

High productivity vapor generation with the VGA 77 accessory

Technical Overview



Agilent's fully automated, modular VGA 77 Vapor Generation Accessory is an optional accessory for the 200 Series Atomic Absorption Spectrometers.

It is ideal for rapid trace level determinations of mercury (using the proven cold vapor technique) and other hydride-forming elements at parts-per-billion ($\mu\text{g/L}$) concentrations.

The VGA 77 offers:

- The convenience of flame AA determinations
- Unmatched precision at ppb levels
- Ease-of-use, flexibility and automation

The continuous flow VGA 77 offers the convenience of flame AA operation, while delivering exceptional precision with total flexibility and automation. Benefits of the VGA 77 include:

- High sensitivity
- Precisions of 1-2 % RSD at ppb levels, achieved using integration of the steady state signal for a few seconds
- High sample throughput—results are achieved in less than 1 minute allowing determination of up to 70 samples/hour
- Simple operation—the integral pump provides continuous flow conditions with automatic reagent addition
- Enhanced stability—the continuous flow conditions ensure a stable baseline and eliminate varying blank levels
- Low sample consumption: < 8 mL per element during analysis
- Modular construction to reduce set-up time and eliminate cross-contamination—simply exchange modules when switching between elements with conflicting chemistries
- Enhance productivity by coupling the VGA 77 with the SPS 4 Sample Preparation System. This automates hydride and mercury vapor determinations with automated sampling, reagent addition, calibration and sample analysis

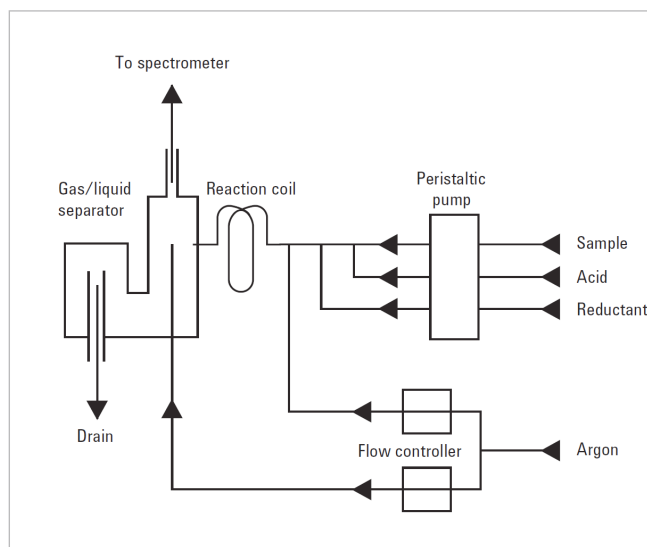


Figure 1. Simply aspirate your sample and read. The VGA 77 automatically mixes acid and reductant with the sample. The resulting vapor flows into the atomization cell for measurement.

Eliminate cross contamination

The modular construction of the VGA 77 eliminates cross-contamination, which can be introduced by the conflicting chemistries required for different elements, such as arsenic and mercury. Residual reagents from determinations of one element can degrade the analytical signal of another. The entire plumbing assembly is integrated into a separate module, which can be simply exchanged when switching between elements. This reduces change-over times and eliminates cross-contamination.

Advantages of continuous flow vapor generation

The continuous flow VGA 77 offers the following advantages over competitive techniques, such as Flow Injection:

- Better sensitivity than discrete injection techniques
- Enhanced precision—the VGA 77 produces a steady state signal, which can be measured using conventional integration. Flow injection produces transient signals, requiring time-consuming multiple injections for precise results

- Greater productivity—samples only need to be aspirated once to obtain precise results from multiple replicates. Flow injection produces transient signals, requiring separate injections for each replicate reading. Each replicate consumes several milliliters of sample to ensure the injection loop is filled. This reduces sample throughput and increases sample consumption
- Simple and automatic operation—each sample is automatically combined with a continuous flow of acid and reagents

Table 1. Typical performance

Element	Char. µg/L	Detection Limit µg/L	Detection Limit with ETC 60 µg/L
Hg	0.3#	0.05	N/A (cold vapor)
As	0.2	0.09*	0.02*
Se	0.2*	0.1*	0.04*
Sb	0.15	0.06*	-
Bi	0.2	0.07*	0.05
Sn	0.3	0.15*	0.15
Te	0.15	0.15	0.1

with flow through cell

* using Agilent high intensity UltrAA lamps

Unattended hydride analyses

For increased sensitivity and reduced detection limits, the VGA 77 can be combined with the ETC 60 Electrothermal Temperature Controller. Utilizing electrical heating of the atomization cell, the ETC 60 adds the economy of flameless atomization. Flame heating of the atomization cell is eliminated, enabling atomization at lower temperatures. This enhances sensitivity and enables safe, unattended, flameless hydride determinations. This also facilitates hydride determinations using the Zeeman instrument module.



Figure 2. The ETC 60 electrothermal temperature controller (metal box in burner compartment) is an optional accessory for use with the VGA 77.

Combining the ETC 60 with the VGA 77 offers unique benefits, including:

- Flameless atomization of the hydride-forming elements
- Reduced running costs, as flame gases are eliminated
- Safe, unattended hydride determinations for improved productivity
- Reduced baseline noise by eliminating flame flicker
- Increased sensitivity (up to 30 %). Atomization temperatures can be programmed for each element (typically < 1000 °C). This increases the atom residence time in the optical path, ensuring enhanced sensitivity
- Lower detection limits (sub ppb), resulting from the improved signal-to-noise performance

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