

Trace Metals in Water & Waste Samples Using an Agilent 7850 or 7900 ICP-MS

Consumable workflow ordering guide for EPA 200.8, EPA 6020A
and ISO 17294-2





Water quality has a direct impact on the health of all ecosystems, therefore environmental monitoring of water is often subject to strict legislation.

EPA 200.8 provides procedures for determination of dissolved elements in ground, surface and drinking waters and requires labs to carry out performance and quality control (QC) tests to verify the quality of the data.

EPA Method 6020A is a performance-based ICP-MS method that can be applied to the determination of over 60 elements in various matrices. Typical sample types include surface water, groundwater, industrial wastes, soils, sludges, sediments, and other solid wastes for which determination of total (acid-leachable) elemental concentrations are required.

The international standard **ISO 17294-2** specifies an ICP-MS method for the determination of more than 60 elements in drinking water, surface water, ground water, and wastewater. The list includes analytes covering a wide concentration range from ultra-trace level to major elements. Analytes include Hg, As, Se, Sb, Ag, Sn, Mo, and Tl, all of which are more stable in solutions that contain HCl. The routine addition of HCl to samples is now possible, as all Agilent ICP-MS systems include the ORS⁴ collision reaction cell, which operates in helium collision mode to resolve common polyatomic interferences including those formed from Cl.

Some sample types may also contain novel contaminants such as rare earth elements (REEs), which can form doubly charged ion (M^{2+}) overlaps on some required analytes such as Zn, As, and Se. Agilent ICP-MS systems support a novel half-mass mode which allows simple, automatic correction of the REE^{2+} interferences.

Table 1. Typical 7850 ICP-MS operating conditions for water analysis.

ICP-MS Parameter	No Gas Mode*	He Mode
Plasma mode	General purpose	
RF power (W)	1550	
Spray chamber temp (°C)	2	
Sample depth (mm)	10	
Nebulizer gas flow rate (L/min)	1.09	
Dilution gas flow rate (L/min)	0.0	
Lens tune	Autotune	
Cell gas flow rate (mL/min)	0.0	4.3 (10**)
Energy discrimination (V)	5.0	5.0 (7.0**)
Number of elements	3 analytes, 1 ISTD	25 analytes, 5 ISTDs

Shaded parameters are defined automatically by the preset plasma conditions.

* No gas mode provides the highest sensitivity for uninterfered, low-mass analytes. However, for highest throughput, these elements can be measured in He mode instead.

** Enhanced He mode settings used for Se.

If you are running water samples, the preferred configuration of Agilent ICP-MS is the solution ready [7850](#). The 7850 will free your workflow from common time traps. The 7850's Ultra High Matrix Introduction (UHMI) system uses an argon stream to dilute samples. Samples with matrix levels up to 25% TDS can be measured without time-consuming and error-prone manual dilutions. The helium collision cell and half-mass correction of the 7850 automatically remove polyatomic and doubly-charged ion interferences. These functions simplify method development and remove a common cause of measurement failure.

If water samples are only the start of your analysis needs, the Agilent [7900](#) ICP-MS provides extended capabilities for more demanding applications. The 7900 offers greater flexibility, the industry's lowest detection limits, and the widest dynamic range to meet all your sample challenges.

An Agilent ICP-MS system meets the method requirements by providing the highest matrix tolerance for varied water samples, the widest elemental coverage (including Hg, if HCl is added to all samples), the simplest control of interferences using He cell gas, and the widest concentration coverage with the 10 or 11 orders dynamic range detector.

Agilent 7850/7900 ICP-MS include fully developed methods for regulated and routine methods to save you weeks of method development and documentation time. Preset Methods for EPA 200.8, EPA 6020A, and Drinking Water (with He cell mode) predefine all the required operating parameters.

