



# Phoenix™

Microwave Muffle Furnace





## Ash analysis made rapid and simple.

Ash samples with unmatched speed, safety, ease-of use, and energy savings with the Phoenix™ Microwave Muffle Furnace. This system will improve your process control, allow for rapid adjustments, and reduce out-of-specification products. The Phoenix can perform many high-temperature applications up to 97% faster than traditional muffle furnaces, giving you more time to make adjustments to your process and reduce out-of-specification analysis.



## Efficient

Accurate results in minutes. Up to 10 times faster than conventional muffle furnaces.

Built-in calibration software available with NIST-traceable accessories.

Furnace temperature uniformity exceeds requirements of standard methods (USP, ASTM, AOAC).

Satisfy standard methods that require electrically heated furnaces.

Heating element placed in furnace walls for optimum heating.



## Flexible

Programmable temperature control allows single set point temperature or multiple stage programs.

Programmable warm-up and shutdown. Store up to 20 custom user-programmed methods.

8 GB of storage provides sufficient data storage for the lifetime of the system.

Airwave™, sulfated ashing, and nitrogen purge options available.

Use any kind of crucible, including metal, platinum, porcelain, graphite, and quartz fiber.



## Safe

Quartz fiber crucibles cool to the touch in seconds, allowing for safe operator handling.

Closed exhaust system that eliminates the need for using a fume hood.

Dual-protection system prevents microwave door from closing without the furnace door in place.

IR sensor shuts down heat source in the event of overheating.

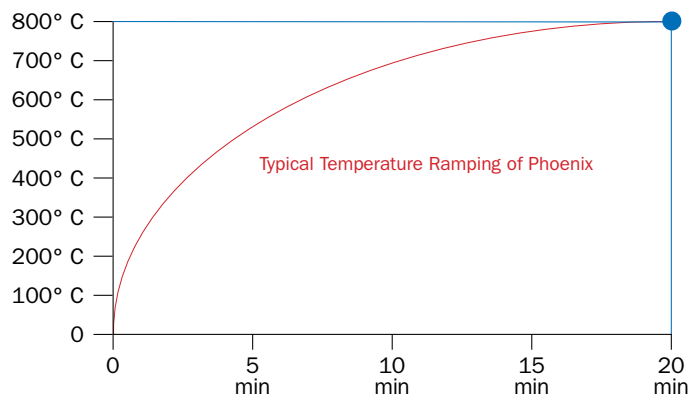
Furnace door hanger for stowing the furnace door while loading and unloading samples.

### Phoenix Meets the Requirements of “electrically heated” and “microwave heated” Muffle Furnaces

- ASTM D874-92 – Sulfated Ash content of Lubricating Oils
- ASTM D482-91 – Dry Ashing Petroleum Samples
- ASTM D5630-94 – Ash content of Thermoplastics
- ASTM D1506-94b – Ash content of carbon black
- IP 501 – Fuel oil sample prep by Ashing
- USP 281 – Residue on Ignition (ROI)/Sulfated Ash
- USP 733 – Loss on Ignition (LOI)
- Various AOAC, FDA, ISO, and DIN methods

# Reduce analysis time to minutes.

Many diverse industries from food manufacturing to petroleum refining use traditional muffle furnaces to ash both incoming and outgoing product for analysis. Unfortunately, ashing samples in a conventional furnace takes hours to complete. Traditional muffle furnaces are often used for quality control, but are impractical for process control. However, a Phoenix microwave muffle furnace can reduce ashing times to minutes, allowing time for the results to be used for improving process control. You now have time to make adjustments to your process, ensuring a higher quality product and less rework.



## Typical Ashing Times

Material	Conventional (minutes)	Microwave (minutes)	Time Savings (percent)
Butyl Rubber	90	20	78
Carbon Black	960	90	91
Cat Food	300	10	97
Coal	240	40	83
Egg (dried yolk)	240	20	92
Graphite Powder	240	35	85
Kaolin	120	30	75
Lactose	960	35	96
Paper	60	10	83
Polyester	480	15	97
Polyethylene (unfilled)	30	5	83
Polyethylene (% carbon black)	30	7	77
Polypropylene	30	5	83
Poultry (feed)	120	10	92
Pulp	180	10	94
Silicon Carbide Mix	120	10	92
Sludge (municipal)	60	15	75
Sludge (petroleum)	60	35	42
Stearates	90	5	94
TiO <sub>2</sub>	60	10	83

# Bone analysis in less than 15 minutes.

Get a fast, accurate and direct bone content analysis without titrations and back calculations. Save money and increase production yields by running closer to target.

