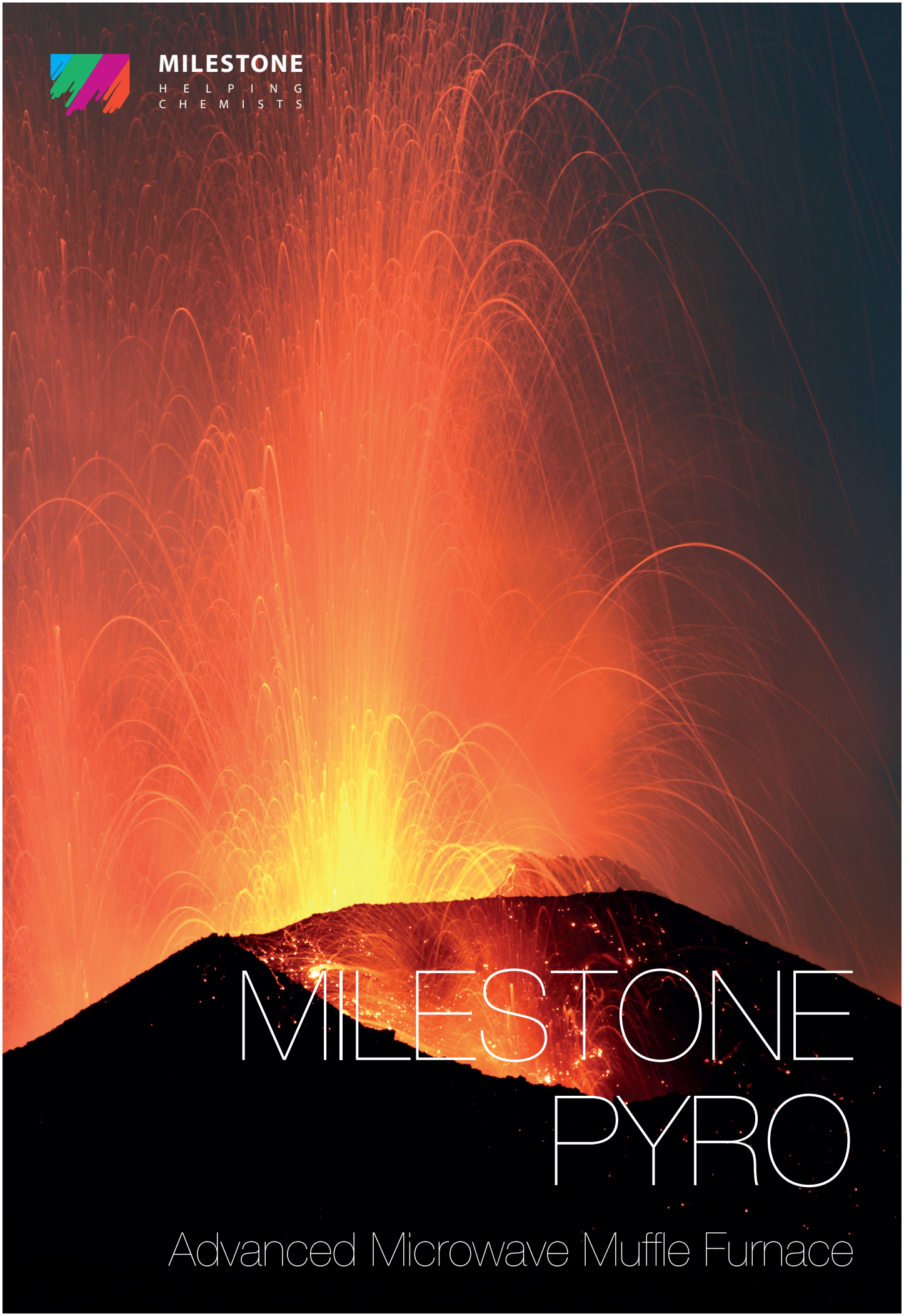

MILESTONE
HELPING CHEMISTS
MILESTONE
PYRO
Advanced Microwave Muffle Furnace


PYRO
www.milestonesrl.com

MILESTONE

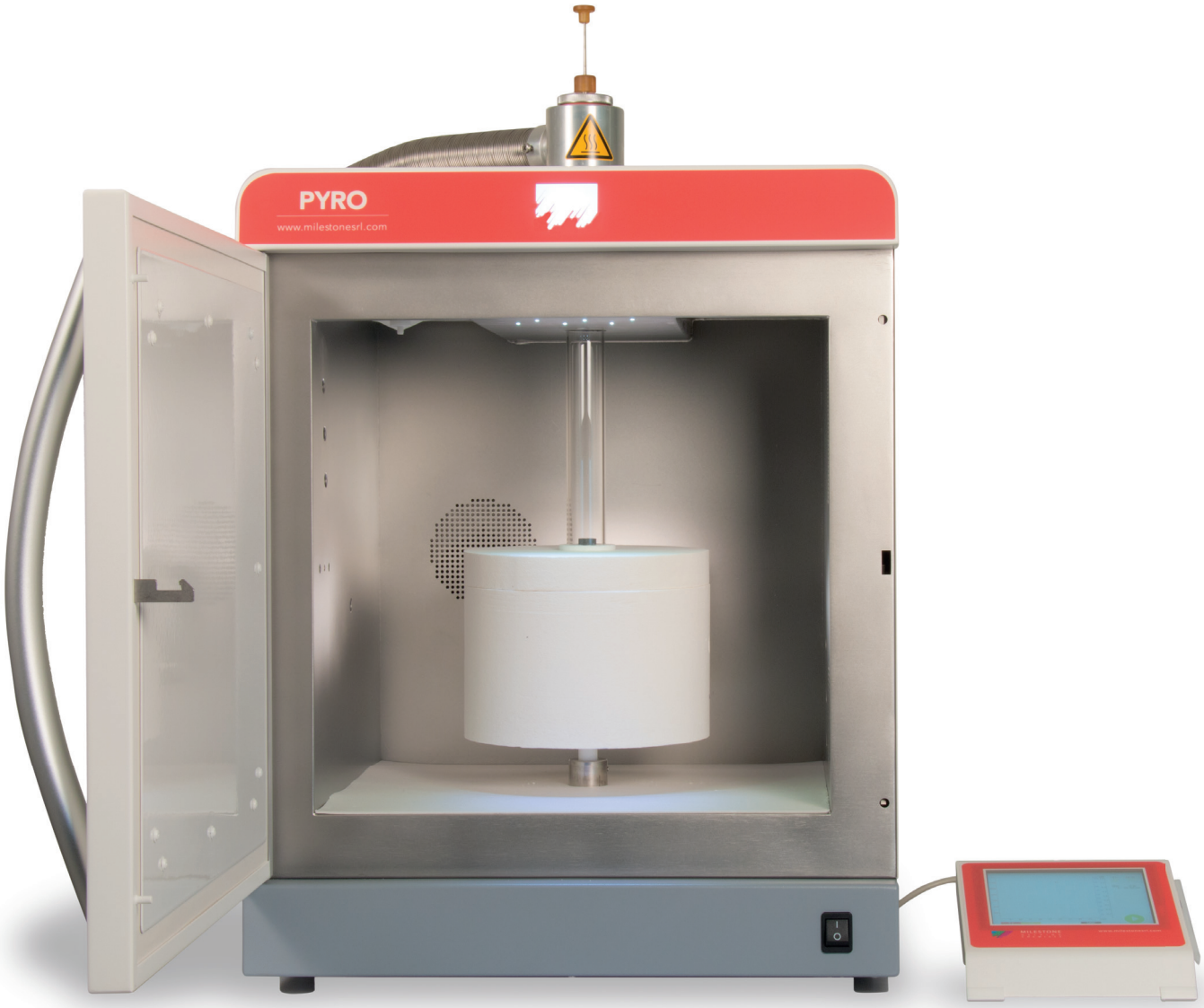
HELPING CHEMISTS – Milestone has been active since 1988 in the field of microwave sample preparation. With over 20000 instruments installed worldwide, we are the acknowledged industry leader in microwave technology. Milestone vision is to help chemists by providing the most technologically advanced instrumentation for research and quality control. Our products offer a wide range of applications, such as microwave acid digestion, solvent extraction, synthesis and ashing. Furthermore we create products for acid purification and direct mercury determination in solid, liquid and gas samples. We offer our customers the highest level of application support, building up over the years a relationship based on trust and commitment.

PYRO

Advanced Microwave Muffle Furnace

The new Milestone PYRO is an advanced microwave muffle furnace, suitable for several applications such as ashing, sulfated ashing, loss on ignition (LOI), residue on ignition (ROI), fusion and, more in general, all high-temperature reactions under controlled conditions. The PYRO is available in 3 different and interchangeable configurations: ultrafast heating setup, high sample throughput setup and sulfated ashing setup; it is therefore the most flexible and adaptable microwave muffle furnace available in the market.

