



Thermo Scientific iCAP 7600 ICP-OES

High productivity and versatility for demanding applications

Benefits

- Best sensitivity and detection limits
- Highest throughput
- Advanced accessory connectivity

Keywords

Automation, cost-efficiency, ease of use, elemental analysis, ICP-OES, productivity, simplified workflow, speed, Sprint Valve, throughput, QA/QC

The Thermo Scientific™ iCAP™ 7600 ICP-OES is designed for the most demanding analytical challenges, with the highest throughput, sensitivity and detection limit capabilities; the instrument incorporates an integrated sample loop, efficiently delivering the sample to the plasma to further drive productivity. The iCAP 7600 ICP-OES maximizes scalability and advanced accessory connectivity to support expanding requirements and full intelligent automation of analysis.

The iCAP 7600 ICP-OES is a powerful simultaneous instrument based on the core technologies of the Thermo Scientific iCAP 7000 Plus Series ICP-OES to solve the challenges of the most demanding laboratory applications. The iCAP 7600 ICP-OES employs the latest technology developments for exceptional performance, long-term stability and low gas consumption for the highest productivity with the lowest cost per sample. The instrument is driven by the Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution™ (ISDS) Software. Developed to combine highly efficient workflow, easy data management with scalability and compliance, Qtegra ISDS Software delivers simplicity, productivity, efficiency and quality in the analysis workflow.

The innovative hardware and software provide powerful tools for method development and the ability to control a range of advanced sample introduction accessories for enhanced performance and application flexibility.

Performance

A 4-channel, mini peristaltic pump with a unique drain sensor, provides smooth, low noise signals and safe operation. The enhanced, high efficiency free-running 27.12 MHz solid state RF plasma generator delivers rugged reliable performance with the power and stability to cope with even the most difficult sample matrices. The high resolution simultaneous echelle spectrometer has a unique optical layout, resulting in high efficiency light transmission and excellent resolution with enhanced sensitivity and detection capability. A powerful Charge Injection Device (CID) detector, the CID86, enables free choice of wavelengths over the complete 166-847 nm wavelength range. More stable, with lower noise and greater dynamic range than previous CID designs, the detector's non-destructive readout allows optimum signal-to-noise measurements at all concentration levels. The iCAP 7600 ICP-OES has an optimized purge gas distribution system which reduces the requirement for optical purge gas and employs only a low 3 L/min purge during operation. The iCAP 7600 ICP-OES is an extremely compact instrument and requires minimal laboratory bench space.

Versatility

The iCAP 7600 ICP-OES provides precise, stable delivery of all gas flows using mass flow control to guarantee plasma stability, irrespective of changes in atmospheric conditions. An additional mass flow controller is integrated into the system for delivery of additional gases for more complex and demanding applications. A comprehensive range of liquid sample handling kits are available to enable simple and effective configuration of the iCAP 7600 ICP-OES for optimum analytical performance with the required sample matrices. Instrument configurations are also available with dedicated Radial plasma viewing or Duo (Axial and Radial) plasma viewing, depending on sample type and elements of interest. Flexible, intuitive Qtegra ISDS Software and data reporting tools make the instrument simple to learn and use due to its minimized workflow from sample introduction to reporting and data interpretation.

Productivity

An integrated Sprint valve with a customizable sample loop provides optimum rinse and sample uptake times to achieve Sprint analyses for aqueous or organic sample matrices. The large sample compartment with full visibility door and ergonomically designed components ensures easy, reliable installation and adjustment of the torch and sample handling components. These features simplify maintenance and increase up-time and productivity. Ducted airflows and a thermostatically controlled polychromator (controlled to within 0.1 °C) ensure an extremely stable spectrometer, enabling extended analytical runs with fewer re-calibrations. Powerful data acquisition modes are available to address the performance requirements for all application areas effectively. The advanced Sprint mode enables ultra-high speed trace element screening for the most demanding high throughput laboratory environments. This mode employs intelligent plasma view sequencing in conjunction with Cumulative Set Pattern Integration (CSPI) to achieve ultimate sample analysis speed and productivity. The Qtegra ISDS Software streamlines the tasks involved with data collection and reporting. With just a few clicks, you can create an analytical LabBook, start your intelligent analysis sequence with full QA/QC protocols in place, and generate a custom data report. Full software control of autosampler sequencing and system optimization ensures simplicity of use and maximum productivity.

Accessories

A range of liquid autosampler accessories are available that allow batches, containing between 180 and 720 samples to run unattended and even fully automated intelligent dilution of out-of-range samples. An integrated hydride generation system accessory, with its high efficiency membrane gas/liquid separator, yields sub-ppb performance for hydride forming elements such as As, Bi, Hg, Sb and Se. Specific sample handling kits are available for organic and volatile solvent based solutions. Additional sampling kits are available for samples containing hydrofluoric acid or dissolved solids at levels up to 25%. An argon humidifier minimizes blockages with glass concentric nebulizers when analyzing samples containing high dissolved solids. The use of a sheath gas allows the analysis of high dissolved solid samples for extended periods of time. The ceramic D-Torch can also be configured as part of the sample introduction system and provides enhanced torch longevity with aggressive sample matrices.

