More than 40 years after PerkinElmer introduced the world’s first commercial system, graphite furnace atomic absorption spectroscopy is still a preferred technique for quantitative trace-metal determination. The reason for this is that after four decades of development and improvement, today’s graphite furnace offers numerous key advantages for trace-metal analysis including:

- Cost-effective investment
- Low operating cost
- Exceptional detection limits, down to the pg range
- Low sample consumption, as low as a few µL
- High freedom from interferences
- Ease-of-handling with full automation
- Proven reliability in tens of thousands of laboratories worldwide

PerkinElmer’s HGA® 900 graphite furnace features the latest advances in graphite furnace technology, delivering unparalleled performance, flexibility and ease-of-use.
**Designed for easy operation**

The HGA 900 is a high-performance graphite furnace system for use with the PerkinElmer® AAAnalyst™ 200 and 400 atomic absorption spectrometers (Figure 1). The HGA 900 is controlled by the powerful, easy-to-use PerkinElmer WinLab32™ for AA software. The unique mounting arrangement of the HGA 900 makes the change from furnace to flame operation (or vice versa) extremely easy. To change from furnace to flame, simply swing out the furnace and slide the burner assembly into the self-aligning guide. All flame gas connections are automatically reestablished using a novel quick-disconnect system, which ensures that all gases are safely blocked when the flame assembly is removed for furnace operation.

**Consistent performance**

With the HGA 900, you do not have to worry about variations in input-line voltage affecting the performance of your furnace. A state-of-the-art power supply monitors and compensates for line variations, providing heating rates independent of input-line voltages (208-240V). The result is heating rates greater than 2000 °C/s, providing the highest degree of freedom from interferences and the most reproducible characteristic mass values of any furnace available – any day, any time. Unlike other furnace systems, with the HGA 900, tube temperatures are virtually independent of graphite-tube electrical resistance, resulting in consistent, repeatable temperatures and performance. Utilizing an advanced True Temperature Control (TTC) feedback system, the HGA 900 measures key graphite-tube parameters and automatically adjusts the applied power as needed.

**Proven furnace design**

The PerkinElmer HGA Massman-type graphite furnace design used in the HGA 900 has proven its capabilities in tens of thousands of laboratories worldwide. Like its predecessors, an important feature of the HGA 900 is the use of separate, independently computer-controlled internal and external protective gas streams, providing maximum tube life. In addition, the internal gas stream can automatically and independently be switched to an alternate gas such as oxygen or argon/hydrogen. The HGA 900 furnace is compact and rugged. The furnace housing is completely coated with PTFE, making it corrosion-resistant to acids and organic solutions, ensuring a long lifetime. The design of the system ensures that routine operation and maintenance such as window cleaning, tube removal or changing contact cylinders, are quick and easy.

**Unique, integrated platform graphite tube**

PerkinElmer was the first to offer a L’vov-type platform more than 30 years ago. Since that time, platform atomization has been recognized as a key requirement to interference-free analyses. The HGA 900 features the patented PerkinElmer graphite tube with integrated platform – the most significant improvement in platform atomization in the last two decades (Figure 2). The tube and spherical integrated platform are machined from a single piece of high-density graphite and then coated with a layer of pyrolytic graphite.

The major benefits of integrated-platform HGA tubes are:
- No need to change tubes as all elements – including refractory elements like Ti and Mo – can now be determined using the same tube
- Easy to use – no need to install a platform
- Improved isolation from tube-wall heating ensures analyte volatilization into a steady-state atmosphere
- Spherical platform design makes pipette alignment easier
- Larger sample volumes (up to 50 µL) for improved detection limits
- Maximum tube-to-tube performance reproducibility
- Reduced interferences eliminates the need for the method of additions in most matrices

**Furnace autosampler ensures high throughput**

The AS 900 furnace autosampler, included with the HGA 900, can accommodate up to 148 samples with true random sampling (Figure 3). Digital micro-stepper, motor-driven pumps provide unmatched accuracy and reproducibility. The autosampler completely automates calibration, reducing operator time and eliminating dilution errors. The autosampler can be easily programmed to automatically add spikes and matrix modifiers, perform multiple injections and dilute over-range samples. Solutions can be automatically injected into preheated tubes to optimize drying conditions and increase analysis speeds. Additionally, the AS 900 offers variable pipetting speeds to maximize reproducibility for viscous solutions.