- Fast heating – 8 minutes only from room temperature to 1.000°C!
- Fast ashing – Minutes instead of hours!
- High sample throughput – up to 24 samples simultaneously!
- 3 different interchangeable setup to choose from
- No exposure to heat and fumes
- Rugged and durable construction – standard 1 year warranty!
- All crucible types can be used – metal, porcelain, quartz fiber
- Unique Milestone UltraFAST quartz fiber crucibles – instant heating and cooling
- Even temperature distribution across the muffle cavity
- On-the-fly microwave programming suitable for FDA CFR 21-Part 11
- ASTM, USP, SEMI and ISO compliance



Milestone PYRO with Ultrafast Heating Setup

Dry ashing is based on the decomposition of organic material by the action of oxygen at elevated temperatures. The determination of the ash content, whether for process control or as a preparation method for other analytical techniques, is an important test performed daily in thousands of laboratories worldwide.

While ashing is a relatively simple process, conventional muffle furnaces are often inefficient, leading to tedious and time-consuming procedures. The advent of microwave technology for dry ashing applications has represented a breakthrough in the process and quality control of samples like polymers, petroleum, food and feeds, pulp paper and pharmaceuticals.

MICROWAVE PLATFORM

LARGEST MICROWAVE CAVITY – Equipped with a full stainless steel door, the new Milestone PYRO microwave cavity has a volume in excess of 70 liters, thus allowing the use of a large muffle which in turn enhances the sample throughput. Additionally, a large cavity ensures that the outer temperature of the PYRO remains very low, even when the inner temperature of the furnace is in excess of 1.000°C.

HIGHEST POWER – The PYRO is equipped with two 950 Watt magnetrons for a total of 1900 Watt making it the most powerful microwave muffle furnace system available in the market. The system additionally employs a rotating diffuser that evenly distributes the microwaves throughout the cavity, assuring a uniform temperature is achieved inside the furnace.

TEMPERATURE CONTROL – The new Milestone PYRO is equipped with the most advanced yet easy to use temperature sensors for complete control of the ashing conditions. This NIST-traceable sensors allow rapid verification and calibration of the furnace temperature for ISO and GLP procedures.

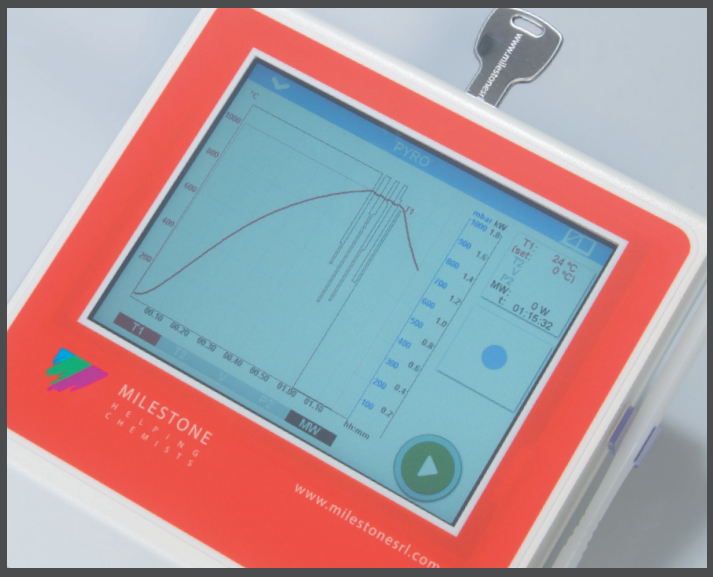
METHODS COMPLIANCE – The PYRO meets or exceeds the equipment requirements for electrically heated furnaces in the following methods: ASTM, USP ROI 281 and LOI 733, AOAC, FDA, ISO and DIN. It also meets or exceeds the requirements for applications listing a microwave heated furnace in the following methods: ASTM D5630-94 and ASTM D1506-94b.

