APPENDIX A: TEST METHOD SPECIFICATIONS

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Specification Sheet for EPA Method 18/25A

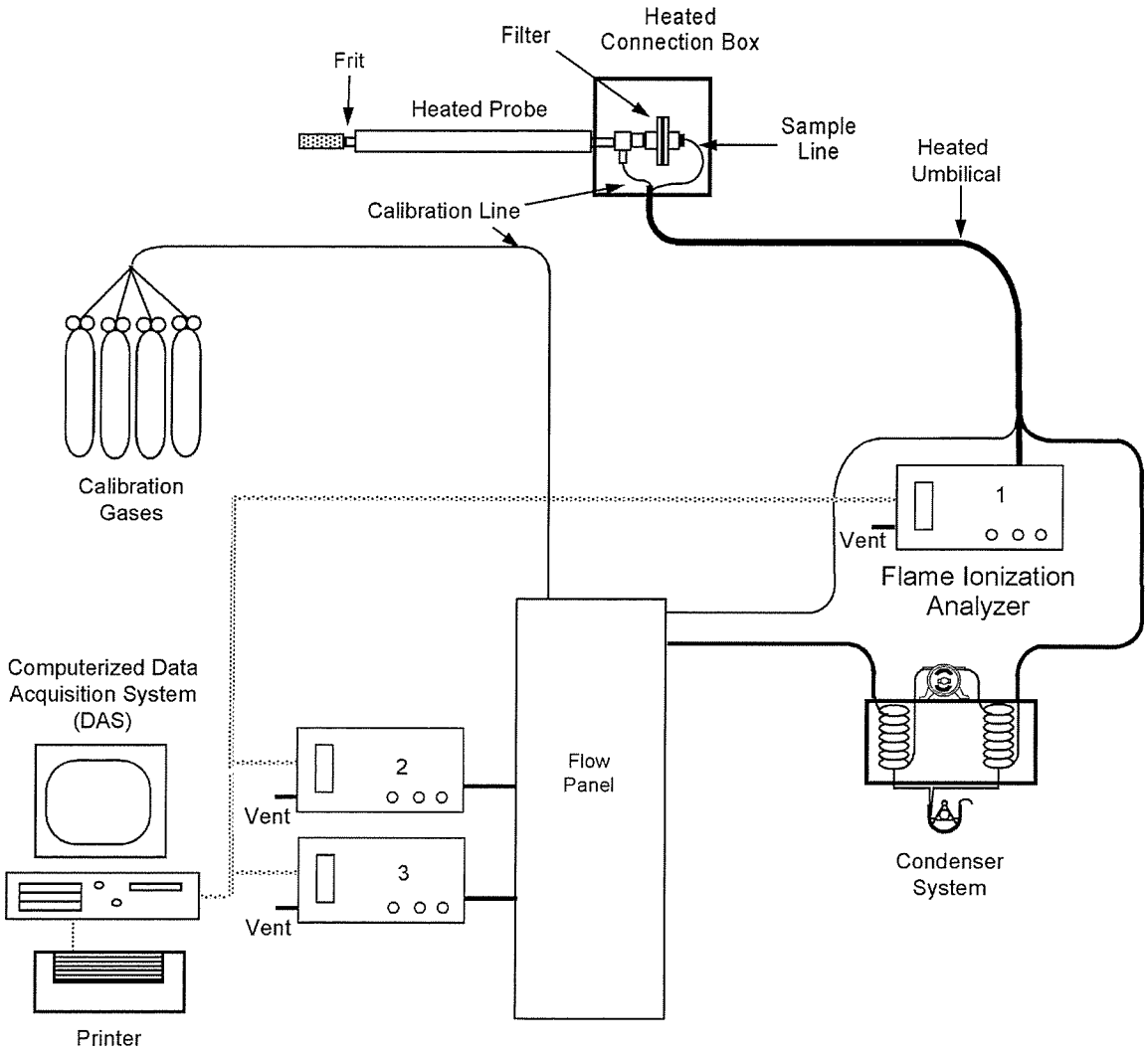
Source Location Name(s)	TE Exhaust Duct
Pollutant(s) to be Determined	Total Gaseous Organic Concentration and Methane / Ethane
Other Parameters to be Determined from Train	Diluents (O2 and CO2) - USEPA Method 3A

