

# ICP Nebulizer Maintenance – Prolong Performance and Lifetime

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To achieve peak performance from your ICP-OES and ICP-MS, it is essential that you first choose the proper nebulizer based on your sample types. Once your ICP laboratory has standardized on a particular nebulizer model, it is crucial that you follow a regular and proper maintenance procedure. This will enable your ICP laboratory to continuously maintain expected levels of performance, in addition to extending the lifetime of your nebulizer. It is also important that your ICP analysts learn how to properly identify performance issues specific to the nebulizer. This will minimize the wasted analysis time spent troubleshooting other sample introduction components.

In this article we detail a complete guide to nebulizer care, listing a step-by-step nebulizer maintenance procedure, featuring Glass Expansion's easy-to-use Eluo™ nebulizer cleaning tool. We also point out nebulizer maintenance practices that should be avoided to prevent damage to the nebulizer and provide methods of identifying an issue specific to nebulizer performance.

## Introduction

Glass Expansion is an international supplier with over 30 years of experience in manufacturing ICP-OES and ICP-MS sample introduction components. Our products are made in-house, in our world-class manufacturing facilities to our exacting standards. These designs are often supplied as standard equipment on many ICPs because of their reproducibility, longer lifetime, and dependability. Glass Expansion's most popular product designs include our extensive line of concentric nebulizers, including trademark models such as the MicroMist, SeaSpray, Conikal and DuraMist.

The nebulizer maintenance procedures that follow are specific to Glass Expansion nebulizer designs; however, many of these guidelines apply to other nebulizer manufacturers. We suggest you contact your nebulizer manufacturer for their recommended maintenance procedure, as all nebulizer models are not the same and, as we have noted, improper care can lead to shortened lifetime and damage.

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## Maintenance Practices to Avoid

First, let's cover how your ICP laboratory can prevent damage:

- Do not insert anything through the orifice of the nebulizer, including wires and probes. This is most likely to damage the nebulizer beyond repair.
- Never touch the nebulizer tip. Any deposit of body oils can have a detrimental effect on the performance of the nebulizer.
- Do not use any concentration of HF to clean a glass or quartz nebulizer. Even dilute HF can alter the orifice of the internal capillary and deteriorate the performance of the nebulizer.
- Do not place a glass nebulizer in an ultrasonic bath as it may dislodge the internal capillary.
- Do not use hot liquid to flush the sample capillary of an inert nebulizer. The temperature can potentially deform the capillary and affect nebulizer performance.

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## How to Identify Nebulizer Issues

Most ICP-OES and ICP-MS instruments have a software feature that can monitor nebulizer back-pressure. It is good practice to record or take note of the nebulizer back-pressure after your instrument has warmed up. This way your analyst can easily identify whether the back-pressure is abnormally low or high. Glass Expansion Direct Connect (DC) concentric nebulizers run optimally at approximately 40 psi.

If you observe a low nebulizer back-pressure and a loss in sensitivity, check the argon nebulizer gas connection at the instrument and at the nebulizer gas arm. PVC or other polymer tubes that are often used for the nebulizer gas supply can harden over time and lose their flexible gas-tight grip. Even a 1% loss of argon can produce changes of several percent in many ICP analytical lines. For this very reason, Glass Expansion developed the DC nebulizer product line in 2016.<sup>1</sup> Features of Glass Expansion's worldwide market-leading high performance SeaSpray DC Nebulizer are shown in **Figure 1a**, and an example of a DC nebulizer installation is shown in **Figure 1b**. same and, as we have noted, improper care can lead to shortened lifetime and damage.

Figure 1a. Features of SeaSpray DC Nebulizer.