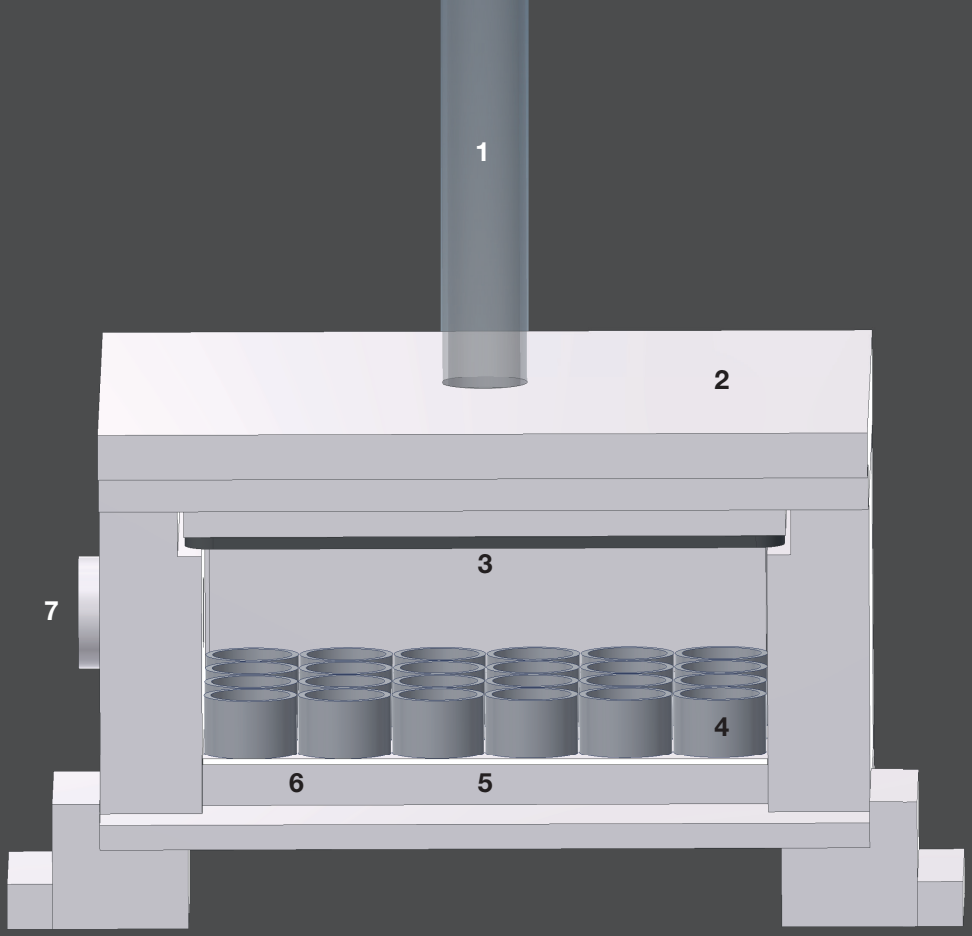
HIGH SAMPLE THROUGHPUT

The PYRO with High-Throughput Setup accommodates up to 24 Milestone quartz fiber crucibles. A unique, rugged, solid, microwave–transparent, ceramic muffle allows microwave radiation to pass through and rapidly raise the temperature of a silicon carbide plate. Sample crucibles are placed on a large clean quartz plate and an airflow is induced by a built-in exhaust system. A porous ceramic honeycomb frit built into the wall of the muffle furnace allows a constant stream of air to pass over the sample crucibles. The combination of microwave “superheating” and induced airflow results in a dramatic reduction of the ashing time. Furthermore, a large quartz tube located above the muffle conveys gases and vapors generated by the ashing process to the exhaust pipe.

A very accurate and precise thermocouple monitors and controls the temperature inside the furnace. The sensor signal serves as a feedback control mechanism to regulate microwave power output and to maintain the desired temperature profile.

Any type of crucible (metal, porcelain, quartz, etc.) can be used. The special microwave-transparent ceramic muffle furnace is an outstanding insulator, minimizing heat loss and transfer to the surrounding area. The ambient temperature of a laboratory will be unaffected, even when the unit is running at its highest temperatures. The combustion of samples containing organic matter often generates noxious odors. The built-in exhaust system of the PYRO removes fumes from the interior of the furnace and directs them through an exhaust hose to a fume hood or other outlet. Unpleasant odors from the ashing process are eliminated from the lab environment.

