

NEWS

Glass Expansion Newsletter | June 2016 | Issue 40

APPLICATION SPOTLIGHT

A Simple, Low Cost Approach to Improving ICP Productivity

**The following report is the result of a collaboration between Glass Expansion and Inorganic Ventures*

In the October 2013 Glass Expansion Newsletter¹ we collaborated with Inorganic Ventures, the well-known Certified Reference Material (CRM) manufacturer (www.inorganicventures.com) to organize an application spotlight titled, "How to Achieve High Accuracy with Difficult Samples." The purpose of this article was to emphasize the importance of choosing a proper ICP sample introduction system based on your sample types. In this particular case we focused on the ICP-OES challenges associated with analyzing samples in a hydrofluoric acid (HF) matrix and samples high in total dissolved solids (TDS).

Once again we have teamed with Inorganic Ventures to introduce a simple, low cost approach to improving your ICP productivity. In this report we will highlight the advantages and versatility of Glass Expansion's Niagara CM Rapid Rinse Accessory, in addition to summarizing the latest updates to the operating software, which better facilitate ease of use and installation.

Introduction

Most ICP systems incorporate an autosampler. With these systems there is a significant delay between the time when the autosampler probe enters the sample and the time when the sample reaches the nebulizer. There is also similar delay between the time when the probe enters the rinse solution and the time when the rinse solution reaches the nebulizer.

Figure 1. Niagara CM Rapid Rinse Flow Diagram

Figure 1a. Sample to Nebulizer, Rinse to Waste (inject)

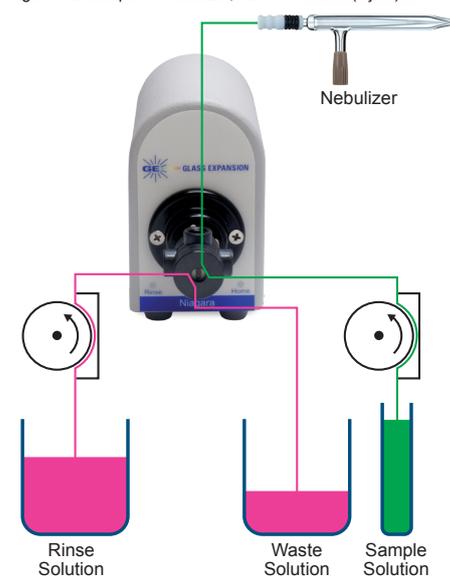
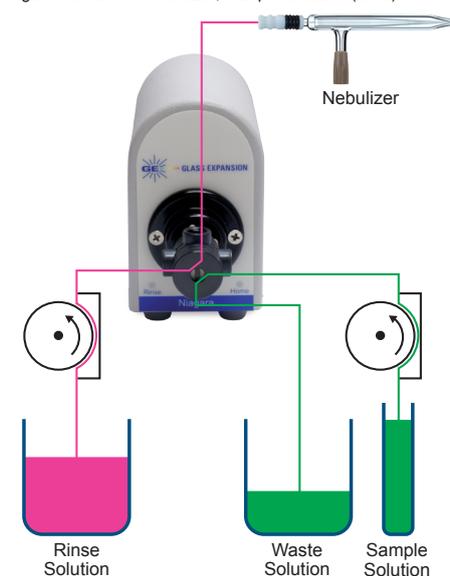


Figure 1b. Rinse to Nebulizer, Sample to Waste (rinse)



Glass Expansion News

New Address

Glass Expansion's Australian office moved on May 9. Our rapid growth meant that we needed more space, so we have moved to a new factory with twice the floor space. There is no change to our telephone and fax numbers. The new contact details are:

Glass Expansion

6 Central Boulevard
Port Melbourne
Victoria 3207, Australia
Tel. +61 3 93201111
Fax. +61 3 93201112
Email. enquiries@geicp.com
Internet. www.geicp.com

Upcoming Exhibitions and Conferences

A wide selection of Glass Expansion products will be on display at the following exhibitions. The display will include nebulizers, spray chambers, torches, RF coils, ICP-MS cones and accessories. Glass Expansion specialists will be on hand to answer your questions and assist you to choose the optimum components for your ICP.

