



Thermo Scientific iCAP 7200 ICP-OES Duo

Cost effective analysis for low sample throughput requirements

Benefits

- Cost effective alternative to AAS
- Easy to use, with minimal user training
- Comprehensive Qtegra ISDS Software

Keywords

Cost-efficiency, ease of use, elemental analysis, ICP-OES, simplified workflow

The Thermo Scientific™ iCAP™ 7200 ICP-OES Duo is a powerful, easy to use instrument for users who are new to the ICP-OES technique, offering simplicity with no compromise on performance. As an alternative to atomic absorption, the iCAP 7200 ICP-OES Duo achieves better sensitivity than microwave plasma instruments and is the ideal solution for laboratories with low throughput and multi-element analysis needs.

The Thermo Scientific iCAP 7200 ICP-OES Duo is a powerful, simultaneous dual view spectrometer, based on the core technologies of the Thermo Scientific iCAP 7000 Plus Series ICP-OES. The iCAP 7200 ICP-OES Duo is a simple alternative to atomic absorption and microwave plasma techniques, providing a multi-element analysis solution for laboratories with increasing demands for sample throughput and lower detection limit capability. The instrument is driven by the Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution™ (ISDS) Software.

Developed to combine a highly efficient workflow, easy data management, scalability and compliance, Qtegra ISDS Software delivers simplicity, productivity, efficiency and quality in the analysis workflow. The instrument is uniquely optimized to reduce gas consumption and running costs with a highly efficient plasma torch and interface design. Integral product components include analysis ready sample introduction kits, enable simple 'out-of-box' operation for rugged, consistent day-to-day analyses, and help analysts who are new to the ICP-OES technique to achieve standard operator competence with minimal training.

Performance

A 3-channel, 12-roller peristaltic pump, with a unique drain sensor, safely and smoothly delivers solution to and from the instrument with minimal background noise. 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 wavelength range of 166-847 nm (with greatest sensitivity above 180 nm). 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 use of an autosampler enables maximized efficiency when larger numbers of samples are analyzed. Comprehensive quality control (QC) checking may be performed at intervals in the analysis to guarantee data quality. Automatic recalibration and repeated sample analyses are possible, reducing the need for next-day sample re-runs. Full autosampler flexibility allows for samples and calibrations to be added/deleted/moved whilst the autosampler is running. The iCAP 7200 ICP-OES Duo is also an extremely compact instrument and therefore requires minimal laboratory bench space.

Cost efficiency

The compact optical and detector technology is combined with an elegant plasma interface to enable routine operation with minimized gas consumption and running costs. The iCAP 7200 ICP-OES Duo employs a low 1 L/min plasma interface gas flow to cool key instrument components. The advanced RF generator design achieves extremely efficient sample coupling with >78% energy transfer – allowing exceptional sample processing capability using lower power and gas consumption rates. An Enhanced Matrix Tolerance (EMT) torch design provides powerful performance whilst minimizing the requirements for routine maintenance operations and reducing plasma gas consumption.

Simplicity

Optimized pressure controlled gas flows provide simplicity of operation for routine analysis. The instrument is supplied with analysis ready sample introduction parameters, so users are no longer required to optimize pump speed, plasma RF power and gas flow rates. This solution is fully compatible with Thermo Scientific application-specific sample handling kits. Qtegra ISDS Software controls the iCAP 7200 ICP-OES Duo and has an intuitive user interface design, making it quick to learn and use. Setting up a method is extremely simple with minimal method development required. Typically, only the elements of interest need to be defined by the user. Following plasma ignition and method creation, the user simply creates and runs an autosampler sequence. Results can either be printed or exported in electronic format to the required file location.

Accessories

A range of liquid autosamplers are available to enable optimization of the iCAP 7200 ICP-OES Duo for automated, unattended analysis. An integrated hydride generation system accessory, with its high efficiency gas/liquid separator, yields sub-ppb performance for hydride forming elements such as As, Bi, Hg, Sb and Se. A range of sample handling kits are available for specific use with samples containing aqueous solvents, high dissolved solids, hydrofluoric acid and organic solvents. Samples containing up to 25% dissolved solids can be handled effectively using the argon humidifier accessory. The ceramic D-Torch 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 7200 ICP-OES Duo 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 7200 ICP-OES Duo 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 7200 ICP-OES Duo.

Element	Wavelength (nm)	iCAP 7200 ICP-OES Duo (Axial view) DL µg/L (15 s)
Ag	328.068	0.32
Al	308.215	4.10
As	189.042	1.43
B	249.773	0.69
Ba	455.503	0.03
Be	311.107	0.017
Ca	393.366	0.003
Cd	214.438	0.07
Co	228.616	0.51
Cr	205.560	0.21
Cu	324.754	0.39
Fe	259.940	0.25
Hg	184.950	0.14
K	766.490	0.6
Li	670.784	0.03
Mg	279.553	0.01
Mn	257.610	0.07
Mo	202.030	0.38
Na	589.592	0.37
Ni	231.604	0.36
P	177.495	1.55
Pb	220.353	1.06
S	180.731	1.05
Sb	206.833	3.25
Se	196.090	3.05
Si	251.611	1.09
Sn	189.989	1.1
Sr	407.771	0.01
Ti	336.121	0.30
Tl	190.856	4.4
V	309.311	0.23
Zn	213.856	0.19

iCAP 7200 ICP-OES Duo	
Dimensions (mm)	840 W x 750 D x 590 H
Peristaltic pump	3-channel, 12 roller peristaltic pump Speed: 0 or 45 rpm
Standard sample introduction kit	Concentric glass nebulizer Glass cyclonic spray chamber Semi-demountable EMT torch 2 mm bore quartz center tube
Plasma gas	Fixed, 12 L/min
Auxiliary gas	Fixed, 4 flows 0, 0.5, 1.0, 1.5 L/min
Nebulizer gas	Pressure control, 0-0.4 MPa
Plasma Viewing	Duo
RF source	27.12 MHz solid state Optimized at 1150 and 1300 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	Standard precision mode

Required items	
iCAP 7200 ICP-OES Duo	8423 200 72001 or 8423 200 72101 (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
Duo sample introduction kits:	
Organics	8423 120 52261
Volatile organics	8423 120 52251
HF resistant	8423 120 52241
High solids	8423 120 52231
Standard aqueous	8423 120 52221
Ceramic D-Torch kit	8423 120 52202
Argon humidifier	8423 120 52090
Basic hydride generation kit/Internal standards mixing kit	8423 120 51551



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