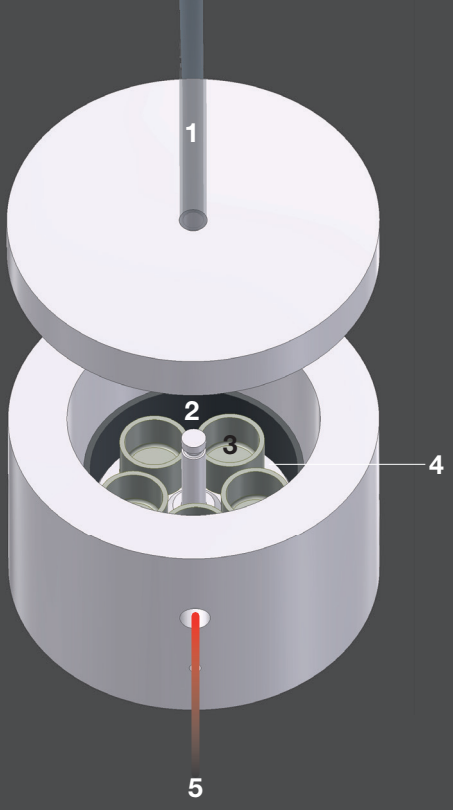


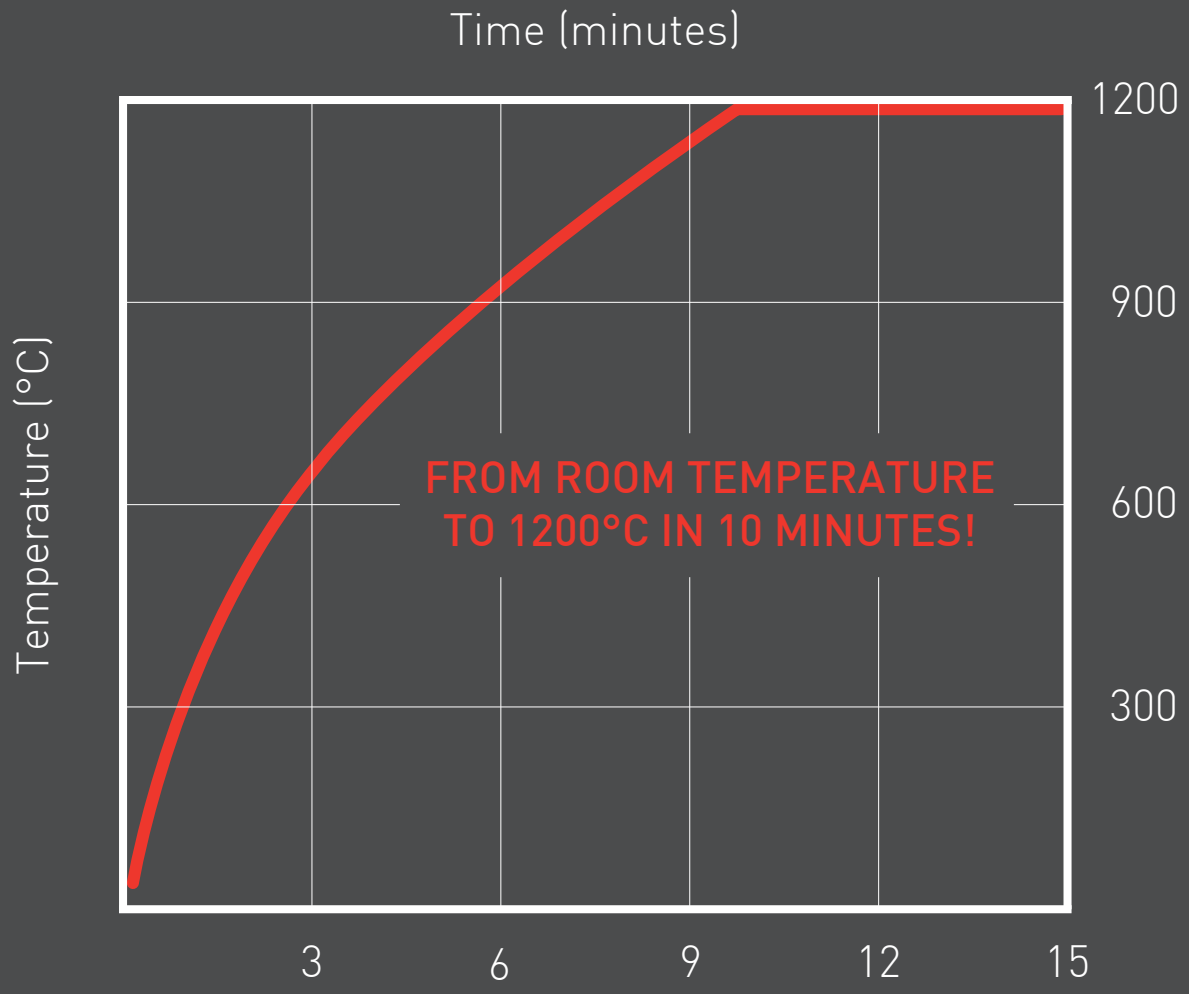


1 - Exhaust quatrz tube
2 - Ceramic muffle
3 - Silicon carbide heating element
4 - Crucibles
5 - Temperature sensor (not shown)
6 - Quartz plate
7 - Ceramic honeycomb frit

Left: PYRO control terminal.
Right: Detailed view of the muffle furnace with multiple crucibles.
Above: High sample throughput setup schematics.

1 - Exhaust quartz tube
2 - Circular silicon carbide heating element
3 - Crucibles
4 - Ceramic tray
5 - Contact-less infrared sensor





Left: Ultrafast setup schematics.
Right: Detailed view of the muffle and the circular heating element.

ULTRAFAST HEATING

As the name implies, the PYRO with Ultrafast Setup has an extremely fast heating rate. A typical ashing temperature of 800°C can be reached in just 5 minutes, starting from room temperature! This eliminates the need of running the system overnight, and avoids the lengthy heat up time associated with electrical resistance furnaces, dramatically lowering the power consumption and cost.

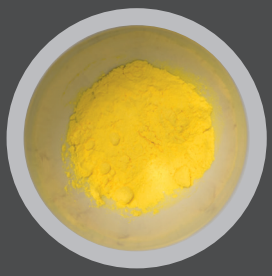
A circular heating element assures a perfect temperature uniformity throughout the cavity, largely exceeding requirements of ASTM, USP, SEMI and ISO standard methods. Temperature is monitored and controlled via a contact-less infrared sensor. Up to 5 crucibles are located on a ceramic tray, which can be easily removed from the muffle at the completion of the microwave run.