1. **NY & PA Association of Approved Environmental Laboratories Annual Convention (NYPaAEL)**, State College PA, USA, July 17-19. www.nyaael.org/
2. **JASIS 2016**, Tokyo, Japan, September 7-9. www.jasis.jp/en/
3. **Gulf Coast Conference**, Houston TX, USA, October 11-12 (Booth #311). www.gulfcoastconference.com/

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If these delays could be eliminated, the analysis time per sample could be reduced significantly and the sample throughput increased. This is exactly what the Niagara achieves.

The Niagara begins rinsing the nebulizer and spray chamber the instant the sample measurement is completed and continues to rinse until the next sample is ready. Thus the rinse is carried out in the time that is usually wasted waiting for the sample and the rinse solutions to flow from the autosampler probe to the nebulizer. In Figure 1 (page 1), we show a flow diagram of the Niagara in both the “Home” and “Rinse” positions. The valve is in the “Home” position in Figure 1a., where the sample is being directed to the nebulizer while the rinse solution is directed to waste. At the completion of the sample measurement, the valve switches instantly to “Rinse” position and the rinse solution is directed to the nebulizer (Figure 1b), allowing for the nebulizer and spray chamber to begin rinsing immediately, with no uptake delay. The valve remains in the “Rinse” position while the autosampler probe moves to the next sample. Only when the next sample has made its way through the full length of the uptake tubing does the valve switch back to the “Home” position (Figure 1a).

The typical time saved with the Niagara is around 30% and since the valve switches immediately after the read is complete, you also minimize the amount of sample introduced into the plasma. This feature can drastically reduce your consumables costs, particularly for challenging sample matrices like high TDS, HF and organic solvents where the ICP torch and/or ICP-MS cones require frequent cleaning and can suffer from a shorter life.

Niagara CM Rapid Rinse Updates

Since the original Niagara was introduced in January 2005,² Glass Expansion’s line of enhanced productivity accessories has been continuously evolving to keep up with the demands of ICP analyses. Most recently, in 2013 we introduced the addition of a Control Module (CM), adding the suffix CM to denote this³. With the introduction of the CM, all Glass Expansion enhanced productivity accessories are now controlled by a dedicated central command unit. This provides faster and more reliable communication to the instrument PC and an easy avenue for upgrading. Further details on the benefits of the CM can be found in the February 2013 Newsletter.³

We are now introducing a suite of software upgrades that are specific to the Niagara CM Rapid Rinse. Software version NRRV2 includes a redesigned Method Wizard (Figure 2), which features an Uptake Delay Calculator, Rinse Tubing Calculator, and Time in Sample (TIS) Calculator. The addition of these calculators greatly simplifies method development so that you can quickly add the Niagara to your existing ICP method and optimize for maximum savings.

The Uptake Delay Time is the time required for the sample to reach the valve and pass through to waste, ensuring that the first bit of sample diluted with the previous rinse is flushed out to waste. Once the Uptake Delay Time has finished, the Niagara valve will switch from Rinse to the Home position, directing the sample to the nebulizer (Figure 3a). The Uptake Delay Time is calculated based on the ID and length of the autosampler probe; peristaltic pump tubing ID and length; and RPM of the peristaltic pump (Fast Pump Speed). The Rinse Tubing Calculator calculates the optimum peristaltic pump tubing to be used in order to achieve the same flow rate that is used during analysis while using a fast pump during the uptake and post-acquisition rinsing steps of the analysis.

Time in Sample (TIS) is the time required for the autosampler probe to remain in the sample tube during the acquisition (Figure 3b). The TIS is based on the total read time, RPM of the peristaltic pump (Analysis Pump Speed) and dimensions of the uptake tubing referenced above.