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	1
Sample Time per Point	N/A	60 minutes
Sampling Rate	Constant Rate	Constant Rate
Sampling Probe		
Nozzle Material	N/A	None
Nozzle Design	N/A	N/A
Probe Liner Material	Stainless Steel or Equivalent	Stainless Steel
Effective Probe Length	Sufficient to Traverse Points	4 feet
Probe Temperature Set-Point	Prevent Condensation (>230°F)	248˚F±25˚F
Particulate Filter		
In-Stack Filter	Optional	No
In-Stack Filter Material	N/A	N/A
External Filter	Yes	Yes
External Filter Material	Glass Fiber Mat	Borosilicate Glass Fiber Mat
External Filter Set-Point	Prevent Condensation (>230°F)	248˚F±25˚F
Sample Delivery System		
Heated Sample Line Material	Stainless Steel or Teflon	Teflon
Heated Sample Line Set-Point	Prevent Condensation (>230°F)	248˚F±25˚F
Heated Sample Line Connections	Probe Exit to Analyzer	Probe to Moisture System and THC Analyzer
Moisture Removal System	N/A	Refrigerator-type condenser
Sample Pump Type	N/A	Diaphragm
Sample Pump Material	Non-reactive to sample gases	Teflon
Sample Flow Control	Constant Rate	Constant Rate (±10%)
Non-Heated Sample Line Material	N/A	Teflon
Non-Heated Sample Line Connections	N/A	Moisture Removal to Diluent Analyzers
Additional Filters	Optional	Yes
Additional Filter Type	N/A	Particulate Removal
Additional Filter Location	Optional	Before Analyzers
Filter Material	N/A	Glass Fiber
Analyzer Description		
Oxygen (O_2)	EPA Method 3A (Paramagnetic)	EPA Method 3A (Paramagnetic)
Carbon Dioxide (CO_2)	EPA Method 3A (NDIR)	EPA Method 3A (NDIR)
Sulfur Dioxide (SO_2)	N/A	
Nitrogen Oxides (NO_x)	N/A	
Carbon Monoxide (CO)	N/A	
Total Hydrocarbon (THC)	EPA Method 25A (Flame Ionization Detection)	EPA Method 25A (Flame Ionization Detection)
Metthane	EPA Method 18	Tedlar Bag Collection
Ethane	EPA Method 18	Tedlar Bag Collection

Specification Sheet for EPA Method 18/25A

	Standard Method Specification	Actual Specification Used
Instrument Span Range		
Oxygen (O_2)	≤ 1.33 x Expected Maximum	0-25%
Carbon Dioxide (CO_2)	≤ 1.33 x Expected Maximum	0-10%
Sulfur Dioxide (SO_2)	N/A	N/A
Nitrogen Oxides (NO_x)	N/A	N/A
Carbon Monoxide (CO)	N/A	N/A
Total Hydrocarbon (THC)	1.5 to 2.5 x Expected Maximum	0-100 ppm
Total Hydrocarbon (THC)	1.5 to 2.5 x Expected Maximum	0-1,000 ppm
Ammonia (NH_3)	N/A	N/A
Data Acquisition		
Data Recorder	Strip chart, Analog Computer or Digital Recorder	Analog Computer
Recorder Resolution	0.5 Percent of Span	0.1 Percent of Span
Data Storage	Manually or Automatic	Manually
Measurement Freq. <60 min. Sample Time	1-min. intervals or 30 measurements (less restrictive)	One reading per second
Recording Freq. <60 min. Sample Time	1-min. intervals or 30 measurements (less restrictive)	One Minute Average (60, 1 second readings)
Measurement Freq. >60 min. Sample Time	2-min. intervals or 96 measurements (less restrictive)	N/A
Recording Freq. >60 min. Sample Time	2-min. intervals or 96 measurements (less restrictive)	N/A
Calibration Gas Specifications		
Oxygen (O_2)	EPA Protocol 1	EPA Protocol 1
Carbon Dioxide (CO_2)	EPA Protocol 1	EPA Protocol 1
Sulfur Dioxide (SO_2)	N/A	
Nitrogen Oxides (NO_x)	N/A	
Carbon Monoxide (CO)	N/A	
Total Hydrocarbon (THC)	EPA Protocol 1 (Both)	EPA Protocol 1
Hydrogen Chloride (HCl)	N/A	
Ammonia (NH_3)	N/A	