The incredibly fast heating rate of this PYRO setup, combined with the properties of the Milestone UltraFAST crucibles, makes this configuration the best choice for all high-temperature applications requiring no heating/cooling inertia.

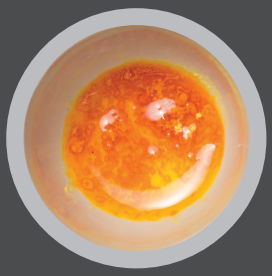
SULFATED ASHING

Ashing of pharmaceutical, polymers, and food samples often involves the use of sulfuric acid. Hot sulfuric acid vapors are hazardous to analysts and corrosive to equipment. Additionally, sulfate ashing methods are labor-intensive and time-consuming, requiring manual fuming of the acid and 8-12 hours to be completed. To overcome these issues, Milestone has developed the Sulfated Ashing Setup.

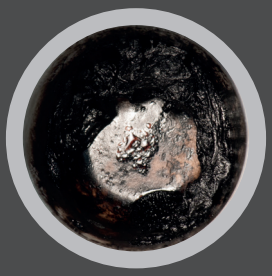
This PYRO configuration enables the analysts to add sulfuric acid to the samples and directly place crucibles into the microwave muffle furnace, without a preliminary charring step. Tedious handling of samples and operator exposure to acid fumes are totally eliminated. The system is designed for complete operator safety, and performs the complete sulfate ashing procedure in just 1 hour. Sulfuric acid fumes released from crucibles are continuously exhausted passing through a quartz tube and an air-cooled quartz collection vessel outside the unit. The fumes are finally contained and neutralized in a dedicated acid scrubber module.



