1. PROJECT OVERVIEW

TEST PROGRAM SUMMARY

EES Coke Battery, LLC contracted CleanAir Engineering (CleanAir) to complete compliance testing at the Zug Island EES Coke Battery, LLC facility located in River Rouge, MI.

The objective of the test program was to perform particulate testing on the Pushing Emissions Control System (PECS) to demonstrate compliance with Michigan Permit to Install 51-08C (MI-PTI-51-08C).

The PECS Stack has a baghouse to control particulate emissions during each oven push. Process conditions provided by EES include the following:

- Oven number
- Push time
- Amount of coke pushed
- Coke volatile matter content
- Fan amps
- Baghouse pressure drop

A summary of the test program results is presented below. Section 2 Results provides a more detailed account of the test conditions and data analysis.

Table 1-1:
Summary of Results / Permit Limits

Source Constituent	Sampling Method	Average Emission	Permit Limit[1]
PECS Stack			
PM (lb/Ton Coke)	EPA 201A	0.0039	0.02
PM (ton/yr)	EPA 201A	1.8	9.7
PM_{10} (lb/hr)[2]	EPA 201A/202	0.64	0.69
$PM_{2.5}$ (lb/hr)[2]	EPA 201A/202	0.53	0.69

[1] Permit limits obtained from Michigan Permit to Install number: MI-PTI-51-08C.

[2] The source does not emit continuously; lb/hr values are operating hour of the PECS exhaust fan.

TEST PROGRAM DETAILS

PARAMETERS

The test program included the following measurements:

- particulate matter less than 10 microns in diameter (PM_{10})
- particulate matter less than 2.5 microns in diameter ($PM_{2.5}$)
- condensable particulate matter (CPM)
- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas temperature
- flue gas flow rate

SCHEDULE

Testing was performed on November 29 through December 2, 2022. Table 1-2 outlines the on-site schedule followed during the test program.

Table 1-2:
Test Schedule

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	PECS Stack	USEPA Method 201A/202	PM, PM_{10}, $PM_{2.5}$	11/29/22	11:02	17:34
2	PECS Stack	USEPA Method 201A/202	PM, PM_{10}, $PM_{2.5}$	12/01/22	08:44	13:39
3	PECS Stack	USEPA Method 201A/202	PM, PM_{10}, $PM_{2.5}$	12/02/22	08:29	13:54

DISCUSSION

Emission Calculation Explanation

Due to the intermittent operations of the facility, the approach to the emission calculations was adjusted. Each PM test run consisted of approximately 90 minutes of sampling time. However, 4 to 7 hours of time was required to obtain each sample since sampling can only occur while the PECS exhaust fan is operating. This is referred to as a push. A ratio of the metered sample time to elapsed test time was applied to the emission rate values to ensure representative results based on the process operations. Emission rates shown in pounds per hour are therefore corrected to be pound per hour (lb/hr) of clock time.

Test Program Summary

The test program was completed over the span of four days. Due to the intermittent nature of the process at current operations, approximately 5-7 hours was required to complete one test run as the sampling can only occur during a push. A push occurred approximately every 13 minutes and during each push, roughly three minutes of sample was collected.

Each Method 201A/202 test run was completed so that 12 points were sampled. Each point was sampled for approximately eight minutes. Samples were collected isokinetically so that a minimum of 30 dry standard cubic feet (dscf) of sample was collected.

Due to high winds with gusts over 45mph, no testing occurred on November 30. CleanAir personnel safely secured all of the equipment on the test platform. Weather forecasts showed high winds persisting into the late evening. EES and CleanAir decided to begin Run 2 the following day, December 1.

PM Result

EES demonstrated compliance within their permit limits for all PM parameters. This test program was completed because PM_{10} results exceeded permit limits in September, 2022. On this mobilization no significant delays or outages occurred. Each test run was completed on the same day it was started.

PM_{10} / $PM_{2.5}$ – USEPA Method 201A/202

EPA Method 201A, "Determination of PM_{10} and $PM_{2.5}$ Emissions", was used for the particulate matter measurements along with EPA Method 202, "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources". These methods are contained in Appendix M of 40 CFR 51.

Method 201A defines PM_{10} as particulate emissions equal to or less than an aerodynamic diameter of nominally 10 microns, and $PM_{2.5}$ as particulate emissions equal to or less than an aerodynamic diameter of nominally 2.5 microns.

The sampling apparatus utilized stainless steel in-stack cyclones followed by a Gelman filter holder. The cyclones are constructed according to the design specifications provided in Method 201A. When operated at a specified flow rate, the first cyclone is designed to collect particles greater than 10 microns while allowing particles less than or equal to 10 microns to pass through. The second cyclone is designed to collect particles greater than 2.5 microns while allowing particles less than or equal to 2.5 microns to pass through. The exit of the second cyclone connects directly to a 45-mm stainless steel filter holder that contains a high-efficiency quartz fiber filter to collect the $PM_{2.5}$ particles.

Sampling was performed at a constant flow rate that maintains the 10/2.5-micron cut-points of the cyclones. The sampling time (dwell time) at each traverse point varied proportionally with the velocity at each point, as determined from a pre-test velocity traverse. All particulate analyses were performed gravimetrically following EPA Method 5 procedures.

