

# CHALLENGES OF ANALYZING PETROCHEMICALS AND OTHER ORGANIC SOLVENTS

Glass Expansion February 2015 Newsletter, “Optimizing your ICP Sample Introduction System for Improved Analysis of Oils and Organic Solvents.”

Visit: <http://www.geicp.com/cgi-bin/site/wrapper.pl?c1=News>

# CHALLENGES FOR ORGANIC SOLVENTS

- Volatility
- Transport efficiency
- Material compatibility
- Plasma loading
- Wear and tear
- Sample Prep

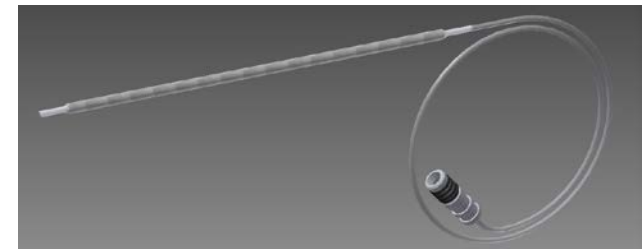
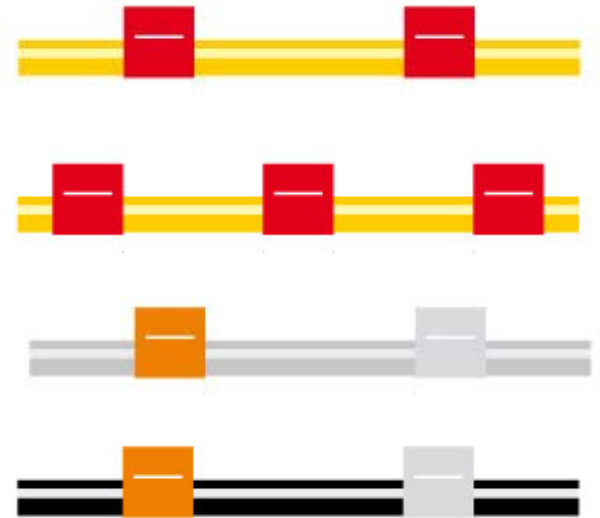
# PUMP TUBING SELECTION

- Material

- Solva for aliphatic solvents
- TygonMH for ketones
- Viton for corrosive solvents
- Natural aspirations for some (NMP)
  - GE custom autosampler probes.

- Size

- Go small for most organics
- Go really small for the volatile ones



# NEBULIZER SELECTION

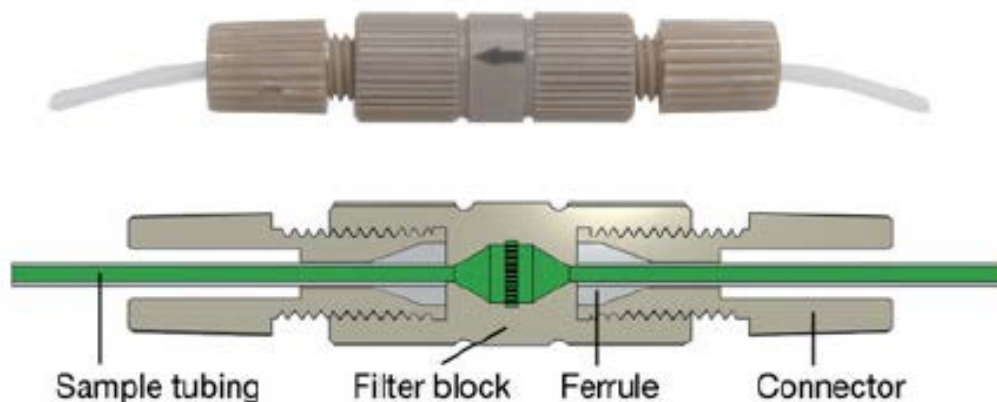
- Conikal for moderate volatility
  - 1 and 2mL/min uptake rate
  - Low RSDs
  - ICP standard
- MicroMist for high volatility
  - Standard low uptake nebulizer
    - (0.05 to 0.6mL/min)
  - Small droplet size
- Slurry for wear metals
  - Handle up to 125 $\mu$ m particulates
  - 1.5 to 2.5 mL/min optimum uptake rate



# INLINE PARTICLE FILTER

- Prevent large particles from clogging your nebulizer
- Insert between probe and nebulizer
- Re-usable PEEK filter (120  $\mu\text{m}$ )
- Easily back flush to remove build up

Glass Expansion Inline particle filter.