Figure 2. Niagara CM Rapid Rinse Method Wizard

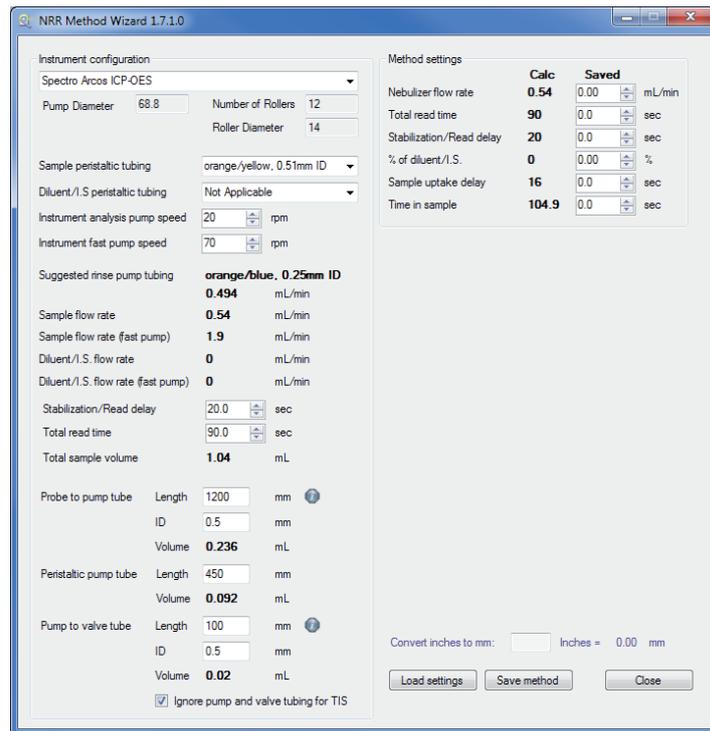


Figure 3a. Niagara CM Rapid Rinse – After Uptake Delay

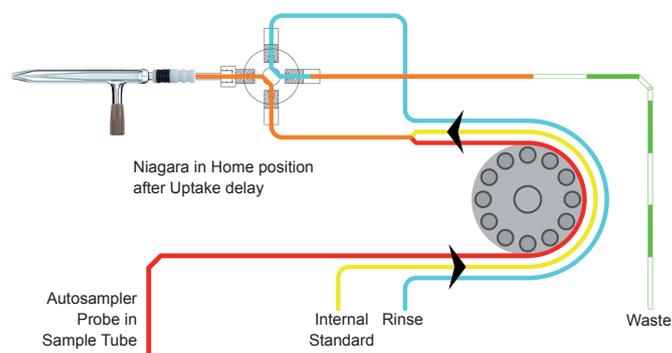
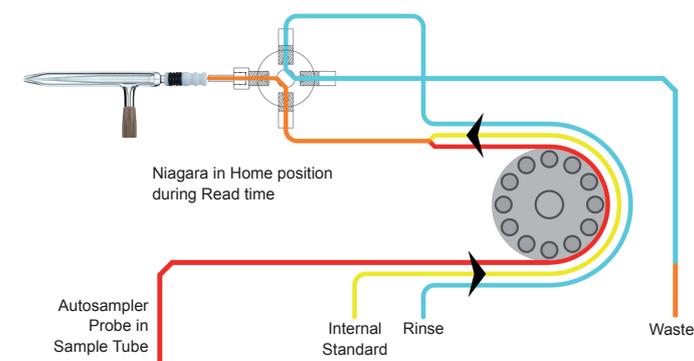


Figure 3b. Niagara CM Rapid Rinse – During Acquisition



To improve washout, it is well known that adding a bubble or series of bubbles can help “scrub” the uptake line. However, air bubbles introduced into the plasma can lead to instability and require longer stabilization delay times. With the Niagara, we can easily add a series of air bubbles with our new post wash command without the worry of introducing any air or extra argon into the plasma. To achieve this, the NRRV2 software sends the autosampler probe to the rinse station after the TIS has completed, followed by a series of commands to slowly raise and lower the probe in the rinse station. This creates a series of air gaps between the rinse solution (Figure 3c) helping to rinse the probe, uptake tubing and sample peristaltic pump tubing. Once the ICP method rinse begins, the air bubbles and any excess sample are directed to waste while rinse solution is directed to the nebulizer (Figure 3d).

