

MILESTONE CLEAN CHEMISTRY LINE

A Breakthrough in Reduction and Control
of the Analytical Blank

DUOPUR
TRACECLEAN
VESSEL INSERTS



MILESTONE



MILESTONE CLEAN CHEMISTRY LINE

AN INNOVATIVE AND COMPLETE LINE OF SYSTEMS AND ACCESSORIES FOR CONTROL AND REDUCTION OF THE ANALYTICAL BLANK IN ICP-MS, ICP-AES AND GFAA


Analytical chemists continue to advance the performance of trace and ultra-trace elemental analysis. Multi-element analyses of trace metals at ppb or ppt levels are routinely performed by ICP-AES and ICP-MS. There is a growing awareness that sample handling and preparation must evolve to meet the same exacting standards as these instrumental techniques. There are a number of external factors that can critically impact the quality of the data. Factors that are well within the control of the modern chemist include:

- 1 Reagent purity
- 2 The sample preparation method
- 3 The materials that come in contact with the sample during preparation
- 4 The environment in which the samples are prepared
- 5 Sample to sample cross contamination

Each of these factors, in one way or another, is related to the analytical blank: its chemical composition, its measurement, and its effective control.

The inability to control the analytical blank is often the primary source of error and the limiting factor for trace analysis

TO ADDRESS THESE ISSUES, MILESTONE HAS DEVELOPED THE "CLEAN CHEMISTRY" LINE OF PRODUCTS.



PROBLEMS FOR BLANK CONTROL	STATUS	MILESTONE SYSTEM
1 Acid purification	✓ Solved	DUOPUR
2 Ultratrace cleaning of vessels	✓ Solved	TRACECLEAN
3 Contamination from vessel surface	✓ Solved	Quartz/TFM inserts
4 Sample preparation method	✓ Solved	ETHOS 1 START D
5 Sample evaporation without element losses	✓ Solved	MMR rotors

MILESTONE ULTRA-TRACE DIGESTION ACCESSORIES

HOW TO REDUCE CONTAMINATION FROM THE SURFACE OF SAMPLE VESSELS

“Over the past two decades, materials identified as being non-contaminating (PTFE, quartz) have become the top choices for reaction vessels... for ultra trace analysis”

US EPA SW-846, Chapter 3, Update IVB



Digestion vessel material is a key consideration for clean chemistry sample preparation.

Milestone engineers all their PTFE vessels from TFM, the most dense and thermally resistant form of PTFE available for microwave digestion.

TFM is chemically inert to most dissolution reagents and provides a non-contaminating environment for trace metals analysis.

Ultra-pure quartz is the other material of choice for insert for trace analysis.

TFM and Quartz inserts can be used within standard TFM vessels for smaller samples or to minimize the dilution factor.



MICROSAMPLING INSERTS

- 3 x 6 ml TFM or Quartz inserts for microsampling applications
- Process up to 36 samples per run in a 12 position rotor
- Reach up to 300°C and 100 bar within sealed vessel
- Ideal for very small samples
- Fits within 100 ml vessels, uses standard temperature monitoring

QUARTZ INSERTS

- 50 mL high purity quartz inserts
- Ideal for ultra-trace analysis
- Convex surface prevents loss of analytes from condensation
- Minimize electrostatic effects
- Fits within standard 100 ml vessels, uses standard temperature monitoring

TFM INSERTS

- 30 ml, extra high purity TFM
- Ideal for smaller samples
- Minimize acid volume
- Optimize dilution factor
- Fits within standard 100 mL vessels, uses standard temperature monitoring



DUOPUR

MAKE YOUR OWN ULTRAPURE ACIDS

“In the preparation of high purity reagents, there is only one significant and practical choice for the method of purification: Sub-boiling distillation...”

US EPA SW-846, Chapter 3, Update IVB



Reagents contaminations increase the background concentration of the analytes present in a sample.

Currently, many laboratories purchase expensive high purity acids for trace elemental.

There is, however, an alternative.