Detection Limits

Detection limits (DL) are key indicators of an instrument's capabilities; useful as an aid in determining its suitability for a chosen task. They demonstrate the lowest level of analyte distinguishable from the background noise under optimal conditions and are typically determined several times to improve the statistical accuracy. As a comparison between instruments, instrument detection limits (IDL) provide useful indication to the laboratory chemist either in the decision process for instrument acquisitions or as a measure of performance for current instruments. An IDL is a generic value that defines the lowest concentration of an analyte that can be detected under ideal conditions; and normally measured on a single element basis, using a clean sample e.g. ultrapure water. Typical detection limits are measured on several instruments of the same type to assess the average level of performance that can be expected. Typical detection limits, presented in Table 1, are the IDLs of an iCAP 7600 ICP-OES as determined by applications chemists in a standard laboratory. The IDLs are an excellent indication of what is achievable with the instrument. The detection limits were determined on an iCAP 7600 ICP-OES using standard sample introduction components, including a concentric nebulizer and cyclonic spray chamber

Detection Limit Determination

To determine the detection limit for an element, a standard of 50-times the expected value of the IDL and a blank were prepared. Following plasma ignition and instrument stabilization, 10 measurements of each solution were taken, using 15 second integration times. The detection limits were calculated using the raw intensity data from the standard and the blank as follows:

$$IDL = 3SD_{\text{blk}} \frac{STD_{\text{conc}}}{STD_x - BLK_x}$$

Where:

IDL is the instrument detection limit

SD_{blk} is the standard deviation of the intensities of the multiple blank measurements

STD_{conc} is the concentration of the standard

STD_x is the mean signal for the standard

BLK_x is the mean signal for the blank

The multiplier of three is based on the student's t-test table and shows that a confidence interval of 99% is used to calculate the detection limit.

Table 1. The detection limits for the iCAP 7600 ICP-OES.

Element	Wavelength (nm)	iCAP 7600 ICP-OES Duo (Axial view) DL µg/L (15s)	iCAP 7600 ICP-OES Radial DL µg/L (15s)
Ag	328.068	0.32	2.46
Al	167.079	0.12	1.51
As	189.042	1.43	4.74
B	249.773	0.69	1.26
Ba	455.503	0.03	0.17
Be	311.107	0.017	0.07
Ca	393.366	0.003	0.02
Cd	214.438	0.07	0.19
Co	228.616	0.51	1.16
Cr	205.560	0.21	0.85
Cu	324.754	0.39	2.36
Fe	259.940	0.25	0.80
Hg	184.950	0.14	1.10
K	766.490	0.60	5.10
Li	670.784	0.03	0.83
Mg	279.553	0.01	0.04
Mn	257.610	0.07	0.21
Mo	202.030	0.38	1.11
Na	589.592	0.37	1.80
Ni	231.604	0.36	2.29
P	177.495	1.55	5.66
Pb	220.353	1.06	4.50
S	180.731	1.05	2.22
Sb	206.833	3.25	9.36
Se	196.090	3.05	7.36
Si	251.611	1.09	7.20
Sn	189.989	1.10	1.60
Sr	407.771	0.01	0.04
Ti	336.121	0.30	0.60
Tl	190.856	4.40	7.30
V	309.311	0.23	0.80
Zn	213.856	0.19	0.60

iCAP 7600 ICP-OES	
Dimensions (mm)	840 W x 750 D x 590 H
Peristaltic pump	4-channel, mini peristaltic pump Speed: 0 to 125 rpm
Sampling valve	Standard: Sprint valve aqueous (4 ml loop) Optional: Sprint valve organics (3 ml loop)
Standard sample introduction kit	Concentric glass nebulizer Glass cyclonic spray chamber Semi-demountable EMT torch 2 mm bore quartz center tube
Plasma gas	Mass flow control, 0-20 L/min
Auxiliary gas	Mass flow control, 0-2 L/min
Nebulizer gas	Mass flow control, 0-1.5 L/min
Additional gas	Mass flow control, 0-100 ml/min
Plasma Viewing	Duo or radial
RF source	27.12 MHz solid state 750-1600 W output power Duo restricted to 1350 W
Spectrometer	Simultaneous echelle type
Spectral bandpass	7 pm at 200 nm
Wavelength range	166-847 nm
Detector	High performance solid state CID86 chip
Data acquisition mode	Normal mode Speed mode Sprint mode Fullframe imaging
Productivity features	Intelligent uptake and rinse Sprint Valve Speed data acquisition mode Sprint data acquisition mode

	Required items	
iCAP 7600 ICP-OES Duo	8423 200 76021 or 8423 200 76121 (N. America)	
iCAP 7600 ICP-OES Radial	8423 200 76001 or 8423 200 76101 (N. America)	
TF900 Turbine Pump Chiller (230 V/50 Hz)	101163010000001 (or user supplied equivalent)	
TF900 Turbine Pump Chiller (115 V/60 Hz)	101163010000003 (or user supplied equivalent)	
TF900 Turbine Pump Chiller (208 V/60 Hz)	101163010000000 (or user supplied equivalent)	
Data Station (110 or 220 V)	8423 140 50004 (or user supplied equivalent)	
Optional accessories		
Autosampler:		
CETAC ASX-280 (up to 180 samples)	BRE0007611	
CETAC ASX-560 (up to 360 samples)	BRE0003260	
CETAC XLR8 (up to 720 samples)	8423 470 04061	
CETAC ASX-1400 stirring autosampler	8423 470 04004	
Automation:		
SDX HPLD Auto Dilutor (incl. ASX-560)	BRE0008829	
SDX HPLD Auto Dilutor Upgrade Kit (excl. ASX-560)	BRE0008830	
Sample introduction kits:	Duo	Radial
Organics	8423 120 52261	8423 120 52311
Volatile organics	8423 120 52251	8423 120 52301
HF resistant	8423 120 52241	8423 120 52291
High solids	8423 120 52231	8423 120 52281
Standard aqueous	8423 120 52221	8423 120 52271
Ceramic D-Torch kit	8423 120 52202	8423 120 52201
Argon humidifier	8423 120 52081	
Basic hydride generation kit/Internal standards mixing kit	8423 120 51551	
Integrated hydride generation accessory	8423 180 50101	



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