce manuel.

Avant d'utiliser toutes autres procédures, les utilisateurs doivent vérifier avec le constructeur que la méthode proposée ne peut pas endommager l'équipement.

Altération des Protections de Sécurité

SSi jamais les Protections de Sécurité ont été altérées, l'instrument et les accessoires doivent être rendus inopérants et protégés contre toute utilisation involontaire. La cause du problème doit alors être communiquée au Service Après Vente le plus proche de Thermo Scientific. Les Protections de Sécurité sont susceptibles d'être altérées si l'instrument ne fonctionne normalement, ou montre des dommages évidents. Les Protections de Sécurité peuvent être compromises si l'utilisation de l'équipement n'est pas conforme aux specifications du fabriquant.

Conformité DEEE

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

Thermo Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l'union européenne et ce produit

devra être collecté ou recyclé par celles-ci. Davantage d'informations sur la conformité de Thermo Scientific à ces directives, les recycleurs dans votre pays, et les informations sur les produits Thermo Scientific qui peuvent aider la détection des substances sujettes à la directive RoHS sont disponibles sur www. thermo.com/WEEERoHS.

Conformitè Normative

Tous les Spectromètres Série iCAP 6000 et accessoires sont marqués CE, indiquant leur conformité avec les Directives Européennes suivantes:

89/336/EEC Directive de Compatibilité Electromagnétique (Directive EMC).

72/23/EEC Equipement Electrique conçu pour une utilisation avec des limites de tension fixées (Directive Basse Tension).

Pour plus de détails sur ces normes, se référer à la notice de conformité fournie avec les spectromètres Série iCAP 6000, reprodute sur la page suivante.

Chapter 7
EC Declaration of Conformity

EC Declaration of Conformity

No. : UIC080601

The undersigned, representing the following manufacturer

manufacturer :	Thermo Electron Manufacturing Ltd
address :	SOLAAR House, 19 Mercers Row, Cambridge CB5 8BZ, UK

herewith declares that the product

product identification :	iCAP 6000 Series Inductively Coupled Plasma Spectrometer System

is in conformity with the provisions of the following EC directive(s)

reference no	title
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the standard(s) and/or technical specifications referenced overleaf have been applied.

Last two digits of the year in which the CE marking was affixed : 06

Place : Cambridge, CB5 8BZ, UK **Date :** 31st March 2006

Signature : 

Name : Dr Michael P Wassall **Function :** Product Director

EC Declaration of Conformity

No. : UIC080601

References of standards and/or technical specifications applied for this declaration of conformity, or parts thereof :

- harmonized standards :

number	title	result
safety:		
BS EN 61010-1:2001	General Requirements	Pass
IEC1010-2-061:1995	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use	Pass
EMC:		
Conducted & Radiated Emissions		
EN61326	Conducted & Radiated Emissions	Pass
Methods:		
CISPR16	Conducted Emissions	Pass
CISPR16	Radiated Emissions	Pass
EN61000-3-3	Flicker	Pass
Immunity		
EN61326	Immunity	Pass
Methods:		
IEC1000-4-3	Radiated Field Immunity	Pass
IEC1000-4-6	Conducted RF Immunity	Pass
IEC1000-4-4	Electrical Fast Transients	Pass
IEC1000-4-2	Electrostatic Discharge	Pass
IEC1000-4-5	Surges	Pass
IEC1000-4-11	Voltage Dips & Interruptions	Pass
IEC1000-4-8	Power Frequency Magnetic Field	Pass

- other standards and/or technical specifications :

- other technical solutions, the details of which are included in the technical documentation or the technical construction file :

Other references or information required by the applicable EC directive(s):

The documentation relating to this declaration is on file.

Notices:

1. About the system: Use only with Thermo Electron approved computer and accessories
2. About Shielded Cables: Use only shielded cables supplied by Thermo Electron when connecting this instrument to the computer and other accessories

Compliance with the above notices is necessary to ensure that the appropriate radio frequency emissions will be maintained within the limits of the specifications referred to in this declaration.

Notes

Notes

SOFTWARE LICENSING AGREEMENT

USE AND POSSESSION OF THE ENCLOSED SOFTWARE PACKAGE IS GOVERNED BY THE FOLLOWING TERMS and using the software indicates your acceptance of these terms:

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Neither Thermo Electron Manufacturing Ltd nor anyone else who has been involved in the creation, production or delivery of the enclosed program shall be liable for any interruptions of business or organisation or the direct, indirect, consequential or incidental damages arising from the use or inability to use the enclosed program even if Thermo Electron Manufacturing Ltd has been advised of the possibility of such damages or claims.

4 TERMINATION

You may terminate this agreement by written notice to Thermo Electron Manufacturing Ltd at any time. Thermo Electron Manufacturing Ltd may terminate this agreement at any time by written notice to you if you should fail to comply with any of its terms.

Upon termination of the agreement for whatever reason, you agree to immediately stop the use of the enclosed program and all copies thereof and return to Thermo Electron Manufacturing Ltd or destroy the enclosed software and all copies thereof. You agree to confirm to Thermo Electron Manufacturing Ltd in writing, within five days after termination, that the enclosed software has been destroyed or returned.

In the event of termination because of your failure to comply with any of the terms of this agreement, Thermo Electron Manufacturing Ltd reserves the right to invoke any and all other remedies available to it, including the right to claim damages.

This licensing agreement shall be governed by the laws of England and subject to the jurisdiction of the English courts.

5 ACKNOWLEDGEMENT

You agree that this is a complete and exclusive statement of the agreement between us and supersedes any prior agreement or proposal, oral or written and any other communications between us relating to the subject matter of this agreement.

Thermo Fisher Scientific
SOLAAR House, 19 Mercers Row
Cambridge CB5 8BZ
United Kingdom