EPA Methods 3A and 25A
Sampling Train Configuration



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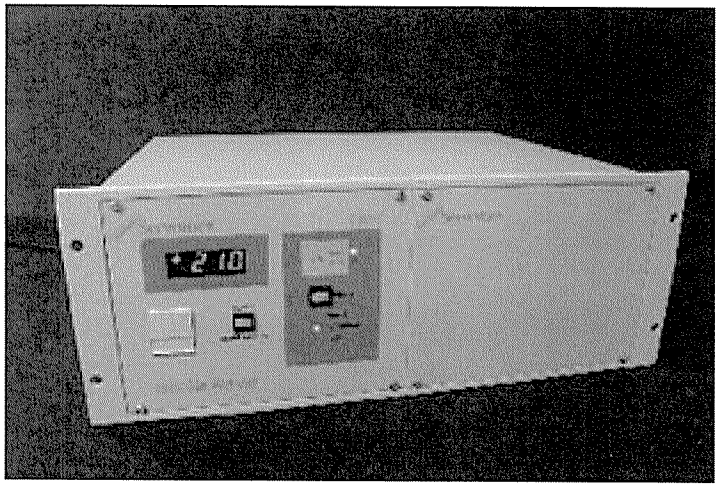
Servomex 1420C Oxygen Analyzer



Rental and Application Notes:

- Shipping Weight: 28 lbs.
- The analyzer measures the partial pressure of oxygen in the sample gas. Therefore, any change in sample pressure at the measuring cell will have an effect, which is proportional to the change in absolute pressure from the time of calibration.
- The Servomex 1420C/1415C can be plumbed together in a 19" rack mount. The combined weight is 44 lbs.
- These units are compatible with the older 1400B series.

Specifications:

- Weight: 12 lbs.
- Dimensions: 19" x 7" x 14".
- Power: 120VAC.
- Output: 0-1V or 4 - 20mA.
- Range: 0 - 25 & 100% O_2.
- Response Time (T_{90}): 2.5 sec.
- Accuracy: $\pm$ 0.1%.
- Flow Rate: 1 - 6 L/min.
- Inlet Pressure: 1-10 psig.
- Vent Pressure: 11.8 to 15.9 psia.
- Linearity: $\pm$ 0.1%.
- Repeatability: $\pm$ 0.1% O_2.
- Zero Drift: < $\pm$ 0.002% O_2/hour.
- Span Drift: < $\pm$ 0.002% O_2/hour.
- Relative Humidity: 0 - 90% non-condensing.

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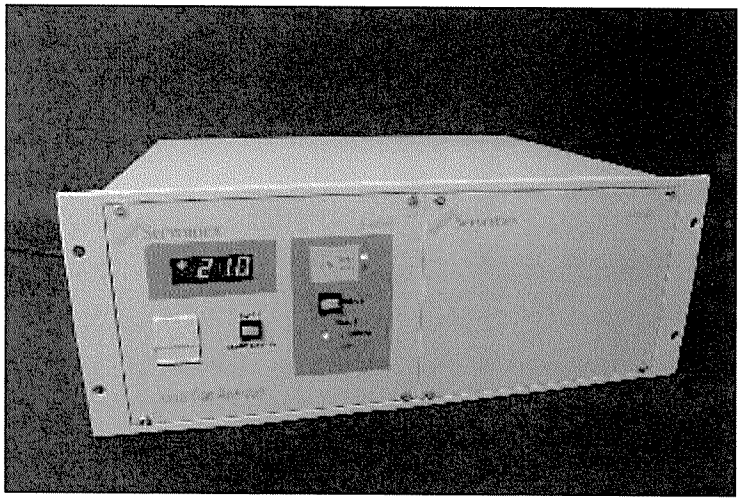
Servomex 1415 CO_2 Analyzer



Rental and Application Notes:

- Shipping Weight: 28 lbs.
- The Servomex 1420C/1415C can be plumbed together in a 19" rack mount. The combined weight is 44 lbs.
- These units are compatible wiith the older 1400B series.

Specifications:

- Weight: 12 lbs.
- Dimensions: 19" x 7" x 14"
- Power: 120VAC.
- Output: 0-1v non-isolated or 4-20mA.
- Range: 0-20 & 25% CO_2.
- Response Time (T_{90}): <10 seconds.
- Accuracy: 1% of selected range.
- Flow Rate: 1 - 6 L/min.
- Inlet Pressure: 1 - 10 psig.
- Vent Pressure: 13.1 to 16.0 psia.
- Linearity: 1% of selected range.
- Repeatability: 1% of selected range.
- Zero Drift: 2% of full scale/week.
- Span Drift: 1% of reading/day.
- Relative Humidity: 0% - 90% non-condensing.
- Storage Temperature: -4°F to 158°F.
- Infrared Detector.