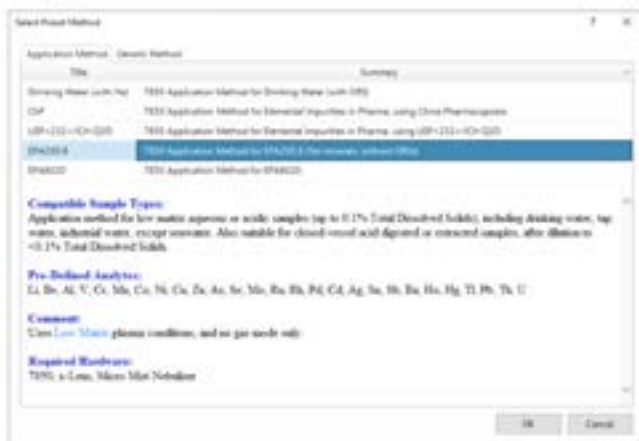


Figure 1 Details of 7850 preset method for drinking water by EPA 200.8. An equivalent method is also provided with the 7900 software.

To protect the sample introduction, especially the nebulizer, from blockages sample filtration may be required for turbid samples. The Agilent Captiva syringe filters provide an economical and convenient solution. We recommend a [PTFE membrane with 0.45 µm pore size](#) for ICP-MS water analysis.

Water samples are usually acidified to stabilize the range of required analytes. HCl is used to stabilize important elements including Hg, Ag, Mo. Acidified samples, particularly with high salts or chloride matrix, can be run for longer with one of our [Nickel-plated sampling cones](#). Protection of the copper base will result in longer sampling cone lifetime and less frequent and less time-consuming maintenance.

High throughput water analysis by using an integrated switching valve

A standard ICP-MS setup can run up to about 400 samples a day (at 4 mins per sample). For further productivity improvements, environmental laboratories with many hundreds of samples per day to process can simplify the routine analysis by using the [Agilent Integrated Sample Introduction System \(ISIS3\)](#) for high-throughput discrete sampling.

Simple yet powerful workflow-oriented ICP-MS [MassHunter](#) software also supports other high throughput third party devices including prepFAST.

For new installations, the **Agilent Water Analyzers EPA 200.8 (available in US)** and [ISO 17294 \(available in Western Europe\)](#) are an integrated package of hardware, software, consumables, professional services and documentation. Developing, optimizing, and implementing a method for regulated ICP-MS water analysis can traditionally take weeks or even months. The Agilent 7850 Water Analyzer shortens this time to just a few days. An Agilent engineer will install and optimize the pretested EPA 200.8 or ISO 17294 method on your 7850 ICP-MS in your lab. Using a structured process with agreed performance criteria, we will set up the instrument and train your analysts. You'll benefit from an optimized instrument, a proven method, and an operational workflow that is ready for you to perform testing required to meet regulatory requirements.

[ICP Go](#) is included with 7850 ICP-MS Analyzer bundles, or can be purchased separately as an option for ICP-MS MassHunter.



Figure 2 A complete Agilent 7850 ICP-MS based Water Analyzer package is available as a bundle, providing a turnkey solution for water labs in the US and some European countries.

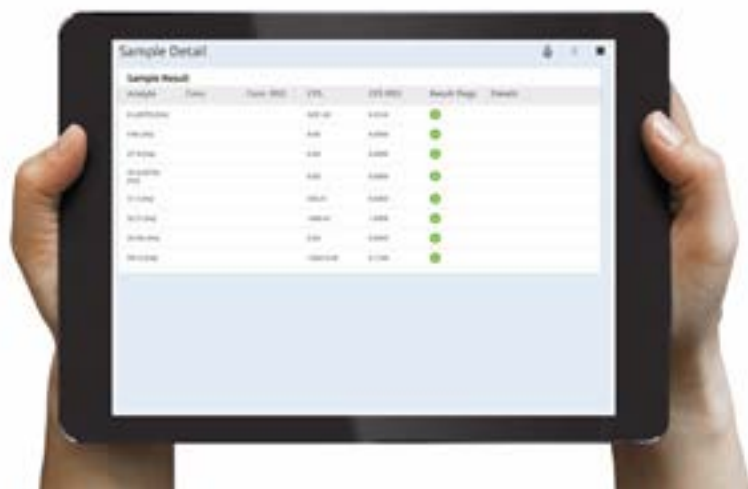


Figure 3 ICP Go is a simple, browser-based interface that allows users to quickly set up and run sample batches from stored templates. ICP Go also supports remote setup and monitoring of your instrument analysis from any PC or tablet via a network connection.