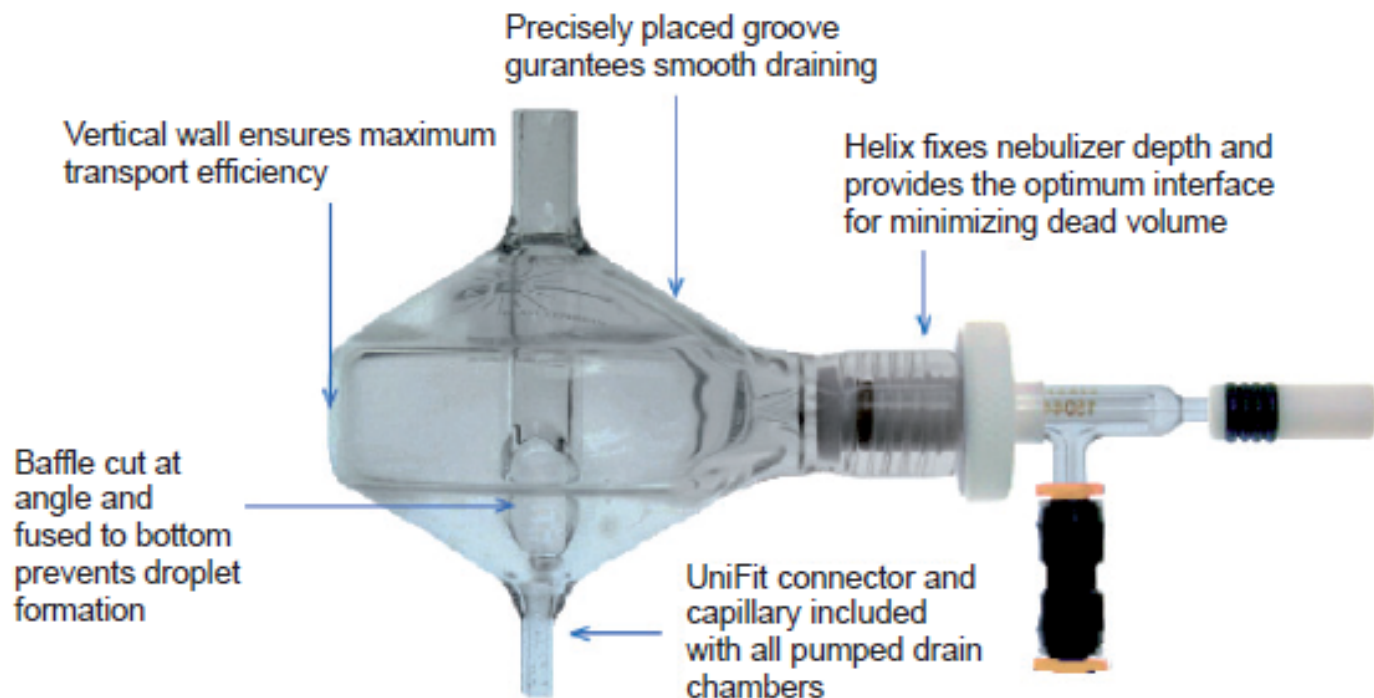


Eluo Nebulizer Cleaning Tool



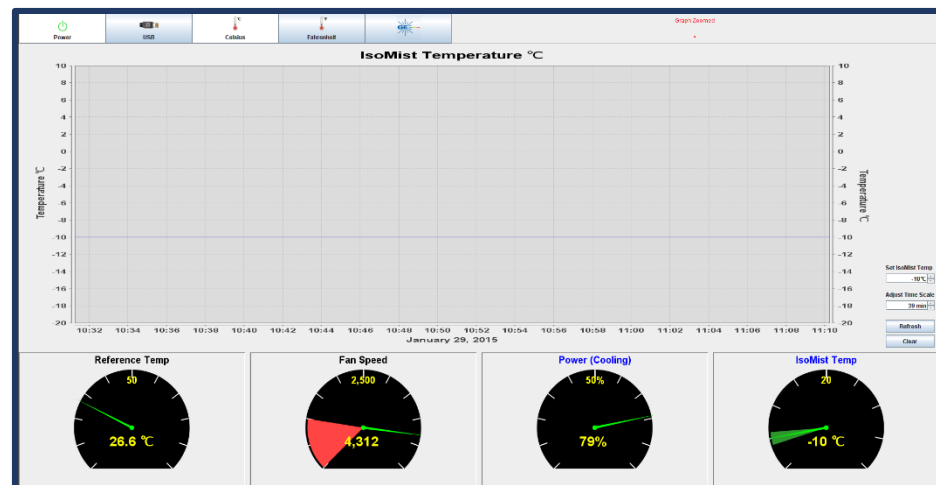
# SPRAY CHAMBER SELECTION

- Twister for most solvents
- Twinnabar for low uptake ( $\leq 0.4\text{mL}/\text{min}$ )



# ISOMIST TEMPERATURE CONTROL

- Programmable from -10 to 60°C in 1°C increments
- Maintains temperature to within 0.1°C
- Compact design (7.5x4x4 inches)
- 100% self-contained (no external lines)
- Incorporates Bluetooth® technology for clean wireless control (USB available)
- Compatible with all ICP-OES and ICP-MS models
- IsoMist XR for -25°C





# ANALYSIS OF NAPHTHA BY ICP-OES

Results of spiked Naphtha based on 3x measurements with IsoMist.\*

- Thermo iCAP Radial ICP