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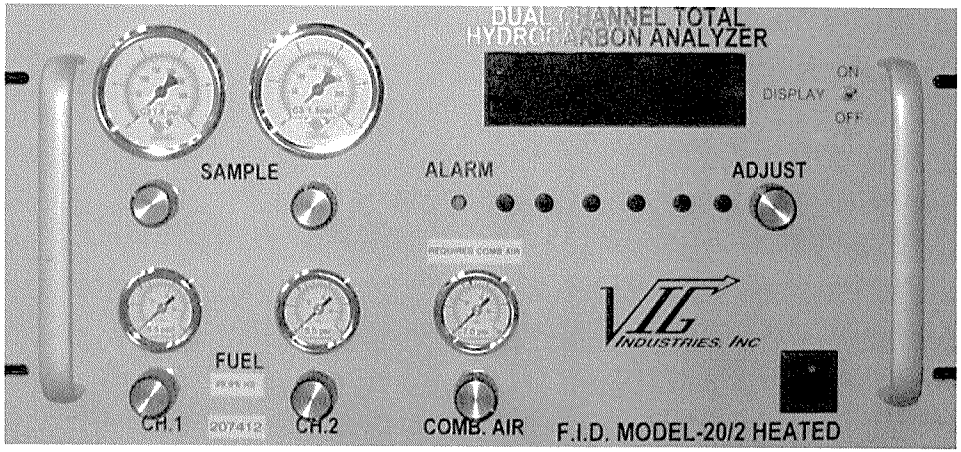
VIG Industries 20/2
Total Hydrocarbon Analyzer



Rental and Application Notes:

- Shipping Weight: 55 lbs.
- Choice of H_2 or H_2/He fuel.

Specifications:

- Weight: 45 lbs.
- Dimensions: 19" x 27" x 9".
- Power: 115VAC, 60 Hz or 20VAC, 5 Hz.
- Outputs: 4 - 20mA DC, 0-1, 5 and 10V.
- Range: 0-100, 0-1,000, 0-10,000, 0-100,000ppm.
- Measuring Method: 2 oven heated (FID).
- Respoonse Time: within 5 seconds to 90% of full scale.
- Accuracy: 1% of full scale.
- Flow Rate: 4 L/min.