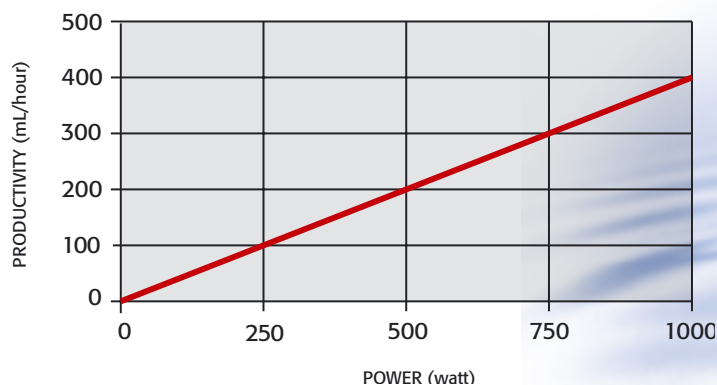
Milestone has developed the DUOPUR, a sub-boiling distillation system which allows laboratories to make their own high purity acids at dramatically reduced costs.

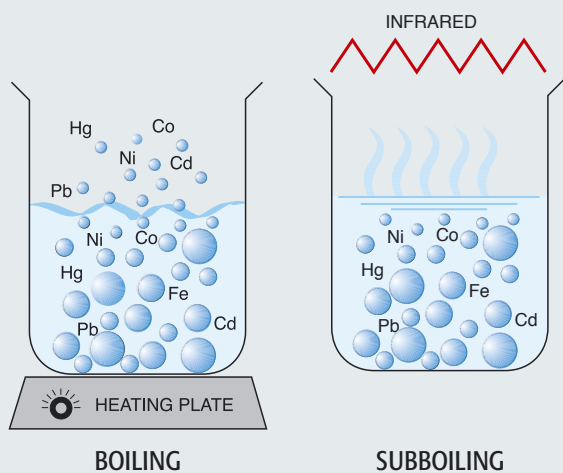
The advantages of the DUOPUR include:

- Up to 90% cost saving of ultra-pure acids by purifying low cost reagent grade acids
- High productivity, up to 3 liters in 8 hours
- Continuous supply of high purity acids
- 'On-demand' acid purification
- Re-purification of contaminated acids
- Single or double distillation upon on requirements



HNO₃ PRODUCTIVITY





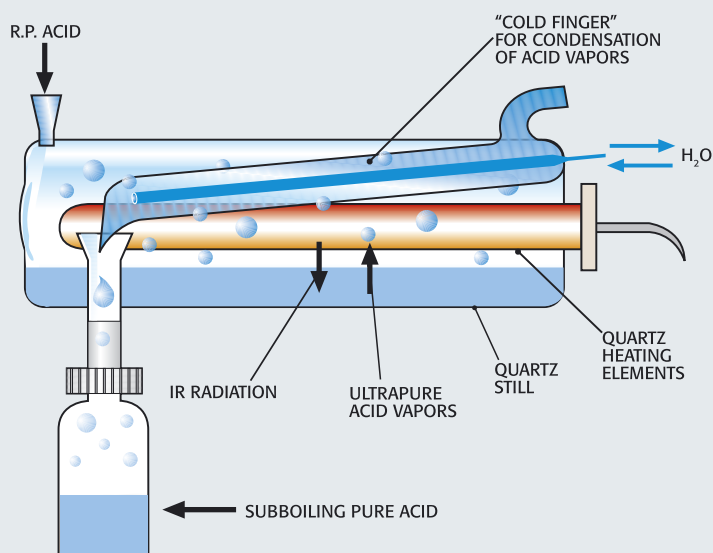
THE PRINCIPLE OF SUBBOILING

Sub-boiling distillation is recognized as the best method to obtain high purity reagents and the lowest blank values for ultra-trace analysis. Sub-boiling distillation is based upon vaporizing a liquid by radiative heating of its surface to prevent boiling.

This technique prevents the formation of spray or droplets.