The condensable particulate matter was collected in dry impingers after the gas has traveled through the Method 201A cyclone. Total CPM was represented by the impinger fractions and the CPM filter.

The CPM fractions were used for the PM_{10} and $PM_{2.5}$ results.

End of Section

2. RESULTS

This section summarizes the test program results. Additional results are available in the report appendices.

Table 2-1:
PECS Stack – Particulate Matter (PM)

Run No.		1	2	3	Average
Date (2022)		Nov 29	Dec 1	Dec 2	
Start Time (approx.)		11:02	08:44	08:29	
Stop Time (approx.)		17:34	13:39	13:54	
Process Conditions					
R_P	Production rate (ton/hr)	109	106	111	**109**
P_1	Starting Oven Number	32	55	30	**39**
P_2	Elapsed Pushing Time (minutes)	392	295	325	**337**
P_3	Amount of coke pushed (tons)	711	523	599	**611**
P_4	Coke volatile matter content (%)	0.49	0.49	0.62	**0.53**
θ	Sample Time (minutes)	97	102	101	**100**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	20.1	20.6	20.7	**20.5**
CO_2	Carbon dioxide (dry volume %)	0.8	0.3	0.2	**0.4**
T_s	Stack temperature (°F)	117	93	105	**105**
B_w	Actual water vapor in gas (% by volume)	1.8	0.8	1.3	**1.3**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	169,000	165,000	174,000	**169,000**
Q_s	Volumetric flow rate, standard (scfm)	151,000	156,000	160,000	**156,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	148,000	155,000	158,000	**154,000**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	35.96	40.76	39.14	**38.62**
%I	Isokinetic sampling (%)	92.2	94.9	90.6	**92.6**
FPM Laboratory Data					
m_n	Total FPM (g)	0.00363	0.00223	0.00231	
n_{MDL}	Number of non-detectable fractions	1 out of 4	1 out of 4	1 out of 4	
DLC	Detection level classification	DLL	DLL	DLL	
FPM Results					
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.4882	0.3872	0.3817	**0.4190**
$E_{T/yr}$	Particulate Rate (Ton/yr)	2.1385	1.6959	1.6716	**1.8353**
E_{Rp}	Particulate Rate - Production-based (lb/ton)	0.0045	0.0036	0.0035	**0.0039**

Average includes 3 runs.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

Table 2-2:
PECS Stack – $PM_{10}/PM_{2.5}$

Run No.		1	2	3	Average
Date (2022)		Nov 29	Dec 1	Dec 2	
Start Time (approx.)		11:02	08:44	08:29	
Stop Time (approx.)		17:34	13:39	13:54	
Process Conditions					
R_P	Production rate (ton/hr)	109	106	111	**109**
P_1	Starting Oven Number	32	55	30	**39**
P_2	Elapsed Pushing Time (minutes)	392	295	325	**337**
P_3	Amount of coke pushed (tons)	711	523	599	**611**
P_4	Coke volatile matter content (%)	0.49	0.49	0.62	**0.53**
θ	Sample Time (minutes)	97	102	101	**100**
Cap	Capacity factor (hours/year)	8,760	8,760	8,760	**8,760**
Gas Conditions					
O_2	Oxygen (dry volume %)	20.1	20.6	20.7	**20.5**
CO_2	Carbon dioxide (dry volume %)	0.8	0.3	0.2	**0.4**
T_s	Stack temperature (°F)	117	93	105	**105**
B_w	Actual water vapor in gas (% by volume)	1.8	0.8	1.3	**1.3**
Gas Flow Rate					
Q_a	Volumetric flow rate, actual (acfm)	169,000	165,000	174,000	**169,000**
Q_s	Volumetric flow rate, standard (scfm)	151,000	156,000	160,000	**156,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	148,000	155,000	158,000	**154,000**
Sampling Data					
V_{mstd}	Volume metered, standard (dscf)	35.96	40.76	39.14	**38.62**
%I	Isokinetic sampling (%)	92.2	94.9	90.6	**92.6**
Total PM10 Laboratory Data					
$m_{n\text{-}10}$	Total FPM < 10 µm (g)	0.00180	0.00093	0.00126	
m_{CPM}	Total CPM (g)	0.00274	0.00381	0.00171	
$m_{Part\text{-}10}$	Total PM < 10 µm (g)	0.00454	0.00474	0.00297	
n_{MDL}	Number of Non-Detectable Fractions	1 out of 5	1 out of 5	1 out of 5	
DLC	Detection Level Classification	DLL	DLL	DLL	
Total PM10 Results					
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.6106	0.8230	0.4907	**0.6414**
Total PM2.5 Laboratory Data					
$m_{n\text{-}2.5}$	Total FPM < 2.5 µm (g)	0.00061	0.00061	0.00061	
m_{CPM}	Total CPM (g)	0.00274	0.00381	0.00171	
$m_{Part\text{-}2.5}$	Total PM < 2.5 µm (g)	0.00335	0.00442	0.00232	
n_{MDL}	Number of Non-Detectable Fractions	1 out of 4	1 out of 4	1 out of 4	
DLC	Detection Level Classification	DLL	DLL	DLL	
Total PM2.5 Results					
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.4506	0.7674	0.3833	**0.5338**

Average includes 3 runs.