Specification Sheet for EPA Method 5/29

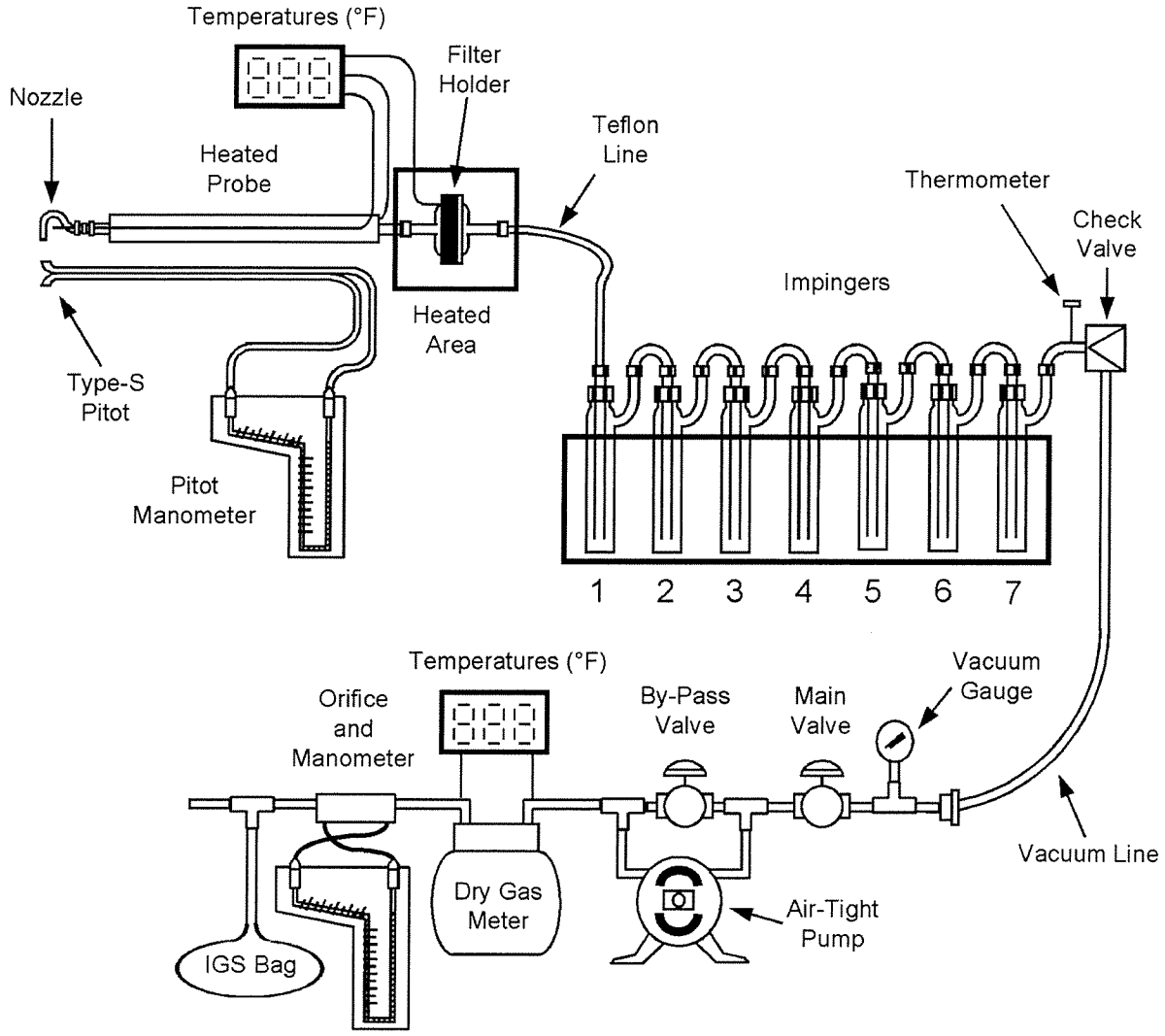
Source Location Name(s)	TE Exhaust Duct
Pollutant(s) to be Determined	Particulate Matter (PM) and Trace Metals (including Mercury)
Other Parameters to be Determined from Train	Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	60 minutes
No. of Sample Traverse Points	N/A	12
Sample Time per Point	N/A	5 minutes
Sampling Rate	Isokinetic (90-110%)	Isokinetic (90-110%)
Sampling Probe		
Nozzle Material	Borosilicate or Quartz Glass	Borosilicate Glass
Nozzle Design	Button-Hook or Elbow	Button-Hook
Probe Liner Material	Borosilicate or Quartz Glass	Borosilicate Glass
Effective Probe Length	N/A	3 feet
Probe Temperature Set-Point	248˚F±25˚F	248˚F±25˚F
Velocity Measuring Equipment		
Pitot Tube Design	Type S	Type S
Pitot Tube Coefficient	N/A	0.84
Pitot Tube Calibration by	Geometric or Wind Tunnel	Geometric
Pitot Tube Attachment	Attached to Probe	Attached to Probe
Metering System Console		
Meter Type	Dry Gas Meter	Dry Gas Meter
Meter Accuracy	±2%	±1%
Meter Resolution	N/A	0.01 cubic feet
Meter Size	N/A	0.1 dcf/revolution
Meter Calibrated Against	Wet Test Meter or Standard DGM	Wet Test Meter
Pump Type	N/A	Rotary Vane
Temperature Measurements	N/A	Type K Thermocouple/Pyrometer
Temperature Resolution	5.4˚F	1.0˚F
ΔP Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
ΔH Differential Pressure Gauge	Inclined Manometer or Equivalent	Inclined Manometer
Barometer	Mercury or Aneroid	Digital Barometer calibrated w/Mercury Aneroid
Filter Description		
Filter Location	After Probe	Exit of Probe
Filter Holder Material	Borosilicate Glass	Borosilicate Glass
Filter Support Material	Teflon (or other non-metallic material)	Teflon
Cyclone Material	N/A	None
Filter Heater Set-Point	248˚F±25˚F	248˚F±25˚F
Filter Material	Quartz or Fiberglass Fiber	Quartz Fiber
Other Components		
Description	N/A	N/A
Location	N/A	N/A
Operating Temperature	N/A	N/A