- IsoMist set to -5°C
- Majority of RSDs below 0.5%
- Percent recovery within 5% of spiked value
- Excellent precision and linearity at low concentrations

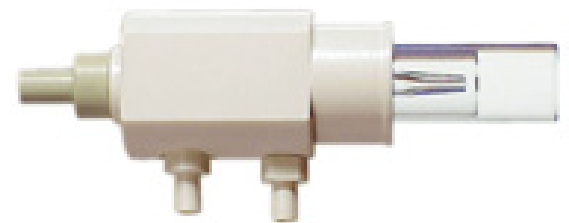
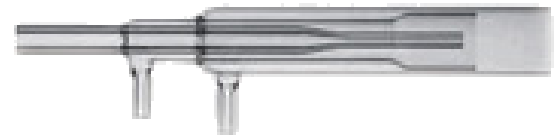
Wavelength (nm)	Naphtha spike (2.4mg/kg)	%RSD (3 Reps)	Detection Limit (µg/kg)
Ag 338.389	2.39	0.56	0.8
As 189.042	2.44	0.30	15
Ba 223.527	2.35	0.64	1.3
Cd 214.438	2.38	0.98	1.0
Cr 267.716	2.37	0.25	0.8
Fe 238.204	2.39	0.55	1.8
Mg 279.553	2.40	0.10	0.8
Mn 293.930	2.38	0.23	0.8
Na 589.592	2.41	0.55	13
P 178.284	2.40	0.44	15
Si 212.412	2.40	0.47	10.5
Zn 213.856	2.39	0.24	0.8

\*Thermo Application Note: 40899, "The Analysis of Trace Elements in Naphtha."