**STPF increases accuracy and productivity**

More than 30 years ago, PerkinElmer pioneered the Stabilized Temperature Platform Furnace (STPF) technique to provide interference-free graphite furnace analyses. By eliminating the need for standard additions, STPF improves accuracy, precision and detection limits, while dramatically improving sample throughput. While some other instrumentation offers partial STPF implementation, PerkinElmer AA spectrometers have fully implemented the technique, providing the best furnace performance.
Specifications

**Principle**
Fully computer-controlled Heated Graphite Atomizer (HGA). The furnace assembly, including the AS 900 autosampler, is mounted on a high-strength swing arm and can be moved manually into the sample compartment of an AAAnalyst 200 (using WinLab32 for AA) or 400 atomic absorption spectrometer. The graphite tube is heated longitudinally. Two inert gas streams (internal flow through the graphite tube; external protection flow around the tube) are independently computer-controlled. Pneumatic opening and closing of the furnace for easy tube changes.

**Tube temperature**
Ambient temperature up to 2700 °C, programmable in steps of 10 °C. Programmable heating rates up to 2000 °C/s, with maximum power heating.

**Gas requirements**
Inert gas supply required (not provided); argon recommended. A second gas (alternate gas) can also be used. Automatic gas shutdown when the furnace has been idle for 10 minutes. Pressure: 350-400 kPa (3.5-4 bar, 51-58 psig). Gas flow: 1.2 L/min max. Internal gas flow selectable: Gas Stop (0 mL/min), Mini Flow (50 mL/min), Full Flow (250 mL/min).

**Cooling**
Water cooling is required. When the HGA 900 is ordered with cooling system, a self-priming recirculatory cooling system is supplied as standard. This fan-assisted heat exchanger provides constant cooling of the graphite furnace, improving analytical precision, extending tube lifetime and reducing operating costs. Coolant temperature during operation is approx. 40 °C with a flow in a closed loop of 2.5 L/min. Power requirements: 230 V (±10%), 50/60 Hz; approx. 140 VA. Dimensions: 20 cm wide x 37.5 cm high x 50 cm deep, 18 kg with coolant.

**Note:** When operating the HGA 900 without the recirculatory cooling system, cooling water meeting the following specifications should be used: sediment-free drinking water; 20-40 °C; flow rate between 2 and 2.5 L/min; pressure between 2.5 and 3.5 bar (36-50 psig); pH between 6.5 and 7.5; hardness not greater than 14°dH or 100 ppm.

**Furnace control**
Required for operation of the HGA 900 with an AAAnalyst 200 or AAAnalyst 400 (but not included) is a personal computer (PC) and WinLab32 for AA software. The following minimum PC configuration is required: Intel® Pentium® III processor; 993 MHz; 256 MB RAM; 1 serial, 1 parallel (bi-directional) interface; 6.0 GB hard disk drive; CD-ROM drive; SVGA graphics board and compatible monitor; mouse pointer; Microsoft® Windows® 7. A compatible Hewlett-Packard® DeskJet® or LaserJet® printer is required for hard-copy data.
Furnace program  Up to 12 independent steps. Parameters – holding time: 0-99 s, in steps of 1 s; temperature: 20-2700 °C in steps of 10 °C; heating rate: programmable, time-dependent or maximum power; internal gas flow; read delay; read time.

Safety features  The HGA 900 offers a complete array of safety features, including automatic circuit-breaker protection, a safety interlock to prevent operation with low gas pressure or with a broken tube or when the furnace is open, and thermal protection against overheating of the furnace. The HGA 900 continuously monitors its status and informs the user of any problems.

Power requirements  230 V (±10%) single-phase alternating current, 50/60 Hz, 3600 VA; 3-pole CEEKON outlet 230 V, 16 A (fuse 16 A slow blow) or NEMA® L6-20R twistlock outlet 250 V/60 Hz, 20 A (fuse 20 A slow blow). The mains-line house wiring must have a minimum wire cross-section of 4 mm² (10 gauge) or 6 mm² (8 gauge) for distances > 10 m.

Electrical protection  As defined in EN 61010-1 (IEC 61010-1); insulation class 1; installation category II; pollution degree 2.

Technical standards  The instrument is designed and tested to be in compliance with safety requirements: EN 61010-1, EN 61010-2-061, CAN/CSA-C22.2 No. 61010.1, CAN/CSA-C22.2 No. 61010.2.061, and the ElectroMagnetic Compatibility requirements EN 55011 for emissions and EN 61326 for immunity. The instrument bears the CSA mark (CSA/Canada and NTRL/USA) and the CE mark (Europe). The instrument is developed and produced in compliance with ISO 9001.

Environment  Ambient temperature: 15 °C to 35 °C; 20-80% relative humidity, non-condensing; 0-2000 m.

Dimensions  Power unit alone: 32 cm wide x 47 cm high x 63 cm deep.
Power unit with furnace in the standby position: 32 cm wide x 47 cm high x 97 cm deep.

Mass (weight)  43 kg.