- Fast, direct method
- More accurate than titration
- No chemicals
- Automatically calculates results

Sample	% Bone	AOAC Bone	Difference
1	0.77	0.83	-0.06
2	0.70	0.76	-0.06
3	0.80	0.62	0.18
4	0.86	0.51	0.35
5	0.59	0.55	0.04
6	0.64	0.56	0.08
7	0.79	0.50	0.29
8	0.50	0.50	0
9	0.83	0.85	-0.02
10	0.85	0.88	-0.03

Bone Content Results: Mechanically Separated Chicken (MSC)

# Programmable temperature control.

Phoenix was designed to maintain a uniform temperature throughout the furnace. It is the only microwave muffle furnace which has its heating element placed in the walls of the furnace, giving the Phoenix greater temperature stability.

Programmable and automatic temperature controls are standard. Multiple methods may be stored with up to 8 individual ramp, dwell, and hold times per method. Recall any method and use your own method names.

For more control, the NIST-traceable dual thermocouple measures air temperature in the furnace center, allowing simultaneous, independent measurement of the furnace chamber temperature. The Calibration Source Instrument, also NIST-traceable, works with the Phoenix software to calibrate the temperature controller with the time and date recorded in the computer memory for display and/or printout.



Use any crucible that may be used in a conventional muffle furnace including platinum.

# How to Ash a Sample



1

Select the ashing program for your sample using the keypad.



2

Weigh your sample into a crucible.



3

Place samples in furnace.



4

Press *Start*.



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Phoenix

Microwave Furnace



## Workstation Option

All Phoenix Systems are available as a workstation, including balance, and printer (not shown). The Phoenix Workstation option transforms your microwave muffle furnace into a complete center for accurate ashing and data compilation for complete documentation of the ashing process to assist you in complying with ISO and other QC requirements.

Two furnace configurations available.

### High Temperature

1200 °C Furnace holds up to 8 (20 mL) crucibles.



### High Capacity

1000 °C Furnace Holds up to 15 (20 mL) crucibles. Ideal for high-throughput laboratories.





# Sulfated Ashing Option

This Vapor Scrubbing System features a vapor scrubber to safely remove harmful fumes from the furnace cavity and neutralize any residual acid exhausted (sulfur dioxide and nitric acid). This setup meets ISO 14000 regulations and can be rapidly disconnected in less than 5 minutes without the use of tools.

- Meets requirements for USP 281 (ROI) & USP 733 (LOI)
- Full documentation of method, completion date, and time
- Rapid disconnect feature allows system to be used as either a standard ashing system or a sulfated ashing system in less than 5 minutes without the use of tools
- Quartz furnace ceiling assures sample purity



# AirWave™ Option

AirWave provides increased airflow for high organic sample ashing. This system configuration meets the most demanding requirements of large organic samples with ease and eliminates volume reduction/carbonization on hot plate or Bunsen burner.

- Fast, accurate analysis
- Ash volatile organics, diesel and jet fuel without a Bunsen burner
- Accuracy comparable to standard methods
- Convenient-to-use, easy-to-clean
- Compressed air driven exhaust system will not clog - No moving parts

The Phoenix Airwave provides accurate carbon black results in a fraction of the time it takes conventional furnaces. The reproducibility is excellent, making the use of nitrogen atmosphere or quartz tubes unnecessary.





### Calibration Source Instrument (NIST-traceable)

The calibration source instrument and built-in system software allow rapid calibration of the temperature control circuitry of the Phoenix. An NIST-traceable certificate of calibration is supplied with the instrument.



### Dual-Element Thermocouple (NIST-traceable)

The type K Dual Element Thermocouple contains two thermocouples in one sheath. While one thermocouple controls the operating temperature, the second thermocouple can be connected to a digital thermometer to verify the accuracy of the controlling thermocouple. It is NIST-traceable with a certificate of calibration.



### Cooling Fan

The furnace cooling fan rapidly reduces heat to the starting temperature.



### Balance

Analytical grade 110 g or 210 g balance with 0.1 mg sensitivity.

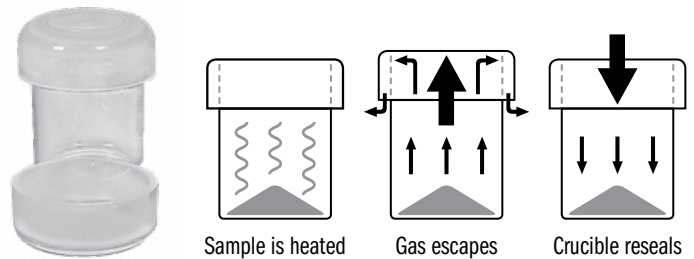
# Faster ashing that cools in seconds.

Phoenix microwave muffle furnaces can use any crucible that may be used in a conventional muffle furnace (including platinum), but it's hard to beat our patented, quartz fiber crucibles for speed, convenience, and safety. The quartz fiber material allows oxygen to circulate around the sample, dramatically reducing ashing times. Plus, it cools in seconds, eliminating crucible burns.