# AVAILABLE TORCHES

- Single-piece quartz torch
  - No removable parts
- Semi-demountable (SDT) torch
  - Removable injector
- D-Torch
  - Removable injector
  - Removable outer tube
- Fully Demountable torch (FDT)
  - Removable injector
  - Removable inner tube
  - Removable outer tube



# COMMON TORCH PROBLEM

## D-Torch Demountable ICP Torch



**Torch Problem?**



**Your Solution**

# CERAMIC OUTER TUBE PERFORMANCE

DL Comparison of standard quartz torch and ceramic D-Torch.\*



Element ( $\lambda$ )	Detection Limit ( $\mu\text{g/L}$ )	
	Radial Quartz Torch	Radial Ceramic D-Torch
Al 167	1.6	1.1
Ba 455	0.07	0.12
Cu 324	0.88	0.62
K 766	25.5	11.7
Mg 279	0.05	0.05
Mn 257	0.36	0.25
Ni 221	1.6	1.3
P 177	5.1	5.0
Zn 213	0.23	0.28

\*Thermo Application Note: 43053, "Radial Demountable Ceramic Torch for iCAP."

# ASSIST OILS PACKAGE

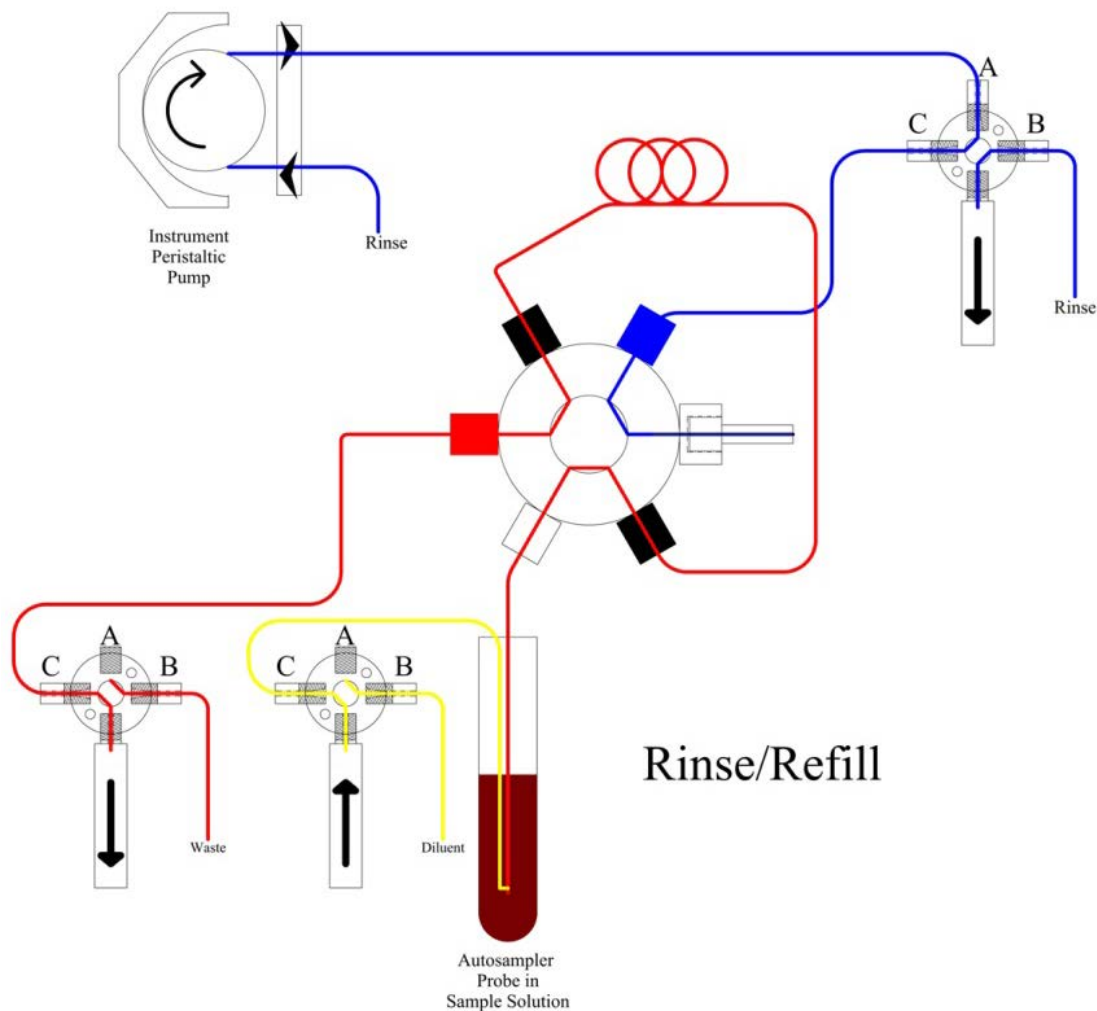


- In-line dilution
- Stainless steel dilution probe
- Rapid syringe delivery
- Rapid rinse