Detection level classifications are defined as follows:

ADL = Above Detection Level - all fractions are above detection limit

DLL = Detection Level Limited - some fractions are below detection limit

BDL = Below Detection Limit - all fractions are below detection limit

End of Section

3. DESCRIPTION OF INSTALLATION

PROCESS DESCRIPTION

EES Coke Battery, LLC is a facility located on Zug Island in River Rouge, Michigan. The testing described in this document will be performed at the pushing PECS Stack location. The process includes the PECS Baghouse, Pushing Stack (PECS Stack) and a Combustion Stack.

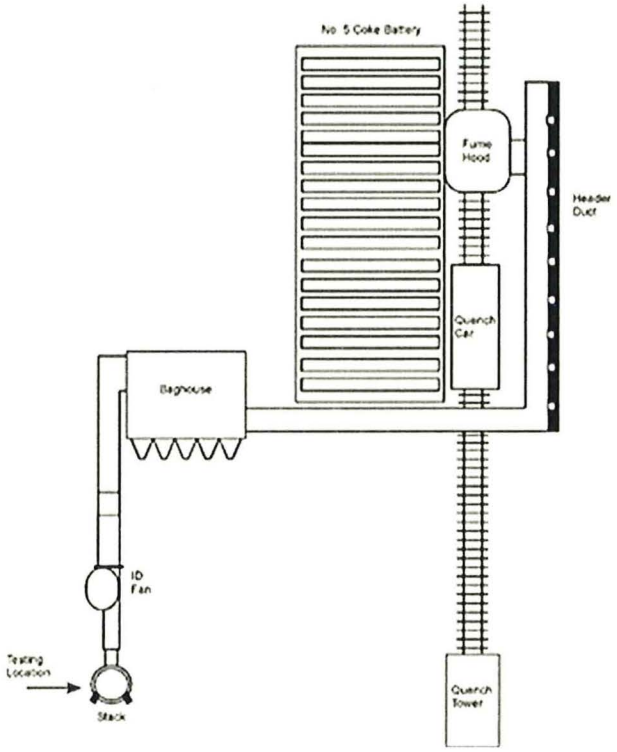
The No. 5 Coke Battery consists of 85, six-meter-high ovens producing furnace coke. A coal blend is used to charge each oven at timed intervals depending on the current production of the battery. Coking of the coal occurs in an oxygen free environment for 17 to 30 hours and the gases produced are collected, cleaned, and used to under fire the battery, supply fuel for other site sources, and sold to permitted off-site utilities.

The current permit limits allow for the charging of up to 1.420 million dry tons of coal per year. The design capacity heating requirement of the battery is approximately 375 MMBtu per hour. The heating requirements of the battery at the current production rate are approximately 325 MMBtu per hour.

Process source description information above was taken from written information provided by EES Coke.

A schematic of the process, indicating sampling locations, is shown in Figure 3-1.

Figure 3-1:
Process Schematic



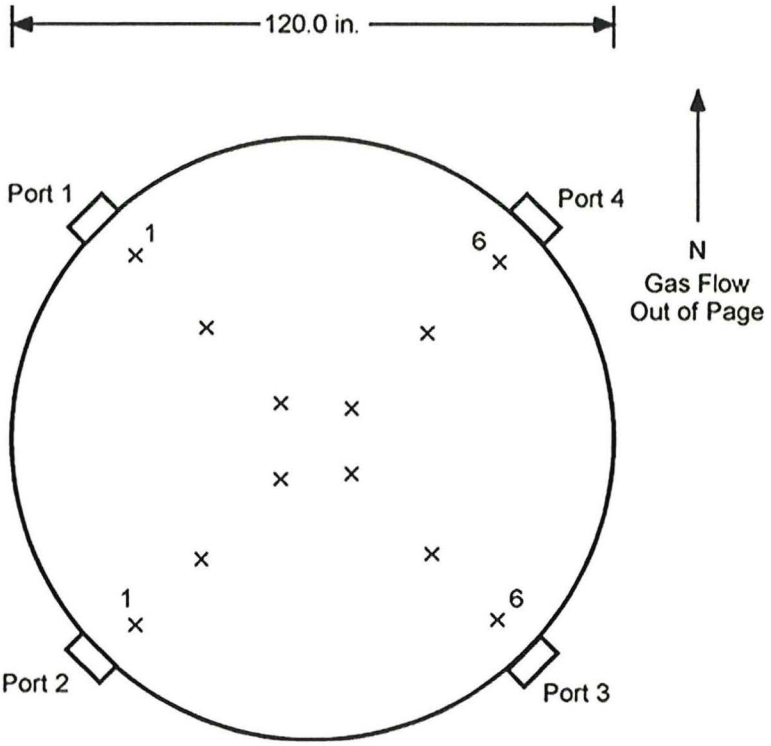
TEST LOCATION

The sample point placement was determined by EPA Method 1 specifications. Table 3-1 presents the sampling information for the test location. The figure below represents the layout of the test location.