In conventional distillation, violent boiling action generates aerosolized particles, resulting in contamination of the original liquid with the distillate.

Surface evaporation during sub-boiling distillation prevents this, thus yielding a higher purity distillate.



* Comparison of trace metal contamination in select high-purity nitric acids. Concentration is shown in pg/g.

Trace impurity	single-distilled	double-distilled	ref.1	ref.2
Be	<2	<1	<5	<20
Mg	<195	<42	<5	<100
Al	<557	<147	<20	<300
Ca	<900	<157	<50	<300
Ti	<59	<8.1	<20	<100
V	<51	<11	<1	<20
Cr	<118	<4.6	<10	<50
Mn	<9.7	<2.1	<1	<20
Fe	<1000	<210	<20	<300
Co	<6	<1	<1	<20
Ni	<155	<23	<10	<100
Cu	<58	<21	<2	<50
Zn	<261	<49	<2	<100
As	<3	<0.9	<10	<100
Se	<3.9	<1.2	<10	Not listed
Sr	<12	<1.2	<1	<10
Mo	<7.1	<0.4	<1	<100
Ag	<46	<1.5	<1	<10
Cd	<8.1	<1.8	<1	<20
Sn	<22	<9.1	<10	<100
Sb	<6.1	<0.5	<10	<100
Ba	<25	<3.5	<1	<20
Tl	<2.6	<0.9	<1	<10
Pb	<10	<2.5	<1	<100

Concentration expressed as the upper limit of the 99% confidence limit of the measured result (n = 4)

* On-Demand Production of High-Purity Acids in the Analytical Laboratory
By Robert C. Richter, Dirk Link, and H.M. (Skip) Kingston.
Spectroscopy, Volume 15, Number 1, Pages 38-40. January 2000

The DUOPUR consists of two high-purity quartz distillation units. Each unit contains two heating elements (which supply a maximum power of 1250 W), a water cooled condenser, reagent addition and collection bottles, and a drain.

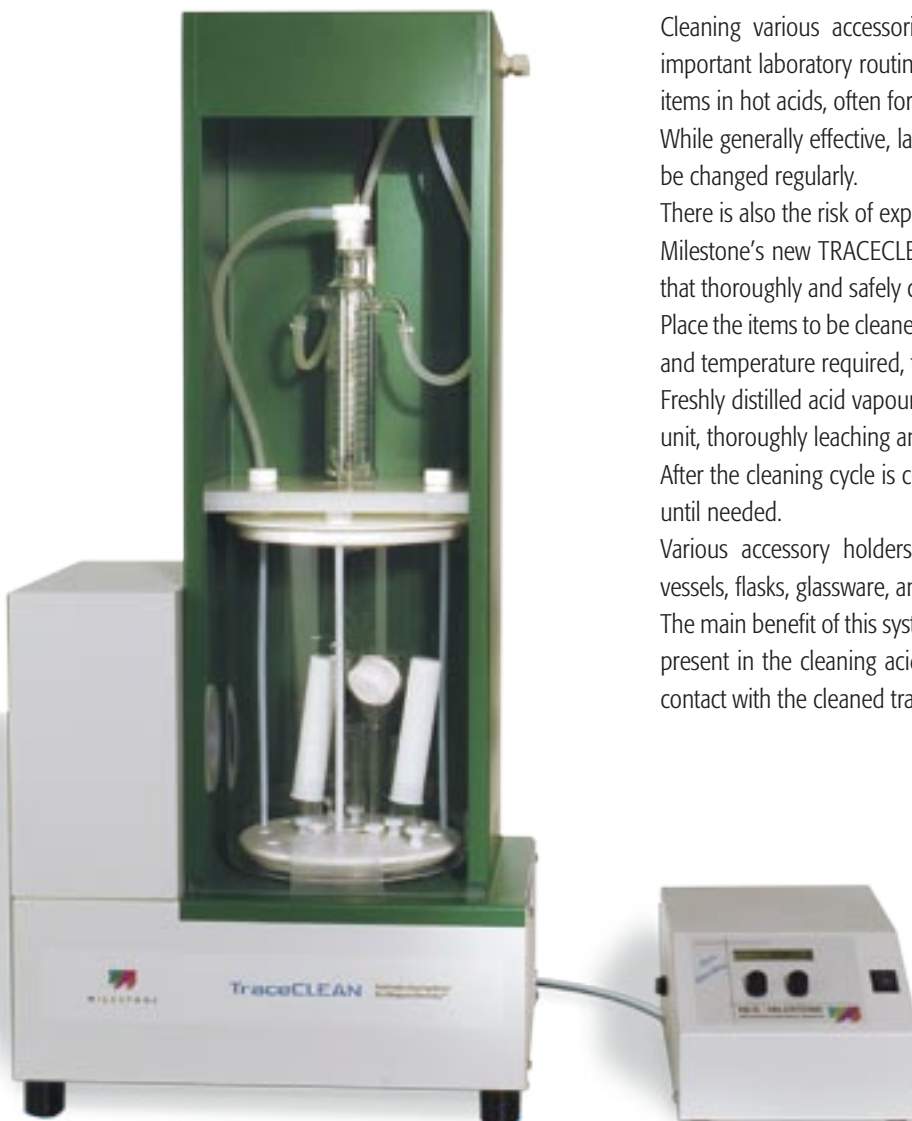
The distillation process is microprocessor controlled, allowing the user to set the distillation time and power level.