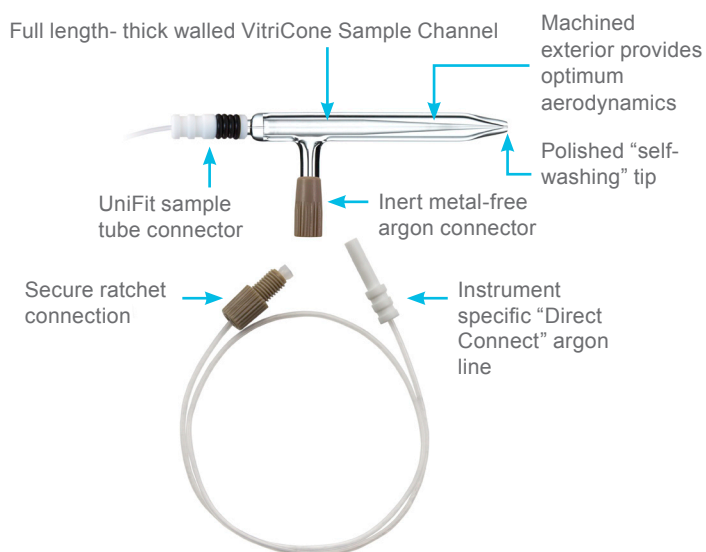
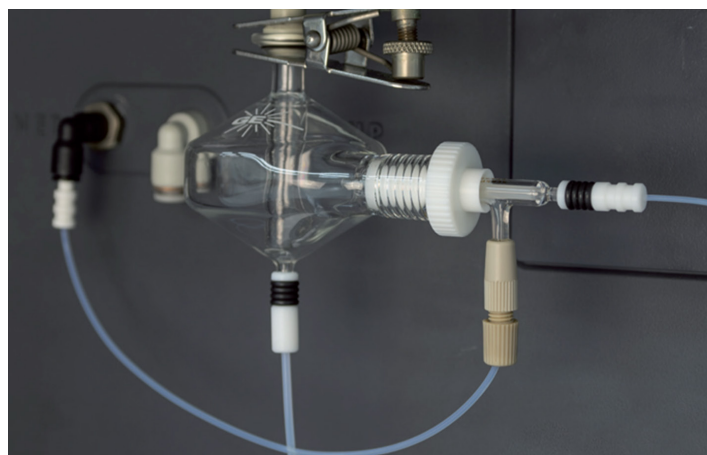


Figure 1b. SeaSpray DC nebulizer installation.



The benefits of the DC nebulizer gas line include:

- Inert metal-free argon connector
- Instrument-specific Direct Connect flexible argon line
- Do not place a glass nebulizer in an ultrasonic bath as it may dislodge the internal capillary.
- Reliable ratchet fitting ensuring leak-free gas connection

If a high nebulizer back-pressure is observed, you likely have a partially blocked or clogged nebulizer. A blocked nebulizer can also be identified by a decrease in your sample uptake rate. Glass Expansion's TruFlo sample monitor (Figure 2) provides a real-time digital display of the sample uptake rate. The actual sample flow is shown on the TruFlo's inbuilt digital display, and a graph of flow vs. time can also be displayed on your computer. This enables the analyst to take immediate corrective action if there is a nebulizer blockage in the middle of an analysis, peristaltic pump tubing is worn, or the tension on the pump tubing clamps is incorrect. In addition to monitoring your nebulizer back-pressure, your laboratory can also record your normal sample uptake rate, to ensure you are using the same uptake rate from day to day. The TruFlo sample monitor is an essential tool for any ICP laboratory attempting to improve day-to-day performance of their nebulizer.

Figure 2. TruFlo real-time sample monitor.



## Nebulizer Maintenance

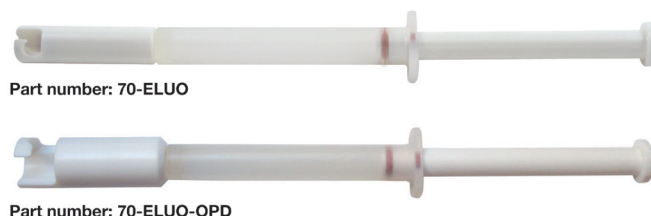
To keep your nebulizer in good condition, always start and finish a run by nebulizing a mildly acidic blank solution followed by deionized water (DIW) for several minutes. This ensures that sample deposits or crystals do not form on the inside of the nebulizer when the solvent dries, which can deteriorate performance and shorten its lifetime. For regular analysis of samples with high TDS, we recommend aspirating a 2.5% Fluka RBS-25 solution (P/N [FLUKA25](#)) for 15 minutes at the end of each day or analysis followed by DIW. Nebulizing a cleaning solution at the start and end of each day will also clean your spray chamber. For additional tips on analyzing challenging matrices, like high TDS samples, see Glass Expansion's June 2017 newsletter.<sup>2</sup>

When a nebulizer becomes blocked, Glass Expansion's Eluo Nebulizer Cleaning Tool provides a safe and convenient way to remove the blockage from your Glass Expansion nebulizer. The Eluo is designed to efficiently deliver a cleaning solution through the nebulizer capillary to dislodge particle build-up and thoroughly clean the nebulizer. We suggest using the Eluo regularly to maintain nebulizer performance and prolong nebulizer life.