Table 3-1:
Sampling Information

Source Constituent	Method	Run No.	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
PECS Stack							
Total PM	EPA 201A/202	1-3	2	6	~8	~90	3-2

Figure 3-2:
PECS Stack Sample Point Layout (EPA Method 1)



Sampling Point	% of Stack Diameter	Port to Point Distance (inches)
1	95.6	114.7
2	85.4	102.5
3	70.4	84.5
4	29.6	35.5
5	14.6	17.5
6	4.4	5.3

Duct diameters upstream from flow disturbance (A): 2.0 Limit: 0.5
Duct diameters downstream from flow disturbance (B): 8.0 Limit: 2.0

End of Section

4. METHODOLOGY

PROCEDURES AND REGULATIONS

The test program sampling measurements followed procedures and regulations outlined by the USEPA and Michigan Department of Environment, Great Lakes, and Energy (EGLE). These methods appear in detail in Title 40 of the CFR and at https://www.epa.gov/emc.

Appendix A includes diagrams of the sampling apparatus, as well as specifications for sampling, recovery, and analytical procedures. Any modifications to standard test methods are explicitly indicated in this appendix. In accordance with ASTM D7036 requirements, CleanAir included a description of any such modifications along with the full context of the objectives and requirements of the test program in the test protocol submitted prior to the measurement portion of this project. Modifications to standard methods are not covered by the ISO 17025 and TNI portions of CleanAir's A2LA accreditation.

CleanAir follows specific QA/QC procedures outlined in the individual methods and in USEPA "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source-Specific Methods," EPA/600/R-94/038C. Appendix D contains additional QA/QC measures, as outlined in CleanAir's internal Quality Manual.

TITLE 40 CFR PART 60, APPENDIX A

Method 1 "Sample and Velocity Traverses for Stationary Sources"

Method 2 "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"

Method 3A "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

Method 4 "Determination of Moisture Content in Stack Gases"

TITLE 40 CFR PART 51, APPENDIX M

Method 201A "Determination of PM_{10} and $PM_{2.5}$ Emissions from Stationary Sources (Constant Sampling Rate Procedure)"

Method 202 "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources"

End of Section

5. APPENDIX

Appendix A: Test Method Specifications

Appendix B: Sample Calculations

Appendix C: Parameters

Appendix D: QA/QC Data

Appendix E: Field Data

Appendix F: Field Data Printouts

Appendix G: Laboratory Data

Appendix H: Facility Operating Data

Appendix I: CleanAir Resumes and Certifications

APPENDIX A: TEST METHOD SPECIFICATIONS

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Specification Sheet for EPA Method 201A/202

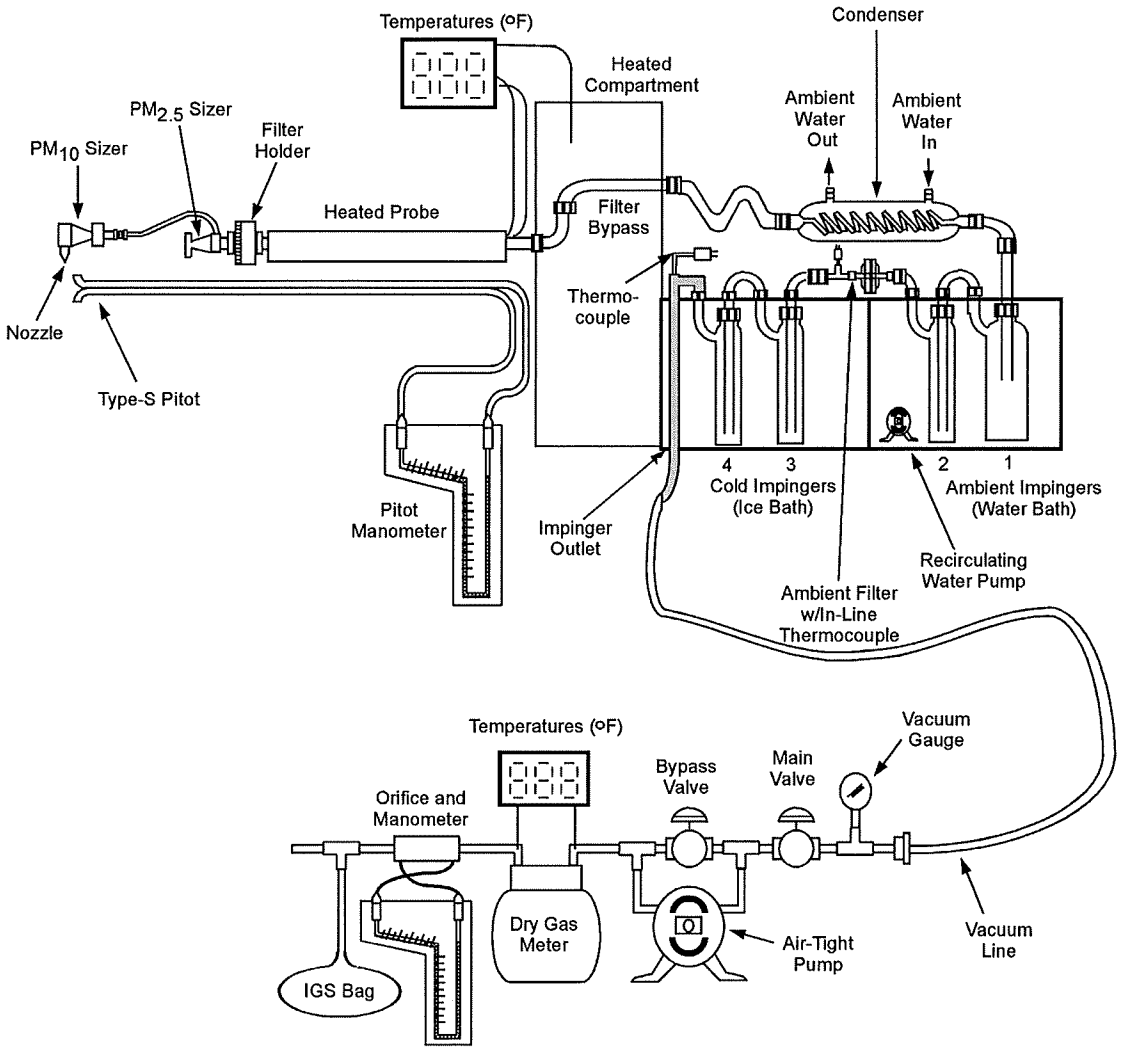
Source Location Name(s)	PECS Stack
Pollutant(s) to be Determined	$FPM_{2.5}$, FPM_{10}, Total FPM, CPM
Other Parameters to be Determined from Train	Gas Density, Moisture, Flow Rate