References

1. Fast Accurate Analysis of 28 elements in water using ISO Method 17294-2 for ICP-MS. Agilent publication [5994-2804EN](#)
2. Soil analysis with the 7850. [5994-2933EN](#)
3. Simple and Reliable Soil Analysis using the Agilent 7800 ICP-MS with ISIS 3. Agilent publication [5991-8674EN](#)
4. High Throughput, Direct Analysis of Seawater using the Agilent 7800 ICP-MS with HMI for Aerosol Dilution. Agilent publication [5991-7936EN](#)
5. Agilent 7900 ICP-MS simplifies drinking water analysis. Agilent publication [5991-4938EN](#)
6. High Throughput Water Analysis using the Agilent 7900 ICP-MS coupled with ESI prepFAST. Agilent publication [5991-8148EN](#)
7. Analysis of Trace Elements in Water Samples per ISO 17294-2. Agilent publication [5994-2803EN](#)
8. Routine Analysis of Soil Samples using ICP-MS. Benefit from sample and operational insights with the Agilent 7850 ICP-MS. Agilent publication [5994-2828EN](#)

Easy Selection and Ordering Information

This guide provides recommendations for Agilent products used in this analysis, so you can find what you're looking for quickly. Click the MyList* links in the header below to add items to your "Favorite Products" list at the Agilent online store. Then, enter the quantities for the products you need. Your list will remain under "Favorite Products" for your use with future orders.

MyList of EPA 200.8 Standards

EPA 200.8 Standards – Kit	
5191-3908	EPA 200.8 Standards Kit**
EPA 200.8 Standards – individual (kit contents)	
5183-4682	Initial Calibration verification standard, 100 mL**
5183-4688	Environmental Calibration Standard 100 mL**
5188-6525	ICP-MS Internal standard mix 100 mL
5190-8485	Mercury (Hg) standard, 1,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8596	Tuning and Calibration standard 6020 for EPA 200.8, 100 mL
CP3418	Triton X-100

* First time using "MyList"? You will be asked to enter your email address for account verification. If you have an existing Agilent account, you will be able to log in. If you don't have a registered Agilent account, you will need to [register for one](#). This feature is valid only in countries that are e-commerce enabled. All items can also be ordered through your regular sales and distributor channels.

** Not available for online purchase. Contact your local Agilent sales representative.

MyList of EPA 6020A Standards

EPA 6020A Standards	
5183-4682	Initial Calibration verification standard, 100 mL**
5183-4688	Environmental Calibration Standard 100 mL**
5188-6525	ICP-MS Internal standard mix 100 mL
5190-8596	Tuning and Calibration standard 6020 for EPA 200.8, 100 mL
CP3418	Triton X-100
5188-6526	6020 Interference Check Solution A, 100 mL
5188-6527	Interference Check Solution B, 100 mL

MyList of Sample Preparation products

5190-5268	Captiva Econofilter, polypropylene housing, polytetrafluoroethylene (PTFE) membrane, 25 mm diameter, 0.45 µm pore size, 1000/pk
5190-5103	Captiva Disposable Syringe, 20 mL, Polypropylene, 100/pk

MyList of ISO 17294-2 Standards

Standards – Kit ISO 17294-2	
5191-3910	ISO 17294 Standards Kit**
ISO 17294-2 Standards – individual (kit contents)	
5183-4682	Initial Calibration verification standard, 100 mL**
5183-4688	Environmental Calibration Standard 100 mL**
5188-6525	ICP-MS Internal standard mix 100 mL
5190-8485	Mercury (Hg) standard, 100 mL
5190-8596	Tuning and Calibration standard 6020 for EPA 200.8, 100 mL
CP3418	Triton X-100
5190-8209	Sulfur (S) standard, 10,000 µg/mL in H ₂ O, 100 mL
5190-8524	Silver (Ag) standard, 1,000 µg/mL in 5% HNO ₃ , 500 mL
5190-8368	Calcium (Ca), 10,000 µg/mL, in 5% HNO ₃ , 100 mL
5190-8412	Magnesium (Mg) standard, 10,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8432	Potassium (K) standard, 10,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8446	Scandium (Sc) standard, 10,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8450	Silicon (Si) standard, 10,000 µg/mL in H ₂ O, 100 mL
5190-8454	Sodium (Na) standard, 10,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8467	Indium (In) standard, 1,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8469	Iridium (Ir) standard, 1,000 µg/mL in 20% HCl, 100 mL
5190-8499	Phosphorus (P) standard, 1,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8509	Rhodium (Rh) standard, 1,000 µg/mL in 20% HCl, 100 mL
5190-8527	Strontium (Sr) standard, 1,000 µg/mL in 5% HNO ₃ , 100 mL
5190-8543	Tin (Sn) standard, 1,000 µg/mL in 20% HCl, 100 mL
5190-8545	Titanium (Ti) standard, 1,000 µg/mL in H ₂ O, 100 mL
5190-8547	Tungsten (W) standard, 1,000 µg/mL in 5% HNO ₃ , trace HF, 100 mL
5190-8559	Zirconium (Zr) standard, 1,000 µg/mL in 5% HCl, 100 mL