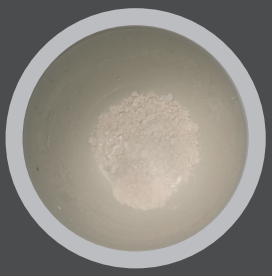
Sample



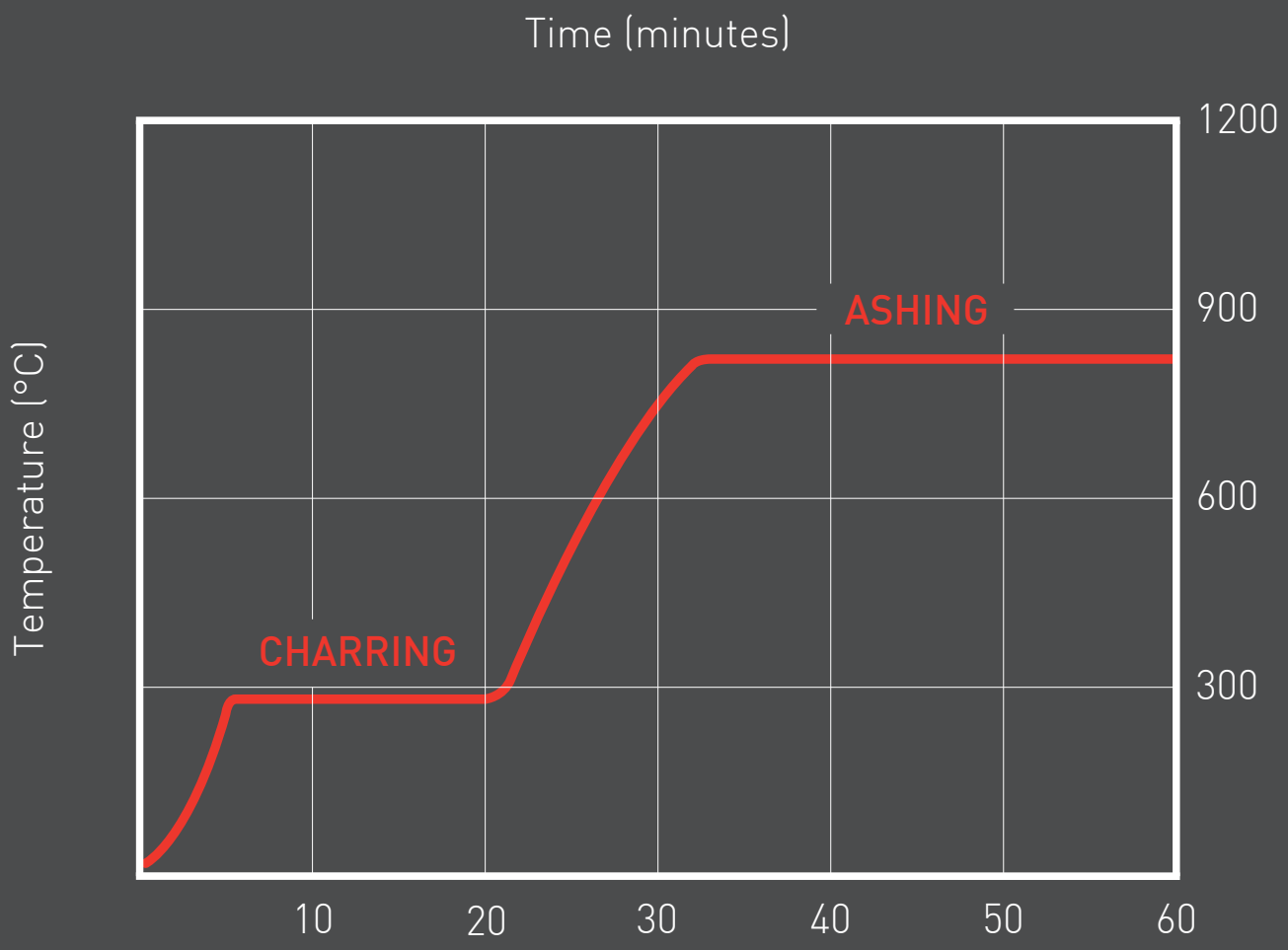
Sample with sulfuric acid



Charring step



At the completion of the ashing process



Left: Pharmaceutical samples.
Right: Detailed view of the muffle furnace with quartz tube.
Above: Typical sulfated ashing temperature profile.

Right: Milestone UltraFAST crucibles.
Above: PYRO control terminal with icon-based operating software.

USER INTERFACE

The PYRO is controlled via a compact terminal with an easy-to-read, bright, full-colour, touchscreen display. The terminal is provided with multiple USB and Ethernet ports for interfacing the instrument to external devices and to the local laboratory network. The terminal runs a completely new user-friendly, icon-driven, multi-language software to provide easy control of the microwave run. Simply recall a previously stored method or create a new one, press 'START' and the system will automatically follow the user defined temperature utilizing a sophisticated PID algorithm.