	Standard Method Specification	Actual Specification Used
Pollutant Sampling Information		
Duration of Run	N/A	90 minutes
No. of Sample Traverse Points	12	12
Sample Time per Point	N/A	7 minutes
Sampling Rate	Constant Rate (80-120% of Average Isokinetic Rate)	Constant Rate (80-120% of Average Isokinetic Rate)
Sampling Probe		
Nozzle Material	Stainless Steel	Stainless Steel
Nozzle Design	Straight	Straight
Probe Liner Material	Glass or Teflon	Teflon
Effective Probe Length	N/A	10 feet
Probe Temperature Set-Point	N/A	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
FPM Filter Description		
Filter Location	In Stack	In-Stack
Filter Holder Material	Stainless Steel	Stainless Steel
Filter Support Material	Stainless Steel	Stainless Steel
Cyclone Material	Stainless Steel	Stainless Steel
Filter Heater Set-Point	Stack Temp.	Stack Temp (±18°F)
Filter Material	Quartz Fiber	Quartz Fiber
Other Components		
Description	Condenser	Condenser
Location	Before Impinger 1	Before 1st Impinger
Operating Temperature	≤85°F	≤85°F

Specification Sheet for EPA Method 201A/202

	Standard Method Specification	Actual Specification Used
Impinger Train Description		
Type of Glassware Connections	Leak-Free Glass Connectors	Ground Glass with Silicone O-Ring
Connection to Probe or Filter by	Direct or Flexible Connection	Direct Glass Connection
Number of Impingers	4	4
Impinger Stem Types		
Impinger 1	Shortened Stem (open tip)	Shortened Stem (open tip)
Impinger 2	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 3	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 4	Modified Greenburg-Smith	Modified Greenburg-Smith
Impinger 5		
Impinger 6		
Impinger 7		
Impinger 8		
CPM Filter Description		
Filter Location	Between 2nd and 3rd Impingers	Between 2nd and 3rd Impingers
Filter Holder Material	Glass, Stainless Steel or Teflon	Borosilicate Glass
Filter Support Material	Teflon	Teflon
Cyclone Material	None	None
Filter Heater Set-Point	>65°F but ≤85°F	>65°F but ≤85°F
Filter Material	Teflon Membrane	See Analytical Flow Chart
Gas Density Determination		
Sample Collection	Multi-point integrated	Multi-Point Integrated
Sample Collection Medium	Flexible Gas Bag	Vinyl Bag
Sample Analysis	Orsat or CEM Analyzer	CEM
Sample Recovery Information		
Nozzle Brush Material	Nylon Bristle or Teflon	Nylon Bristle
Nozzle Rinse Reagent	Acetone	Acetone
Nozzle Rinse Wash Bottle Material	Glass or Polyethylene	Inorganic in polyethylene, organic in Teflon
Nozzle Rinse Storage Container	Glass or Polyethylene	Glass
Filter Recovered?	Yes	Yes
Filter Storage Container	FH filter in petri dish, CPM filter in petri dish	FH filter in petri dish, CPM filter in petri dish
Impinger Contents Recovered?	Yes	Yes
Impinger Rinse Reagent	DI Water/Acetone/Hexane	DI Water/Acetone/Hexane
Impinger Wash Bottle	Inorganic in polyethylene, organic in Teflon	Inorganic in polyethylene, organic in Teflon
Impinger Storage Container	Inorganic in polyethylene, organic in glass	Inorganic in amber glass, organic in amber glass
Analytical Information		
Method 4 H_2O Determination by	Volumetric or Gravimetric	Gravimetric
Filter Preparation Conditions	Dessicate 24 Hours or Filter Extraction	See Analytical Flow Chart
Front-Half Rinse Preparation	Evaporate at ambient temperature and pressure	Evaporate at ambient temperature and pressure
Back-Half Analysis	Sonication and Extraction	See Analytical Flow Chart
Additional Analysis	N/A	None