* If it's your first time using "MyList", you will be asked to enter your email address for account verification. If you have an existing Agilent account, you will be able to log in. If you don't have a registered Agilent account, you will need to [register for one](#). This feature is valid only in countries that are e-commerce enabled. All items can also be ordered through your regular sales and distributor channels.

** Not available for online purchase.

MyList of ICP-MS Consumables

Comprehensive listing for Trace Metals Analysis

Sample Containment	
00000001600L	16.5 mL polypropylene sample tubes 1000/case
190065200	50 mL polypropylene graduated centrifuge tubes 500/pk
5043-0064	250 mL sample bottle narrow neck LDPE for 5 position standard rack
Peristaltic Pump Tubing	
5064-8101	black/black tabs, 0.76 mm i.d. for high matrix sample, 12 pcs/pk
G1833-65569	white/white tabs, 1.02 mm i.d. 12 pcs/pk
G1833-65570	yellow/blue tabs, for spray chamber drain, 12 pcs/pk
G3280-67047	Blue/Orange tab, 0.25 mm i.d. for internal standard (ISTD) uptake, 12 pcs/pk
Sample Introduction	
G1820-65105	PFA sample tubing, 0.5mm i.d., 1.6 mm o.d., 5 m
G1820-65478	Internal standard (ISTD) PFA, tubing 0.3 mm i.d., 1.6 mm o.d., 3 m
G3266-80004	MicroMist nebulizer U-series with UniFit sample connector
G3266-80012	MicroMist sample uptake tube and connector, UniFit, 0.5 mm i.d.; 10/pk
G8400-67150	UHMI quartz spray chamber ¹
G3280-80008	non-UHMI quartz spray chamber ²
G3280-60555	Spray chamber drain tube assembly
G3280-80053	Quartz torch, 2.5 mm i.d. injector
G1833-65419	Long life Pt shield plate for ShieldTorch bonnet
G1833-65421	Quartz ShieldTorch bonnet
G3280-67040	Sampler cone, Nickel-tip with copper base
G3280-67061	Sampler cone, Nickel-tip with Nickel base ³
G3280-67009	Graphite, sampler cone gaskets, 3/pk
G3280-67041	Ni skimmer x-lens ⁴
G8400-67200	Ni skimmer x-lens ⁵
9300-2574	Interface cone cotton swabs, 100/pk
Vacuum Supplies	
X3760-64004	AVF platinum oil
ISIS3 (Integrated Sample Introduction System)	
G8411-68201	Pre-configured kit, tubing and connectors
G8410-80103	1.0 mm i.d. SPS 4 probe with blue marker
SPS4 Autosampler	
G8410-80101	0.5 mm i.d., SPS 4 probe with yellow markers
3710049000	Peristaltic pump tubing PVC Solvaflex 3-bridged, gray/gray tabs, 12/pk
3710052000	Peristaltic pump tubing high vol rinse, purple/black, 12/pk

1. for 7850, 7900, 8900 ICP-MS

2. for 7700, 7800, 8800 ICP-MS

3. optional sampling cone with Nickel-plated Copper base to increase corrosion resistance and extend lifetime with high Chloride matrix.

4. for 7700, 7800, 7850, 8800 ICP-MS

5. for 7900, 8900 ICP-MS

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