Figure 3c. Niagara CM Rapid Rinse – After TIS

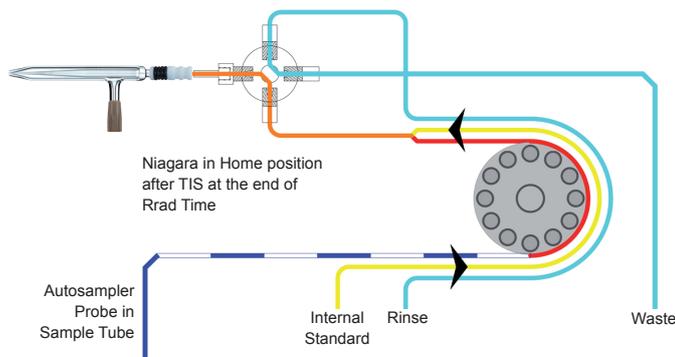
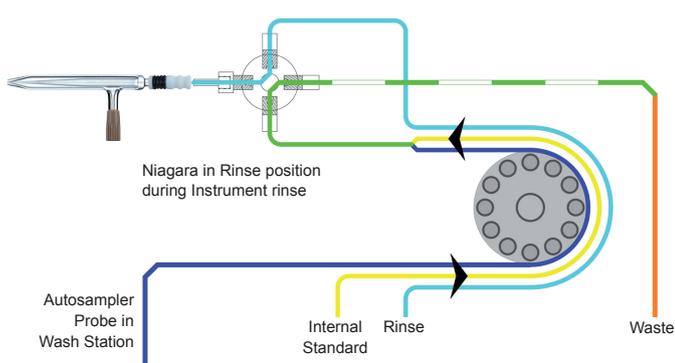


Figure 3d. Niagara CM Rapid Rinse – During ICP Method Rinse (post-acquisition)



Experimental

The speed and performance of Inorganic Venture’s single element CRM ICP-OES certification analysis was compared with and without the use of the Niagara. For these certification experiments a Spectro Arcos EOP (Axial) ICP-OES instrument was used in combination with two sample introduction systems from Glass Expansion. For samples without HF, the SeaSpray DC nebulizer was used with the Twister spray chamber and a single piece quartz torch (Figure 4a). The HF-resistant package consisted of the DuraMist DC nebulizer, Tracey TFE spray chamber and fully ceramic D-Torch for Spectro Arcos EOP ICP-OES. Also required is mounting bracket for Niagara Rapid Rinse.

Table 1. Instrument parameters for Spectro Arcos EOP ICP-OES

	“Glass Setup”	“Inert Setup” (with HF)
RF Power (W)	1400	1400
Plasma gas flow (L/min)	15	15
Auxiliary gas flow (L/min)	1.0	1.0
Nebulizer gas flow (L/min)	0.75	0.75
Nebulizer flow rate (mL/min)	0.54	0.54
Torch	Single Piece Quartz Torch (P/N 30-808-0317)	Ceramic D-Torch (P/N 30-808-3371 & P/N 31-808-3425)
Injector i.d. (mm)	2.5	2.4 (P/N 31-808-3388)
Nebulizer	SeaSpray DC (P/N A21-07-USS2)	DuraMist DC (P/N A21-07-DM1)
Spray Chamber	Twister (P/N 20-809-9199HE)	Tracey TFE (P/N 20-809-2506)
Transfer Tube	31-808-3244	21-809-3298

Figure 4. Glass Expansion Sample Introduction systems for Arcos EOP ICP-OES
 Figure 4a



Aqueous sample introduction system, SeaSpray DC Nebulizer, Twister spray chamber, glass elbow and single piece quartz torch for Spectro Arcos EOP ICP-OES. Also required is mounting bracket for Niagara Rapid Rinse.

HF-resistant sample introduction system, DuraMist DC Nebulizer, Tracey TFE spray chamber, PuraFlex transfer tube, and fully ceramic D-Torch for Spectro Arcos EOP ICP-OES. Also required is mounting bracket for Niagara Rapid Rinse.

The Niagara package (Figure 5), consists of an electronically controlled switching valve, dedicated control module and tubing kit. For maximum chemical resistance the 4-port valve is made entirely of Teflon and PEEK. An additional mounting bracket for the Arcos EOP ICP-OES was required to position the Niagara valve next to the nebulizer; this helps to reduce stabilization time. Please visit www.geicp.com/intro/niagara to find the recommended Niagara setup for your ICP.

The method timings for the Niagara CM Rapid Rinse were calculated using the newly developed Method Wizard. These conditions are listed in Table 2, comparing the timings with and without the Niagara. Typically a very high “Fast Pump” would not be recommended due to the large amount of sample introduced into the nebulizer and plasma. However, with the Niagara the higher uptake rate of

sample is directed to waste while the rinse solution is directed to the nebulizer at the analysis speed. This helps to maintain plasma stability while reducing the uptake delay time, stabilization time and sample load on the plasma. The Method Wizard also calculates the appropriate size “rinse” peristaltic pump tubing to select. This way when the Fast Pump option is used during the uptake, you are able to maintain a constant flow to the plasma. With the Arcos software, a minimum 1 second method rinse is required to properly trigger the Niagara actuator. A longer post rinse time can be used if necessary.

