

MICROWAVE DIGESTION SYSTEM



Brand : MILESTONE
Model : ETHOS UP
Location : K639 Room, 6th Floor, Chaloeprakiet Building, Phyathai Campus
Custodian : PRADUP MESAWAT

MILESTONE ETHOS UP

- Specifically designed for closed vessel acid digestion, user interface, reaction sensors and pressure vessels.
- It offers a complete first-class solution also for microwave solvent extraction, organic and inorganic synthesis, protein hydrolysis, and vacuum evaporation.

PRODUCTIVITY MATTERS

- Cavity has a volume in excess of 70 litres

Why is this important and what are the main implications of this design?

- Firstly, digestion rotors with more sample places can be accommodated thus improving productivity and sample preparation throughput.
- Secondly, the microwave unit is inherently much safer because a larger cavity better contains gases escaping from vessels, should there be a sudden overpressurisation.

POWER MATTERS TOO (Highest power)

- The two 950 Watt magnetrons for a total of 1900 Watt making it the most powerful microwave digestion system available for sample preparation.
- Direct temperature and pressure control are used in a single reference vessel. In all vessels, contact-less temperature is used where the actual temperature.
- In combination with our 'vent-and-reseal' vessel technology, the sensors ensure complete and safe digestions without any loss of volatile compounds.

PRESSURE-RESPONSIVE DOOR

- The door slightly opens for rapid and safe pressure release and the microwave power is instantaneously cut off.
- The door is pulled back, resealing the cavity. For additional safety, an automatic door locking system.
- At the end of the run, the door remains locked until the solutions have cooled down to a user preset temperature.
- This prevents misuse of the instrument and in turn exposure of the chemist to high pressure vessels.

SAFEVIEW

- High definition digital camera interfaced with the instrument terminal.
- The chemist to monitor the progress of the digestion whilst fully protected by the all-stainless steel door of the instrument.
- A video of the entire run is shown in real time along with the digestion figures.



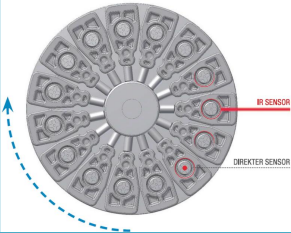
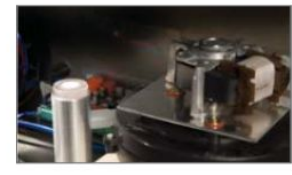

USER INTERFACE

- Controlled via a compact terminal with an easy-to-read, bright, full-colour, touch screen display.
- Provided with multiple USB and Ethernet ports for interfacing the instrument to external devices and to the local laboratory network.

A PIECE OF CAKE

- The SK-15 is a high-pressure rotor featuring up to 15 TFM vessels with a volume of 100 ml and suitable for all applications.
- The MAXI-44 is a high-throughput rotor featuring up to 44 TFM vessels with a volume of 100 ml and suitable for a wide range of samples including environmental and all organics.
- Both rotors are fully compliant with commonly used standard methods, such as the US EPA 3015, 3051, and 3052. The SK-15 and the MAXI-44 feature an enhanced 'vent-and-reseal'
- Highest temperature and pressure, highest safety standards, ease of use, and very fast cooling (180°C to 40°C in 10 minutes).
- Large selection of high purity quartz and TFM inserts is available for the SK-15 and the MAXI-44 rotors for smaller sample amounts or to minimise the dilution factor of the analytical solution.

Sensor & Control Modules

<p>Direct temperature control</p> 	<ul style="list-style-type: none">➤ Thermocouple which is much more rugged than fiber optic designs.➤ Temperature in the vessel is displayed in real time via EasyCONTROL software.
<p>Direct pressure control</p> 	<ul style="list-style-type: none">➤ Direct pressure monitoring and control in a reference vessel.➤ Method development and challenging “unknown” samples to keep pressure levels within the vessel’s specifications.
<p>Indirect (IR) temperature control</p> 	<ul style="list-style-type: none">➤ IR sensor that measures the external temperature of the vessels.➤ Temperature monitoring in all vessels in real time is displayed via EasyCONTROL software.
<p>Indirect pressure sensor</p> 	<ul style="list-style-type: none">➤ The P2 sensor detects venting in all vessels simultaneously.➤ Automatically reduces microwave power to prevent overpressure situations.➤ Works in tandem with the “vent-and-reseal” vessels to provide unmatched protection from exothermic reactions.
<p>Magnetic stirrer</p> 	<ul style="list-style-type: none">➤ Variable speed magnetic stirrer with large turning magnet in base of chassis for continuous stirring, and homogenous mixing in all vessels.

Acid solutions

The possibility of use different types of acid solutions is strictly related to the material of the vessels and accessories.