Assist Oil Package – P/N KT-1132

# HOW IT WORKS

- Works with your existing autosampler
- Uptake syringe takes undiluted oil and mixes it with a solvent via the diluent syringe
- Each sample diluted at the tip of the custom designed probe and loaded onto the sample loop.
- Sample syringe precisely pushes the diluted oil sample out of the loop to the nebulizer



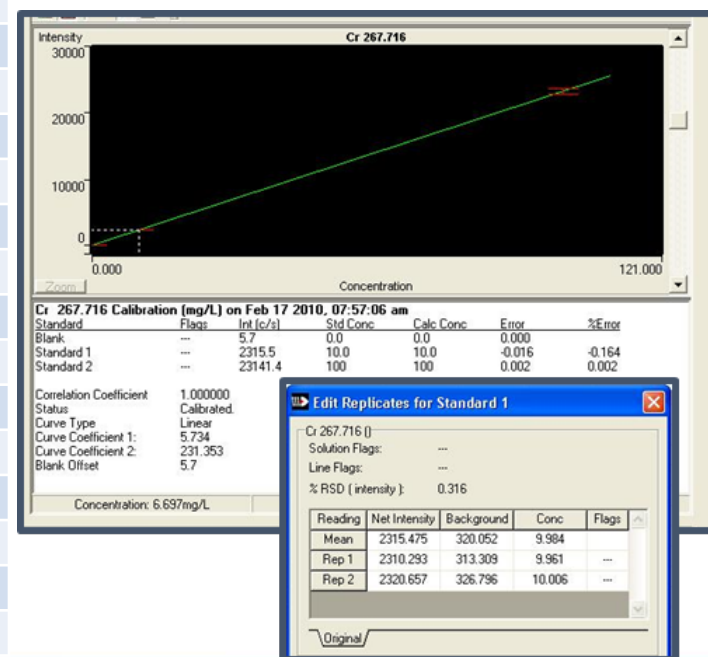
# WEAR METALS IN USED ENGINE OILS

Element and $\lambda$	Mean % Recovery	Mean Wash Concentration (ppm)
Ag 328	103	(-) 0.21
Al 308	99	(-) 0.17
B 249	99	(-) 0.21
Ba 233	101	(-) 0.01
Ca 317	107	0.84
Cd 228	101	(-) 0.06
Cr 357	101	0.12
Cu 327	101	(-) 0.17
Fe 259	101	(-) 0.03
K 766	102	0.00
Mg 279	100	(-) 0.14
Mn 257	101	(-) 0.16
Mo 202	101	(-) 0.09
Na 588	100	(-) 0.09
Ni 231	101	(-) 0.12
P 214	106	0.03
Pb 220	101	(-) 0.02
Si 212	101	0.01
Sn 283	101	(-) 0.03
Ti 334	101	(-) 0.18
V 310	101	(-) 0.19
Zn 213	107	(-) 0.47

## Various Viscosities

Tube	Sample Labels	Mo 202.032 mg/L
1 : 1	Kerosene	74910u
1 : 2	Base Oil	70700u
1 : 3	50% 460	71800u
1 : 4	100% 460	72900u
1 : 5	sample	80200u

## Excellent Correlation





# SUMMARY

- Optimizing sample intro reduces consumable cost while improving accuracy and throughput.
- Ability to reach -10 with the IsoMist and -25 with IsoMist XR allows for direct analysis of volatile solvents.
- D-Torch reduces torch replacement costs, with optional long life ceramic outer tube.
- Assist Oils package eliminates manual sample prep, while improving throughput and washout.