Specification Sheet for EPA Method 5/29

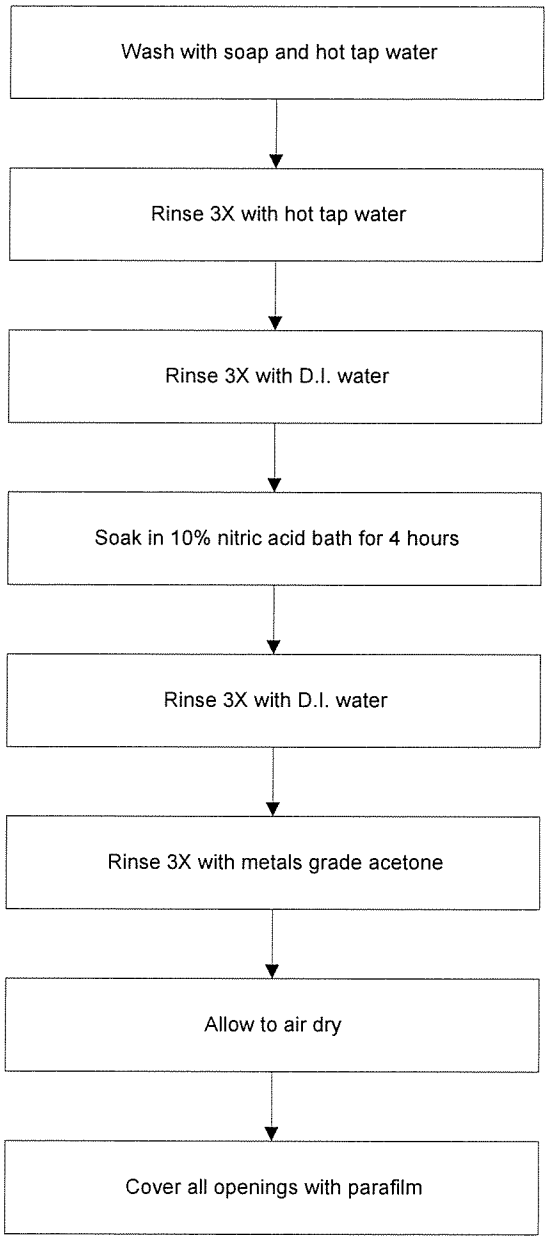
	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Ground Glass or Equivalent	Screw Joint with Silicone Gasket
Connection to Probe or Filter by	Direct Glass Connection	Direct Glass Connection
Number of Impingers	7	7
Impinger Stem Types		
Impinger 1	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Greenburg-Smith	Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 6	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 7	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 8		
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or Fyrite Analyzer	CEM
Sample Recovery Information		
Probe Brush Material	Non-metallic swab or bristle	Teflon Mat
Probe Rinse Reagent	Acetone/0.1N Nitric Acid	Acetone/0.1N. Nitric Acid
Probe Rinse Wash Bottle Material	Glass or Teflon	Teflon
Probe Rinse Storage Container	See Method 29 Recovery Flow Chart	See Recovery Flow Chart
Filter Recovered?	Yes	Yes
Filter Storage Container	Petri Dish - Glass or Polystyrene	Glass
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	See Method 29 Recovery Flow Chart	See Recovery Flow Chart
Impinger Wash Bottle	Glass or Teflon	Teflon
Impinger Storage Container	See Recovery Flow Chart	See Recovery Flow Chart
Analytical Information		
Method 4 H_2O Determination by	Volumetric or Gravimetric	Gravimetric and Volumetric
Filter Preparation Conditions	See Method 29 Analytical Flow Chart	For Metals Analysis
Front-Half Rinse Preparation	See Method 29 Analytical Flow Chart	See Analytical Flow Chart
Back-Half Analysis	See Method 29 Analytical Flow Chart	See Analytical Flow Chart
Additional Analysis	Gravimetric (EPA Method 5)	Gravimetric (EPA Method 5)

EPA Method 5/29
Sampling Train Configuration



	Impinger Contents
Impinger 1	Empty
Impinger 2	5% HNO_3/10% H_2O_2
Impinger 3	5% HNO_3/10% H_2O_2
Impinger 4	Empty
Impinger 5	4% $KMnO_4$/10% H_2SO_4
Impinger 6	4% $KMnO_4$/10% H_2SO_4
Impinger 7	Silica Gel

EPA Method 29
Glassware Preparation Procedures



EPA Method 29
Sample Recovery Flowchart
(includes Mercury and Particulate Matter)

- Tare all sample containers before sample collection
- Mark all liquid levels and final weights on the outside of each sample container
- Seal all sample containers with Teflon tape
- If recycling, bake silica gel for two hours at 350 degrees F (175 degrees C)
- Collect one complete blank set per field test

Container 1
Tared Quartz Filter
Petri Dish

Remove with acid washed polypropylene or Teflon tweezers to plastic container.