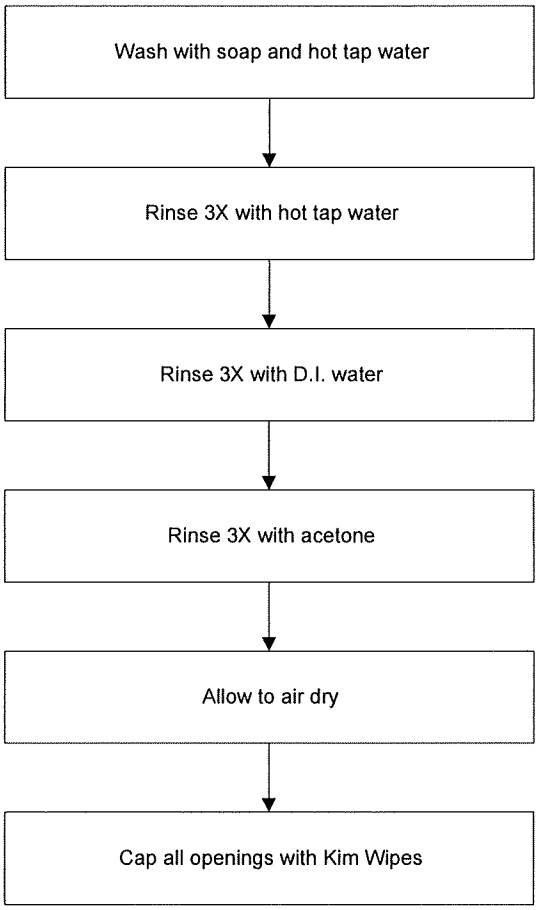
EPA Method 201A/202
Sampling Train Configuration



Impinger Contents

Impinger 1	Empty
Impinger 2	Empty
Impinger 3	DI H_2O
Impinger 4	Silica Gel

EPA Method 201A
Glassware Preparation Procedures



EPA Method 201A
Sample Recovery Flowchart

- 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)

Container 1
FPM ≤ 2.5 µm
Petri Dish

Remove with tweezers to original petri dish. Brush any loose particulate or filter fibers to sample container

Seal and label container

Visual Inspection

Container 2
FPM > 10 µm
250 ml Clear Glass

Includes internal nozzle surface, interior of Cyclone I (including outside surface of the downcomer line), and Cyclone I cup

Brush/rinse 3X with acetone

Visual Inspection

Label container and measure volume by weight

Container 3
10 µm ≥ FPM > 2.5 µm
250 ml Clear Glass

Includes solids from the Cyclone IV cup, Cyclone I turnaround cup (above inner downcomer line), inside of downcomer line, interior surfaces of Cyclone IV

Brush/rinse 3X with acetone

Visual Inspection

Label container and measure volume by weight

Container 4
FPM ≤ 2.5 µm
250 ml Clear Glass

Includes exit tube leading from Cyclone IV and the front-half of the filter holder

Brush/rinse 3X with acetone

Visual Inspection

Label container and measure volume by weight

Container 5*
Cold Impinger Water
1000 ml HDLP or Glass

Impinger that follows ambient filter

Measure volume by weight and discard contents
OR
Transfer liquid into sample container

Follow appropriate back-half recovery procedures (e.g. Method 202)