Figure 5. Niagara CM Rapid Rinse



Table 2. Method settings with and without the Niagara Rapid Rinse

	Without Niagara	With Niagara
Autosampler Probe ID	0.5mm	0.5mm
Sample peristaltic pump tubing	Orange/Green, 0.38mm ID	Orange/Yellow, 0.51mm ID
Rinse peristaltic pump tubing	N/A	Orange/Blue, 0.25mm ID
Waste peristaltic pump tubing	White/White, 1.02mm ID	White/White, 1.02mm ID
Uptake Delay (sec)	50	23
Flush Pump Speed	45 rpm	70 rpm
Stabilization (sec)	30	15
Stabilization Pump Speed	45 rpm	20 rpm
Analysis Pump Speed	45 rpm	20 rpm
Read (sec)	90	90
Rinse (sec)	30	1

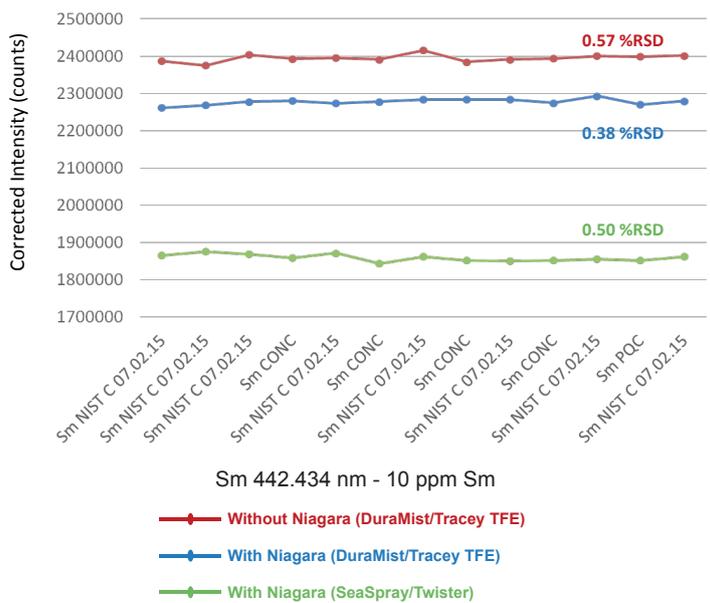
Results

A summary of the method time per sample with and without the Niagara-CM Rapid Rinse is shown in Table 3. The addition of the Niagara allowed Inorganic Ventures to reduce their certification analysis by 71sec per sample, roughly a 35% improvement. This reduction in time allows Inorganic Ventures to run an additional 10 samples per hour with the Niagara. The performance of the ICP certification analysis with the Niagara is also optimal. The stability and precision achieved certifying a 10ppm Sm CRM with the Niagara is summarized in Figure 6. With the Niagara, an average RSD of less than 0.5% is maintained with both Glass Expansion sample introduction systems.

Table 3. Method timing with and without the Niagara Rapid Rinse

	Without Niagara	With Niagara
Total Time (sec)	200	129
Improvement	N/A	35%
Samples per hour	18	28

Figure 6. Single CRM Analysis with and without Niagara



In addition to reducing sample to sample time, the Niagara also improves washout. To evaluate the performance of the new post wash command of the NRRV2 software, we compared the washout time achieved when adding a series of bubbles behind the sample to no bubbles. Thallium (Tl) is known to be a very “sticky” element that can result in the need for very long wash times. Thus a 1000ppm Tl solution was chosen for this test. These experiments were carried out using an Agilent MP-AES 4100. Results in Table 4 contain values in ppm Tl for three consecutive 2% HNO3 Blank solutions that were run after a 1000ppm Tl solution. The washout experiments were run three ways; without the Niagara, with a standard Niagara setup (no bubbles), and with the Niagara utilizing the new wash command adding a series of bubbles. With the new wash command, a dual rinse can be used in addition to adding a series of air bubbles. The dual rinse option provides the ICP analyst an option to use a more aggressive solution to rinse the uptake lines, but be directed to waste and not introduced to the ICP.