Infrared heating gently vaporizes the surface liquid, accelerating evaporation, and preventing aerosolized particles.

Vaporized liquid is collected on an inclined cold finger where it condenses and drips into the high purity PFA collection bottle.

TRACECLEAN

AUTOMATIC ACID REFLUX SYSTEM FOR ULTRA-TRACE CLEANING OF DIGESTION VESSELS AND ICP/ICP-MS ACCESSORIES



Cleaning various accessories used in trace analysis work is a critically important laboratory routine. Traditional cleaning methods require soaking items in hot acids, often for several hours.

While generally effective, large volumes of acid are consumed and need to be changed regularly.

There is also the risk of exposure to hot acids and acid vapours.

Milestone's new TRACECLEAN is an automated, closed, acid reflux system that thoroughly and safely cleans trace work accessories.

Place the items to be cleaned in the TRACECLEAN system, program the time and temperature required, then press start.

Freshly distilled acid vapours will then continuously reflux within the sealed unit, thoroughly leaching any metal contaminants from the items.

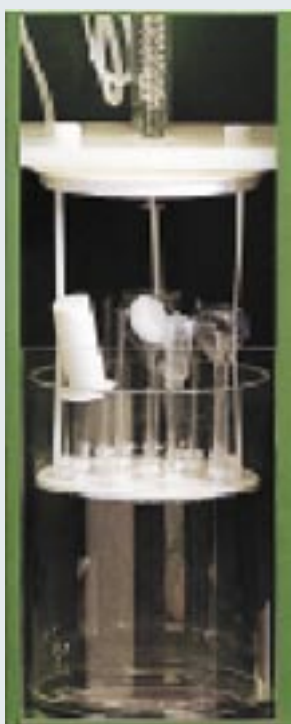
After the cleaning cycle is complete, the items are cooled, dried and stored until needed.

Various accessory holders are available for vials, microwave digestion vessels, flasks, glassware, and ICP/ICP-MS components.

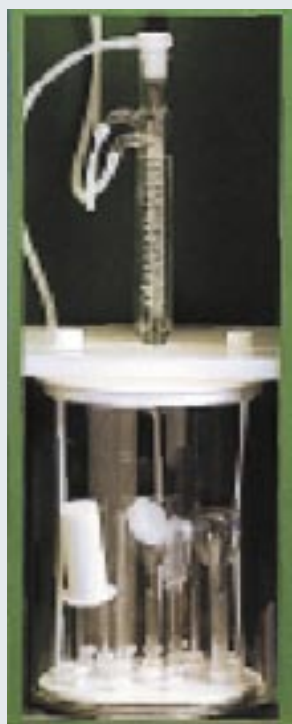
The main benefit of this system is that any trace metal contaminants that are present in the cleaning acid stay within the reservoir and do not come in contact with the cleaned trace accessories.