Container 6
Silica Gel

Measure volume by weight, note any color change

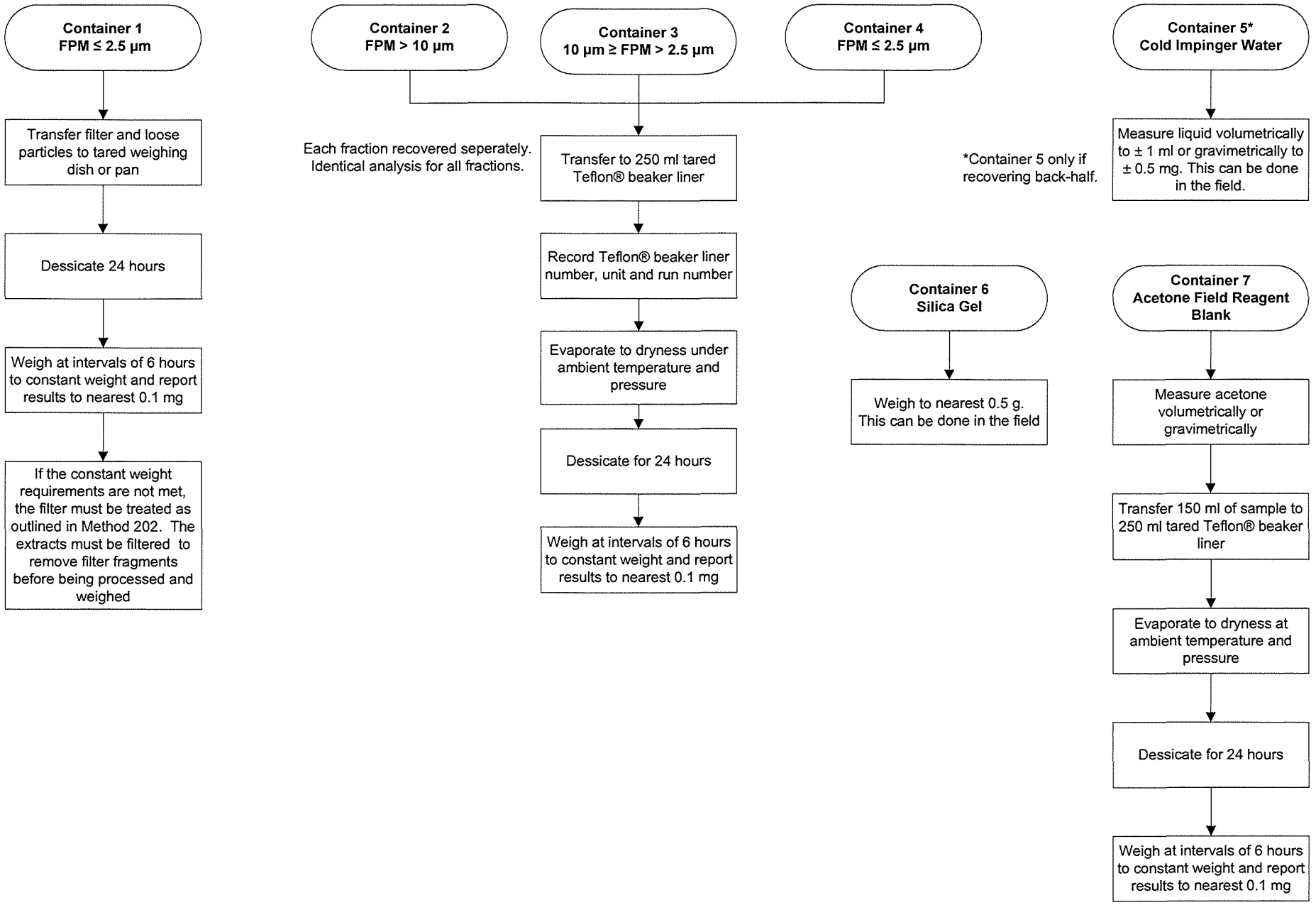
Recycle silica gel

Container 7
Acetone Field Reagent Blank
500 ml Clear Glass

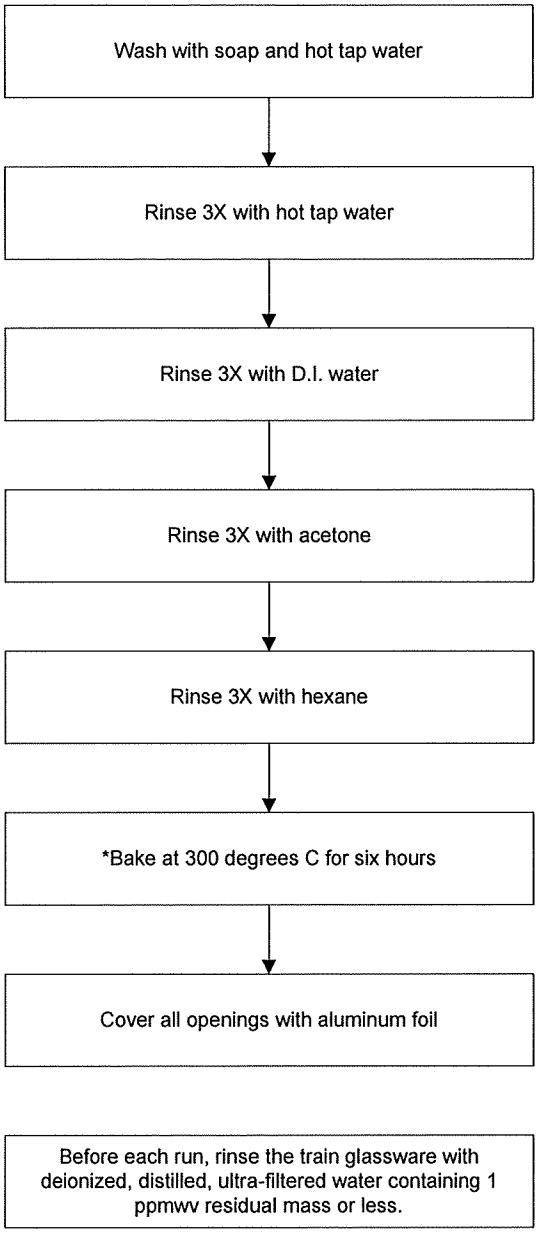
200 ml of acetone directly from wash bottle

*Container 5 only if recovering back half

EPA Method 201A
Analytical Flowchart



EPA Method 202
Glassware Preparation Procedures



*As an alternative to baking glassware, a field train proof blank can be performed on the sampling train glassware.

EPA Method 202
Sample Recovery Flowchart (1 of 2)

- 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 degreesC)
- Samples must be maintained at or below 85 degrees F (30 degrees C) during shipping.