With only a 10 sec rinse, the standard Niagara system achieved a better washout compared to a 30 sec rinse without the Niagara saving a considerable amount of time (31%). However, adding the bubbles and the possibility to have dual rinse stations with bubbles reduced the carryover even further, giving better than 4 orders of magnitude washout with a 46% savings in sample time compared to the standard instrument setup.

Table 4. Washout Experiments after analyzing 1000 ppm TI

Sample ID	Standard setup 30 sec Rinse	Standard setup 1 sec Rinse	Niagara 10 sec Rinse	Niagara with Bubbles 1 sec Rinse
Blank-1 (2%HNO ₃)	0.07 ppm TI	0.48 ppm TI	0.05 ppm TI	0.04 ppm TI
Blank-2 (2%HNO ₃)	0.02 ppm TI	0.06 ppm TI	0.01 ppm TI	0.01 ppm TI
Blank-3 (2%HNO ₃)	0.02 ppm TI	0.04 ppm TI	0.01 ppm TI	0.00 ppm TI
Sample to Sample Time	71 (sec)	41 (sec)	49 (sec)	38 (sec)

Conclusions

The Niagara CM Rapid Rinse provides a simple, low cost approach to improving ICP productivity. Typical time saved with the Niagara is approximately 30%, with little to no changes to the current ICP method settings and no degradation in performance. A new Method Wizard combined with the features of the NRRV2 software facilitate easy optimization and self-installation. A unique new post wash feature with the option to add a series of bubbles and dual rinse drastically improves washout and reduces rinse time.

References

1. Glass Expansion October 2013 Newsletter, [*"How to Achieve High Accuracy with Difficult Samples."*](#)
2. Glass Expansion October 2005 Newsletter, [*"Increasing the Productivity of ICP Analyses."*](#)
3. Glass Expansion February 2013 Newsletter, [*"Latest Developments in Enhanced Productivity Products."*](#)

NEW PRODUCTS

Hollow Cathode Lamps for Atomic Absorption

Glass Expansion has released a full range of Hollow Cathode Lamps to suit atomic absorption spectrophotometers from all major manufacturers. We supply standard uncoded lamps plus data coded lamps for Agilent/Varian, Thermo Fisher and PerkinElmer instruments.

Our lamps are fully guaranteed and each lamp is individually tested to ensure optimal performance in your instrument. The test data for each lamp is stored and tracked by serial number. Our lamps are guaranteed for 2 years or 5000 milliampere-hours, whichever comes first. Rigid quality control ensures that all lamps meet the same high standard for intensity, stability and spectral purity.

1.5inch (37mm) Lamp:



2inch (51mm) Lamp:



Our Lamps feature:

- Intense emission of resonance lines
- Narrow line width for maximum sensitivity and linearity
- Minimal spectral interference
- Rapid warm up and stable long term emission
- Low noise operation
- Long running life and a 5 year shelf life
- Careful selection of cathode materials and geometry to achieve a combination of spectral purity and optimal sputtering rate

Our Hollow Cathode Lamp range includes the following types:

1.5inch (37mm) diameter uncoded 2 pin lamps

Suitable for: Agilent/Varian
 Analytik Jena
 GBC
 Hitachi
 Shimadzu
 Thermo Fisher

1.5inch (37mm) diameter Agilent/Varian coded 4 pin lamps

Suitable for: Agilent/Varian
 GBC

1.5inch (37mm) diameter Thermo Fisher coded 7 pin lamps

Suitable for: Thermo Fisher

2inch (51mm) diameter uncoded 9 pin lamps

Suitable for: PerkinElmer

2inch (51mm) diameter coded Intensitron 12 pin lamps

Suitable for: PerkinElmer

2inch (51mm) diameter coded cableless 4 pin lamps

Suitable for: PerkinElmer

[Please refer to our website for full details.](#)

NEW PRODUCTS

D-Torch for Agilent 5100 and 5110

The D-Torch is a new demountable torch design that provides the benefits of a fully demountable torch at a significantly lower cost. We have previously released the D-Torch for many ICP-OES and ICP-MS models. The D-Torch is now available for the Agilent 5100 and 5110 models. The new 5100 & 5110 D-Torch is a direct replacement for the standard Agilent torch, featuring the same self-alignment mechanism, but in a fully demountable design.