Several applications, including all ASTM, USP, SEMI and ISO methods, are preloaded in the PYRO terminal. There is no need to input the number of crucibles or sample weights, as the software will automatically regulate the microwave power according to the temperature profile desired. This assures a consistent quality of the results and simplifies the use of the instrument.

ULTRAFAST CRUCIBLES

The UltraFAST crucibles are made of an innovative material that, although chemically and thermally resistant, allows the samples to be surrounded by a constant airflow which, in turn, accelerates the ashing process. The ashing time is therefore reduced. Furthermore, the cooling time of the UltraFAST crucibles is so short that there is no need to use a dessicator prior samples weighing. Just 30 seconds are enough for the UltraFAST crucible to go from 1000°C to room temperature. A replaceable pad located at their bottom extends the lifetime of the UltraFAST crucibles.

The UltraFAST crucibles are suitable for the ashing of any solid sample, such as polymers, pharmaceuticals, food and feed, cokes, coals etc.

- Shorter ashing time
- Fast heating and cooling
- High chemical and thermal stability
- Constant weight
- Long lifetime

OVER 90% TIME SAVING

14
15

Sample	Temperature (°C)	Time (minutes)
Pet Food	575	20
Milk Powder	550	20
Wheat Flour	900	50
Polypropylene	650	20
PVC	900	15
Coal	750	20
Heavy Oil	550	45
Rubber Tyre	550	45
Lactose	600	60
Antibiotics	850	60

TECHNICAL SPECIFICATIONS

Milestone PYRO Advanced Microwave Muffle Furnace.

The complete system includes:

- Microwave cavity made of 18/8 stainless steel; largest microwave cavity: 43 x 40 x 41 (H) cm (70,5 litres).
- Inlet/Outlet ports: upper flange 36 mm ID, lower flange 19 mm ID, plus additional ports on the side walls.
- Chassis protected against corrosive media with polymer coating.
- Door completely made of 18/8 stainless steel with heat protection; multiple independent safety interlocks to prevent microwave emission in case of improper closure or misalignment.
- Built-in exhaust system, located above the cavity and separated from electronics to prevent corrosion, with software-controlled variable speed; “Venturi effect”-based blower for enhanced airflow through the microwave cavity.
- Dual magnetron system with rotating diffuser for homogeneous microwave distribution in the cavity; two 950 Watt rated magnetrons, for a total of 1900 Watt; exclusive magnetron protection from reflected microwave power; continuous and PID-controlled microwave emission at all power levels.
- Safety standards: EN61010-1:2001; EN61010-2-010:2003; UL61010-1:2004; CAN/CSA-C22.2 No 61010-1:2004; CAN/CSA-C22.2 No 61010-2-010:2004; IEC 61010-2-010:2003; EN61326-1:2006.
- Control terminal: 660 touch screen; 6,5” TFT display; 640x480 VGA resolution with 64k colors; 5 USB ports, 1 RS-232 port, 1 LAN port, 2 video ports; 480 touch screen; 4,3” TFT display; 480x272 VGA resolution with 16M colors.
- Icon-driven multi-language (Chinese, English, French, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish and Turkish) operating software allowing the user to edit, save and run a virtually unlimited number of methods.
- Weight: ca. 85 kg; dimensions: 54 x 64 x 69 (H) cm; power supply: 230-240V/50 or 60Hz, 3,5 kWatt.

HIGH-THROUGHPUT SETUP

Rectangular muffle furnace, volume 3,8 litres (250 mm x 180 mm x 85 mm H); heating plate; thermocouple temperature sensor; ceramic thermowell; thermocouple fittings and ceramic honeycomb frit element.

ULTRAFAST HEATING SETUP

Circular muffle furnace, volume 1,5 litres (122 mm D x 90 mm H); 5-place crucibles holder; metal tweezers; ceramic plate; heating ring up to 1200°C; entring adapter; infrared temperature control up to 1200°C and laser-based alignment module.

SULFATED ASHING SETUP

Rectangular muffle furnace, volume 3,8 litres (250 mm x 180 mm x 85 mm H); heating plate, thermocouple temperature sensor; ceramic thermowell; thermocouple fittings; ceramic frit element; gas condensation module and acid scrubber module.

CRUCIBLES

UltraFAST ashing crucibles volume 30 mL (set of 100 pieces); dimensions: 26 mm (H) x 41 mm (OD)/ 35 mm (ID).

MILESTONE

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