Remove any particulate or filter fiber to sample container

If necessary, fold the filter and transfer to the container.

Container 2
Acetone Rinse
500 ml Glass

Probe liner, nozzle, cyclone bypass and front half (FH) filter housing

Brush/rinse 3X with a total of 200 ml acetone

Visual Inspection

Label container and measure volume by weight

Container 3
Probe Rinse
250 ml HDPE

Probe liner, nozzle, cyclone bypass and front half (FH) filter housing

Rinse 3X with a total of 100 ml 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 7
Acetone Blank
500 ml Glass

200 ml of acetone

Container 8A
0.1 N HNO3
1000 ml HDPE

300 ml of 0.1N HNO3

Container 8B
D.I. Water Blank
250 ml HDPE

100 ml of water

Container 4
1000 ml HDPE

Back half (BH) filter housing, Z-piece, impingers 1, 2, 3 and U-bends

Measure impinger volume by weight

Transfer to sample container

Rinse each piece 3X with a total of 100 ml 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 9
5% HNO3 / 10% H2O2
250 ml HDPE

200 ml of absorbing solution

Container 5A
250 ml HDPE

Impinger 4 and U-bend

Measure impinger volume by weight

Transfer to sample container

Rinse with 100 ml of 0.1N HNO3

Visual Inspection

Label container and measure volume by weight

Container 10
4% KMnO4 / 10% H2SO4
250 ml Amber Glass

100 ml KMnO4 solution

Container 5B
950 ml Amber Glass

Impingers 5, 6 and U-bends

Measure impinger volume by weight

Transfer to sample container

Rinse each piece 3X with 100 ml of acidic permanganate solution

Rinse 3X with 100 ml of water

Visual Inspection

Label container and measure volume by weight

Container 5C
250 ml Amber Glass

If brown spots remain in impingers, remove residue with 25 ml of 8N HCl total for both impingers

Pour HCl rinse into bottle containing 200 ml of water

Label container and measure volume by weight

Container 6
Silica Gel

Measure and record impinger, volume by weight, record condition of indicating gel

Recycle silica gel

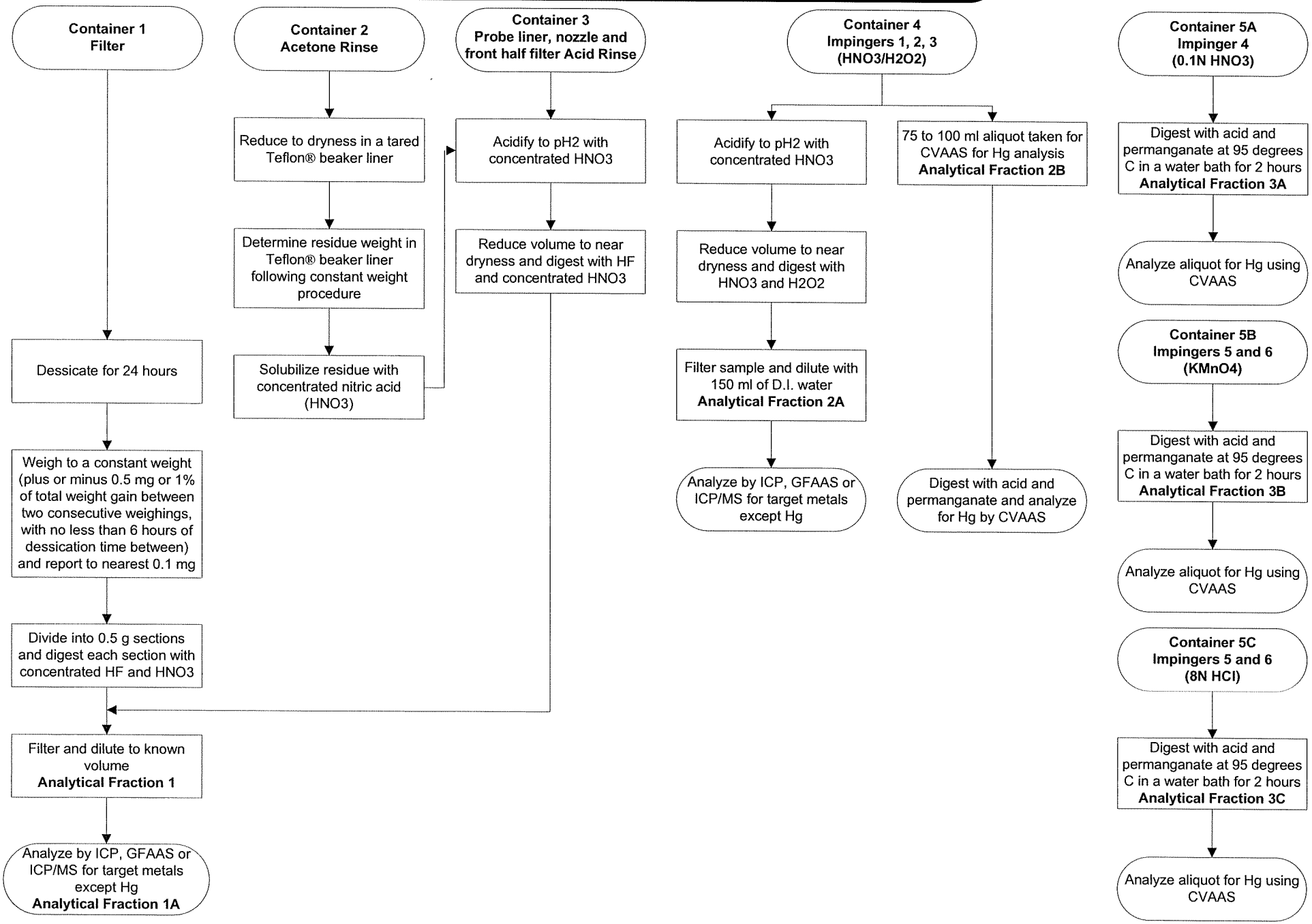
Container 11
HCl Rinse Blank
250 ml Amber Glass