The D-Torch is a cost-effective alternative to the standard fixed torch or semi-demountable torch. It will save money for any laboratory with a moderate workload. In most cases, when the torch wears, you will only need to replace the outer tube instead of replacing the entire torch. You will realize a saving after replacing the outer tube three to five times.

The optional ceramic outer tube is much more robust than quartz and provides extended torch life, particularly with samples that cause rapid deterioration of a quartz torch, such as fusions, high salt solutions or oils.

Please go to our web page to find the D-Torch that is compatible with your model: <http://www.geicp.com/intro/d-torch>

Part No.	Description
30-808-3560	D-Torch for Agilent 5100/5110 SVDV/VDV
30-808-3590	D-Torch for Agilent 5100/5110 RV
31-808-3568	Base and Inner Tube for D-Torch
31-808-3570	Quartz Outer Tube for 5100/5110 SVDV/VDV D-Torch
31-808-3580	Ceramic Outer Tube for 5100/5110 SVDV/VDV D-Torch
31-808-3582	Quartz Outer Tube for 5100/5110 RV D-Torch
31-808-3586	Ceramic Outer Tube for 5100/5110 RV D-Torch
31-808-3576	Tapered Quartz Injector 1.8mm for D-Torch
31-808-3585	Tapered Ceramic Injector 1.8mm for D-Torch

D-Torch for Agilent 5100/5110 SVDV/VDV



Base and inner tube Quartz outer tube Ceramic outer tube Quartz injector Ceramic injector



NEW PRODUCTS

New RF Coils for:

Thermo iCAP7000/6000 MK II

Agilent 7700/8800

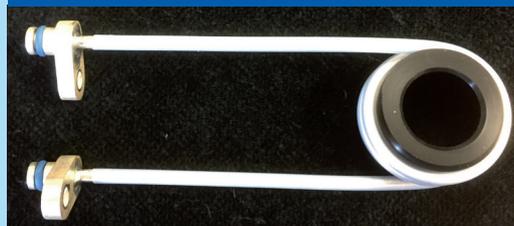
Agilent 7800/7900

Glass Expansion has expanded its range of RF coils to include coils for the Thermo iCAP7000/6000 MK II, Agilent 7700/8800 and Agilent 7800/7900. The Thermo coil is available with silver or gold plating, with silver giving the most efficient energy transfer but gold being more resistant to corrosion. The Agilent coils are available in copper or with silver or gold plating. Copper is the lowest cost but silver provides enhanced efficiency and gold provides longer lifetime with corrosive samples.

Each coil is supplied on a plastic former, ensuring correct dimensions are maintained during transport and simplifying installation. A re-usable installation kit with easy-to-follow instructions is also available.

Glass Expansion RF coils are available for a wide range of ICP-OES and ICP-MS models. For details on our full range of RF coils, check our website at: <http://www.geicp.com/intro/rf-coils>

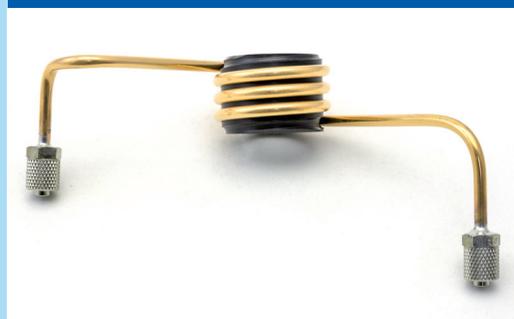
Silver RF Coil for Thermo iCAP
7000/6000 MKII - P/N: 70-900-4005S



Gold RF Coil for Agilent 7700/8800
P/N: 70-900-7700G



Gold RF Coil for Agilent 7800/7900
P/N: 70-900-7800G



INSTRUMENT NEWS

From Analytik Jena - New Model for the PlasmaQuant® PQ 9000 Series of ICP-OES Instruments

Analytik Jena has expanded its product range of ICP-OES with a second model. With PlasmaQuant® PQ 9000 and PlasmaQuant® PQ 9000 Elite, Analytik Jena now offers two systems customized to the analytical demands of applications ranging from agricultural, food and environmental routine analytics to advanced material analysis/research of saline, metallic, and petrochemical materials.