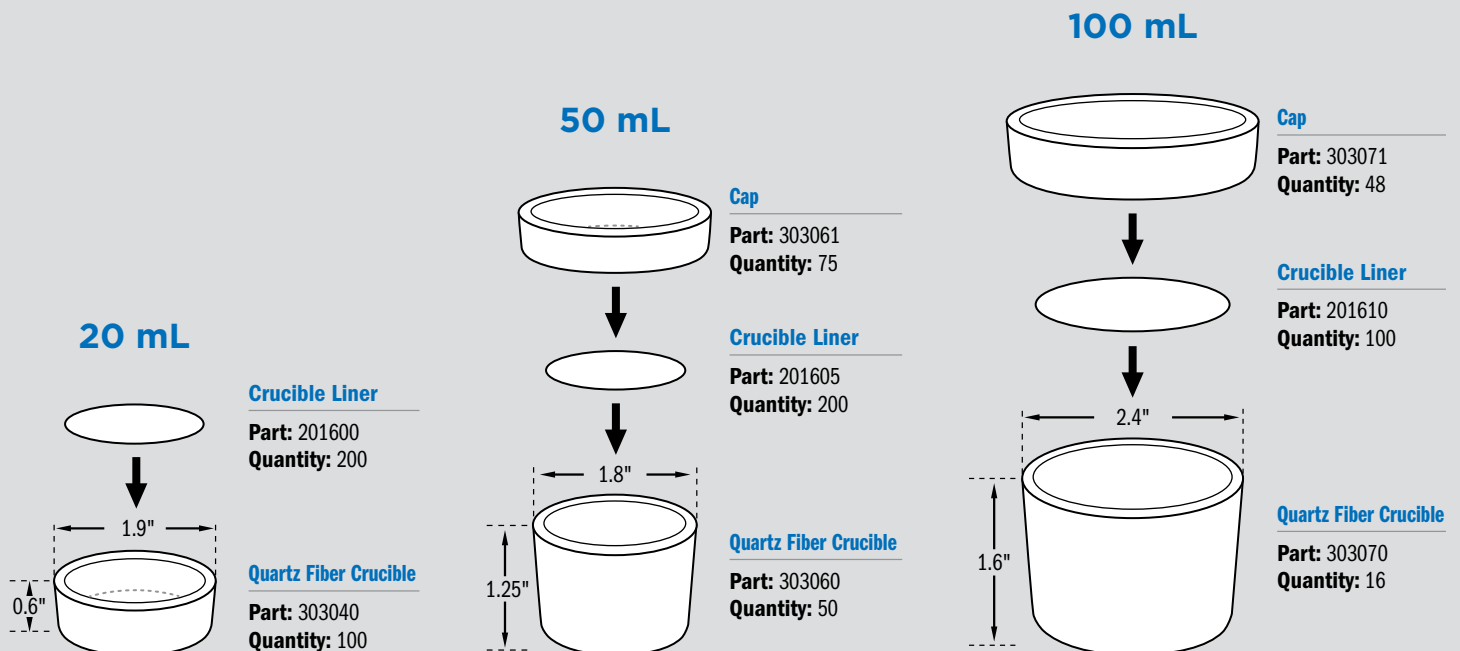
- Increases rate of sample oxidation
- Withstands temperatures up to 1,000 °C
- Safe and unbreakable
- Does not require desiccation
- Available in 20, 50 or 100 mL sizes
- Quartz fiber crucible caps available for our 50 or 100 mL crucibles.
  - Ideal for low ash samples and samples with high organic content
  - Contains the sample when ignition occurs
  - Reduces contamination
  - Improves accuracy on ROI and LOI determinations

## Self-Sealing Quartz Crucibles

For oxygen-free ashing, self-sealing quartz crucibles are available. Ideal for applications such as carbon black determination in polyethylene and polypropylene.



## Quartz Fiber Crucibles





We Simplify Science

cem.com



Over 50,000 systems sold worldwide



CEM has been an ISO-certified facility since 1994



All systems serviced & supported by experts with an average of 15 years of experience



CEM invests 11% of annual revenue into R&D, the result... 11 R&D 100 awards



IQ/OQ/PQ Validation by certified CEM Technicians

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**United States (Headquarters)**

800-726-3331  
704-821-7015  
Fax: 704-821-7894  
info@cem.com

**France**

33 (01) 69 35 57 80  
Fax: 33 (01) 60 19 64 91  
info.fr@cem.com

**Germany, Austria, Switzerland**

(49) 2842-9644-0  
Fax: (49) 2842-9644-11  
info@cem.de

**Ireland**

+353 (0) 1 885 1752  
Fax: +353 (0) 1 885 1601  
info.ireland@cem.com

**Italy**

(39) 35-896224  
Fax: (39) 35-891661  
info.srl@cem.com

**Japan**

+81-3-5793-8542  
Fax: +81-3-5793-8543  
info@cemjapan.co.jp

**United Kingdom**

(44) 1280-822873  
Fax: (44) 1280-822873  
info.uk@cem.com