200 ml water, add 25 ml of 8N HCl. Mix well and seal

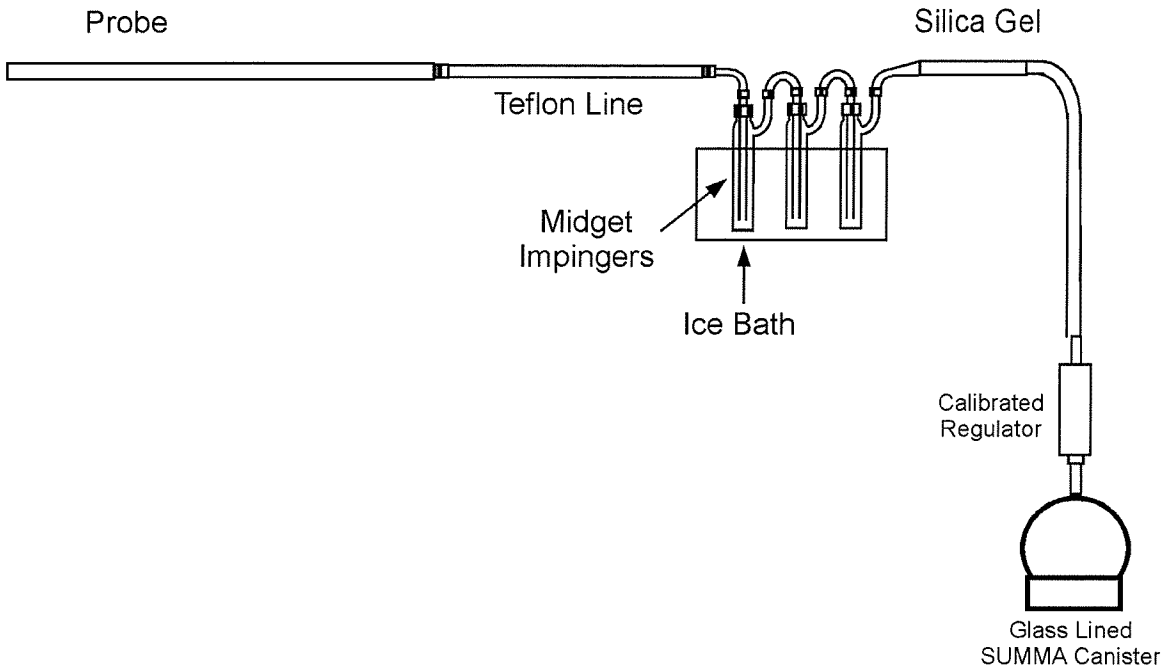
Container 12
Filter Blanks
250 ml HDPE

3 clean, unused filters

EPA Method 29
Analytical Flowchart



TO-15
Sampling Train Configuration



	Impinger Contents
Impinger 1	20 ml DI H_2O
Impinger 2	20 ml DI H_2O
Impinger 3	Empty

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