THE ADVANTAGES OF THE TRACECLEAN



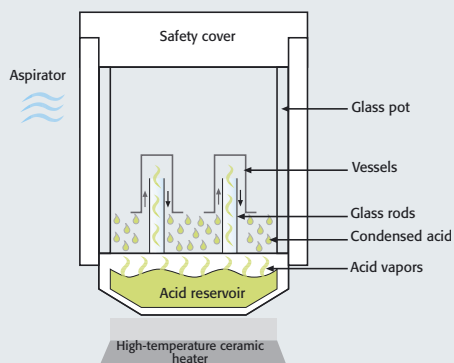
Open for loading/unloading



Sealed processing chamber for safe acid reflux cleaning

- Perfect for unattended cleaning of all TFM, PFA, glass, and quartz ultra-trace accessories, including microwave digestion vessels and ICP/ICP-MS accessories (torches, etc.).
- Only ultra-pure, acid vapours come in contact with the surface of the items to be cleaned.
- Clean components do not remain in contact with the cleaning acids after the surface contamination is removed.
- Items are dried and cooled inside the TRACECLEAN assuring no airborne contamination. No need for rinsing and drying.
- No operator exposure to acid vapours.
- Teflon racks and holders minimize handling of freshly cleaned items.
- Use preset programs or create and store your own.
- Automatic temperature control
- Built-in exhaust/cooling reduces exposure to acid vapours.
- PTFE-coated stainless steel compartment assures system durability and prevents use-to-use contamination.

*Comparison of high-temperature microwave cleaning vs. TRACECLEAN (ng/L)				
Element	TFM Microwave Vessel		Quartz Microwave Insert	
	Microwave	TRACECLEAN	Microwave	TRACECLEAN
Al	287±46	258±24	398±28	327±18
Mg	298±22	232±15	441±56	347±26
Na	≤121	≤121	1190±350	608±67
Fe	≤474	≤474	≤474	≤474
Cu	144±39	117±12	170±15	109±9
Cr	≤85	≤85	176±57	≤85
Cd	≤72	≤72	≤72	≤72
Pb	≤57	≤57	≤57	≤57
Zn	995±80	≤876	1640±1000	1005±124



Schematic of the TRACECLEAN process

* New Developments in Automated Cleaning of PTFE, Glass, and Quartz Components Used in Ultratrace Analysis - By Robert C. Richter, Spectroscopy, June 2001

TECHNICAL SPECIFICATIONS

P/N 84602



DUOPUR

System with 2 Sub-boiling Distillation Units

- Power rate: 1250 W
- Power control: microprocessor in 1% increments from 0 to 100%
- Heating elements: four with gold diffusers
- Temperature control: thermal switch to prevent over-heating in absence of acids
- Water cooling: automatic ON/OFF through solenoid valve
- Control terminal LCD Display 2 x 20 lines
- Program storage up to 50 programs
- Possibility to operate two Distillation units simultaneously with two different heating programs
- Dimensions: 55x35x60 cm (~21"x14"x24")
- Weight 22 kg (~48 lbs)
- Power supply 230V-50/60 Hz

P/N 84601

SUBPUR

System with 1 Sub-boiling Distillation Unit

P/N 87202



TRACECLEAN

Automatic Acid Reflux System

- Automatic Temperature control
- Built-in exhaust/cooling
- PTFE-coated stainless steel compartment
- Control Terminal LCD 2 x 20 lines
- Program storage up to 50 programs
- Dimensions: 48D x 50W x 108H cm (19.2x20x43.2in)
- Weight 70 kg (154 lbs)
- Power supply 230V-50/60 Hz

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