Equipped with the High-Frequency Generator and the V Shuttle Torch, the instruments are working with an innovative plasma and torch technology that offers a robust plasma performance even for extreme loadings and matrices. The systems even tolerate rapidly varying sample types and matrices with ease, which allows for a significant extension of the application range and exceptional method flexibility.

With Dual View PLUS the analyzers furthermore offer the ideal plasma view for trace elements and major constituents in every sample. By selection and attenuation of plasma views the signal intensities of emission lines are adapted to the required sensitivity of each element. This enables synchronous analysis of contents ranging from low ppb to high weight percent without lengthy sample preparation.

PlasmaQuant® PQ 9000 with High-Frequency Generator, V Shuttle Torch, and Dual View PLUS offers excellent plasma performance, detection limits, and accuracy in general applications ensuring productivity and ease of use.

PlasmaQuant® PQ 9000 Elite combines these advantages with a unique spectrometer concept, the High-Resolution Optics. This allows for unmatched spectral resolution of 2 pm at 200nm, revealing even the smallest spectral details. Thus, PlasmaQuant® PQ 9000 Elite warrants the best precision for the most challenging sample matrices and detection limits reaching into the parts per trillion.



From Shimadzu – New ICPMS-2030 – High Sensitivity, Easy Maintenance, Minimal Running Costs

Shimadzu has released its ICPMS-2030 Inductively Coupled Plasma Mass Spectrometer. It meets the requirements of the ICH Q3D guidelines for elemental impurities in pharmaceutical products. The ICPMS-2030 satisfies these requirements with ppt level sensitivity. This is achieved by the newly developed collision cell and the optimized internal structure. The ICPMS-2030 offers FDA 21 CFR Part 11 compliance, automated analytical method development function, and unique measurement result evaluation function, to provide analytical results with exceptionally high reliability.

The newly-developed collision cell enables analysis at sub-ppt level sensitivity by minimized spectral interference and improved transmission efficiency of atomic ions, so that precise quantitation results in elemental impurity analysis become more reliable.

The LabSolutions ICPMS software offers Simplified Analysis and Higher Data Reliability by 2 unique Assistant Functions.

Using the qualitative analysis method of ICPMS-2030, a first estimation on sample composition is achieved. Based on this real measurement data, using the Development Assistant, the software automatically sets the suitable analysis conditions, and a reliable quantitative method can be run within minutes for the elements of interest.

When performing routine analysis, "Diagnosis Assistant" automatically checks if there is spectral interference and indicates problems if there are any.

Like for the ICPE-9800 Series, Shimadzu uses its unique mini-torch plasma unit to significantly reduce the consumption of argon gas. The Eco mode automatically reduces the argon gas flow during standby. In addition, the use with 99.95 % purity argon gas is guaranteed. Therefore, analysis can be performed using the relatively lower cost argon gas, instead of 99.999 % or higher purity argon gas generally used. These features greatly reduce costs in laboratory operations.



INSTRUMENT NEWS

From Inorganic Ventures - Join ICP users from around the country at Inorganic Ventures' 2nd Annual ICP Conference, "Getting Back to Basics."

Launched in 2015, Inorganic Ventures is excited to Get Back to Basics with the return of its signature conference featuring a wide range of topics, including Sample Preparation Basics for ICP, Sample and CRM Stability Considerations, Trace Metals Analysis and more.

The one day event will be held September 20, at the Inn at Virginia Tech & Skelton Conference Center, Blacksburg, VA USA

Visit www.inorganicventures.com/icp to register and learn more about this event.



From SPECTRO - New ARCOS MV ICP-OES

The new SPECTRO ARCOS establishes a new ICP-OES performance class for complex analytical tasks — resolving a wide array of inherent problems in traditional spectrometer design — and caps 30 years of SPECTRO experience in developing advanced solutions for the elemental analysis of metals, chemicals, petrochemicals and other materials. SPECTRO's unique new MultiView capability delivers unmatched performance improvements in accuracy and stability and allows for the fast and convenient selection of axial plasma or radial plasma observation with no optical compromise.

SPECTRO Analytical Instruments Inc. www.spectro.com