- **TFM vessels and TFM inserts:** HNO_3 , HCl , HF , HBF_4 , H_2SO_4 , H_3PO_4 , HClO_4 , H_2O_2
- **Glass and quartz inserts:** HNO_3 , HCl , HBF_4 , H_2SO_4 , H_3PO_4 , HClO_4 , H_2O_2

Rotor SK-15



MAXI-44



Technical Specifications

	SK-15	MAXI-44
Number of Samples	15	44
Max. Sample Weight (g)	Up to 1 g (of organic dried matter)	
Vessel Volume (mL)	100	100
Max. Temp. & Pressure		
Max. Press. (bar)	100	35
Max. Temp. (°C)	300	300
Vessel Material	TFM	TEM
Venting Technology	Vent-and-reseal	Self-regulating
Standard Methods	EPA 3015, 3051 and 3052	EPA 3015, 3051 and 3052

Applications

Applications	SK-15	MAXI-44
Environmental	✓	✓
Food/Feed	✓	✓
Agriculture	✓	✓
Beverages	✓	✓
Chemical	✓	✓
Cosmetics	✓	✓
Metals/Alloys	✓	
Plastic Polymers	✓	
Catalysts Pigments	✓	
Clinical	✓	✓
Pharmaceutical	✓	✓
Geochemistry/Mining	✓	
Ceramics Refractory	✓	
Petrochemical/Energy	✓	

<https://www.youtube.com/watch?v=Fh9ab97IWt8>

Vessel Inserts (Compatibility: SK rotor only)



35 mL and 50 mL Inserts

Designed for ultratrace analysis: manufactured from quartz or extra high purity TFM for lowest possible blank contribution. Also used to digest difficult organics.

Max. temp. 300°C

Typical acid vol. 5 mL

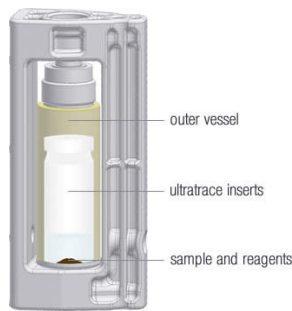


Microsampling Inserts

For very small sample sizes: Quartz or TFM microsampling inserts (3 mL or 6 mL). Increases rotor capacity 3x (SK-15 increases to 45 positions).

Max. temp. 300°C

Typical acid vol. < 2-4 mL



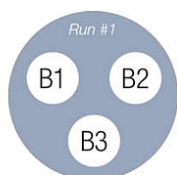
Vessel-inside-vessel schematics



Sample amount Minimum volume :	SK-15
without inserts	10
with QS-50 quartz inserts	5
with 3-positions rack inserts	1
Sample amount Maximum volume :	
without inserts	50
with QS-50 quartz inserts	15
with 3-positions rack inserts	3

No Cross Contamination

Three blanks were analyzed in run #1. The same blank was prepared along with two Animal Tissue samples, showing no cross contamination.



Vial	Cr (ug/L)	Cu (ug/L)	Mn (ug/L)	Ni (ug/L)	Pb (ug/L)	Zn (ug/L)
Blank 1	<2	<2	<2	<2	<2	<10
Blank 2	<2	<2	<2	<2	<2	<10
Blank 3	<2	<2	<2	<2	<2	<10

Blank 2 mL HNO₃. Analysis by ICP-AES



Vial	Cr (ug/L)	Cu (ug/L)	Mn (ug/L)	Ni (ug/L)	Pb (ug/L)	Zn (ug/L)
Sample 1	54,8	40,0	14,4	31,6	11,0	148,5
Sample 2	56,1	40,0	14,3	32,6	10,8	148,2
Blank 3	<2	<2	<2	<2	<2	<10

Sample weight 100 mg. Blank 2 mL HNO₃. Analysis by ICP-AES

Vessel-inside-vessel technology

- To control these exothermal reactions by providing a heat sink for the energy liberated during oxidization.
- The water draws the heat away from the reaction mixture, slowing down the reaction kinetics and preventing a runaway reaction.
- Different materials (Quartz or TFM) and with different sizes and shapes, to accomplish all application requirements.
- The quartz inserts are especially effective for difficult organics such as polymers and oils, since these samples can sometimes stick to Teflon walls and damage them during heating.
- Quartz inserts also enable higher weights of difficult organics (up to 1g) to be digested without causing the vessel to vent.
- The inserts sit in a water/H₂O₂ mixture, which produces O₂ during heating, which in turn converts CO₂ and NO_x produced during digestion to HNO₃, greatly reducing pressure build up in the vessel.
- An additional benefit is that as little as 1 mL HNO₃ is used, which reduces reagent blank and allows analysis at lower dilution levels, improving detection limits.

Advantages

- Less acid volume
- Higher sample amount
- Lower dilution factor
- Increased method detection limit
- Less surface contamination
- Lower analytical blank