Glass Expansion has two Eluo designs (Figure 3):

- Eluo for glass concentric nebulizers (SeaSpray, Conikal, MicroMist & Slurry) – P/N [70-ELUO](#)
- Eluo for inert concentric nebulizers (OpalMist & DuraMist) – P/N [70-ELUO-OPD](#)

Figure 3. Eluo nebulizer cleaning tool.



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## Cleaning Procedure

If there are deposits that cannot be removed with a quick backflush using the Eluo, we recommend the following procedure:

1. Initially flush your nebulizer with warm water\* using the Eluo.
2. Soak the nebulizer tip in a 25% solution of Fluka RBS-25 (P/N [FLUKA25](#)) for 24 hours. Use the Eluo to make sure the Fluka RBS-25 solution fills the nebulizer. An initial flush of 25% Fluka using the Eluo may be required.
3. After 24 hours, flush the nebulizer 3 times with warm water\* using the Eluo.
4. Stubborn deposits may require an additional soaking for 2 hours with a 5% nitric acid solution.
5. Flush 3 times with warm water\* using the Eluo.
6. For faster drying, flush again with methanol.

\* Warm water only recommended for use with glass or quartz nebulizers.

Visit [www.geicp.com/intro/nebcare](http://www.geicp.com/intro/nebcare) for an informative video on nebulizer maintenance using the Eluo.

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## Particulates

The most common nebulizer blockages are due to salting or particulates. Particulates are small undissolved solids that remain in your samples, either due to an incomplete digestion, errant fibers from pre-filtering steps, or contamination from the laboratory environment. Some particulates are impossible to remove from the nebulizer, requiring your laboratory to ultimately replace the blocked nebulizer. To eliminate the risk of particulates getting trapped in your nebulizer, Glass Expansion developed the Guardian inline particle filter, which is a re-usable filter (P/N [70-803-1108](#)).

The Guardian features a 120 micron PEEK filter within its housing, which can be installed on your sample uptake line between the autosampler probe and nebulizer. The filter is easily cleaned by back flushing, using an adaptor (P/N [70-803-1160](#)) connected to the Eluo Nebulizer Cleaning Tool. This allows your laboratory to quickly clean the filter each day without production interruption and greatly extend the lifetime of your nebulizer by preventing blockages.

The best cleaning procedure for the inline filter is to do a quick soak (~5min) in a 25% Fluka RBS-25 solution, sonicate the assembly for ~5min, then backflush 3 times with warm DI water using the Eluo tool and backflushing adapter. If you do not wish to use the Fluka RBS- 25, a similar glassware cleaner or even dilute acid will help. The TruFlo can be used to alert the analyst when the inline filter needs to be backflushed in addition to optimizing nebulizer conditions.

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## Conclusion

Proper care combined with regularly scheduled maintenance of your nebulizer will help to maintain optimum performance and increase lifetime, reducing your laboratory's nebulizer replacement costs. Establishing daily nebulizer performance checks and being able to quickly identify ICP performance issues related to the nebulizer will greatly reduce instrument downtime. Accessories, such as the Eluo, Guardian inline filter and TruFlo, monitor greatly improve and simplify the task of daily nebulizer maintenance, while also protecting one of the most critical sample introduction components of your ICP.

Glass Expansion's Quality Assurance Kit (P/N [KT-1136](#)) combines all the nebulizer maintenance tools discussed in this article: Guardian inline filter, backflushing adapter, Eluo nebulizer cleaner and TruFlo sample monitor. This complete kit provides your ICP laboratory with all the tools necessary to protect and maintain your ICP nebulizer.

Glass Expansion's intimate understanding of the relationship between the various sample introduction components, together with our expertise in manufacturing high quality nebulizers, spray chambers, torches, ICP-MS cones and ICP accessories, means that we can offer you a complete solution regardless of your sample matrix. Visit us at [www.geicp.com](http://www.geicp.com) or contact us at [enquiries@geicp.com](mailto:enquiries@geicp.com) to find the best solution for your ICP laboratory.

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## References

1. Glass Expansion Newsletter, February 2016 Issue, "The Elegra Argon Humidifier: Uninterrupted and Maintenance-Free ICP Operation."
2. Glass Expansion Newsletter, June 2017 Issue, "Considerations when Analyzing Real-World Samples by ICP Spectrometry."

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