Post-Test N2 Purge*

Transfer water collected in condenser and water dropout impinger to back-up impinger; measure and record volume or weight

Conduct purge on condenser, back-up impinger and CPM filter with N2 at 14 LPM for one hour

Purge Notes:

- *Continue operating condenser recirculation pump and maintain gas temperature at exit of CPM filter >65°F but ≤85°F.*
- *If volume of water in moisture traps was not determined prior to purge, maintain trap temperature and keep gas temperature at exit of silica gel impinger below 68°F.*
- *At conclusion of purge, simultaneously turn off delivery and pumping systems.*
- *For high moisture sampling, weigh and change out silica gel prior to purging.*

CPM Container 1
Inorganic Rinse
950 ml Amber Glass

Back-half FPM filter holder, probe extension, condenser, dropout and back-up impingers, connecting glassware, front-half CPM filter holder

Measure and record impinger volume by weight

Empty contents into labeled container

Rinse 2X with deionized, distilled, ultra-filtered water and add to sample container

Visual Inspection

Mark liquid level and label container

CPM Container 2
Organic Rinses
950 ml Amber Glass

Back-half FPM filter holder, probe extension, condenser, dropout and back-up impingers, connecting glassware, front-half CPM filter holder

Rinse 1X with acetone and add to sample container

Rinse 2X with hexane and add to sample container

Visual Inspection

Mark liquid level and label container

CPM Container 3
Filter Sample
Petri Dish

CPM filter

Use tweezers and/or disposable surgical gloves to remove CPM filter and place in Petri dish

Visual Inspection

Label container

CPM Container 4**
Cold Impinger Water
500 ml Plastic

Cold impinger that follows the CPM filter

Quantitatively transfer liquid into sample container

Visual Inspection

Mark liquid level and label container

****If the water has been weighed in the field, it can be discarded.**

CPM Container 5
Silica Gel

Measure volume by weight, note any color change

Recycle silica gel

EPA Method 202
Sample Recovery Flowchart (2 of 2)

- 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)
- Samples must be maintained at or below 85 degrees F (30 degrees C) during shipping.

CPM Container 6 Acetone Field Reagent Blank

↓

Collect 200 ml of acetone from wash bottle into amber glass container

↓

Visual inspection

↓

Mark liquid level and label container

↓

Collect one acetone blank for each lot of solvent used

CPM Container 7 Water Field Reagent Blank

↓

Collect 200 ml of water from wash bottle into amber glass container

↓

Visual inspection

↓

Mark liquid level and label container

↓

Collect one water blank for each lot used

CPM Container 8 Hexane Field Reagent Blank

↓

Collect 200 ml of hexane from wash bottle into amber glass container

↓

Visual inspection

↓

Mark liquid level and label container

↓

Collect one hexane blank for each lot of solvent used

CPM Container 9 Field Train Proof Blank* Inorganic Rinses

↓

Prior to testing, rinse probe extension, condenser, impingers, connecting glassware and front-half CPM filter housing 2X with water

↓

Collect rinses in plastic sample container

↓

Visual inspection

↓

Mark liquid level and label container

If glass ware was not baked a field train proof blank must be performed to demonstrate the cleanliness of the glassware. Baking the glassware is a CleanAir SOP

CPM Container 10 Field Train Proof Blank* Organic Rinses

↓

After rinsing with water, rinse probe extension, condenser, impingers, connecting glassware and front-half CPM filter housing with acetone

↓

Repeat procedure by rinsing 2X with hexane

↓

Collect both rinses in amber glass container

↓

Visual inspection

↓

Mark liquid level and label container

Field Train Blank (required)

↓

A minimum of one field train blank for each source category tested at facility is required.

↓

Recover field blank after first or second run

↓

Assemble sampling train as it would be used for testing.

↓

Prior to purge, add 100 ml water to first impinger and record data

↓

Purge train and recover blank samples as described on Page 1 of 2

↓

From field sample weight, subtract condensable particulate mass determined from blank train or 0.002 g, whichever is less.

EPA Method 202
Analytical Flowchart (1 of 2)

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition

CPM Container 1 Inorganic Rinse

Measure liquid volumetrically or gravimetrically

Transfer inorganic contents into separatory funnel and add 30 ml of hexane

Drain off lower inorganic phase into a clean sample container or beaker

Drain off organic phase into a separate clean sample container or beaker, leaving a small amount of hexane in funnel

Repeat procedure twice with 30 ml hexane, combining the organic phase with each extraction

Inorganic Extraction

Transfer inorganic fraction from extraction into 250 ml tared Teflon® beaker liner

Evaporate to no less than 10 ml on a hot plate or in 105 degree C oven

Allow to dry at room temperature (not to exceed 85 degrees F). Ensure the water and volatile acids have completely evaporated before neutralizing nonvolatile acids in sample

Dessicate for 24 hours

Weigh at intervals of 6 hours to constant weight and report results to nearest 0.1 mg

No constant weight

Redissolve residue in 100 ml of deionized, distilled ultra-filtered water

Titrate sample with 0.1 N NH_4OH to a pH of 7.0, record volume of titrant used.

Evaporate to no less than 10 ml using hot plate or 105 degree C oven

Allow to dry at room temperature (not to exceed 85 degrees F)

Organic Extraction

The extraction should yield around 90 ml of organic extract

Combine the organic extract of Container 1 with the organic train rinse in Container 2

CPM Container 2 Organic Rinses

Measure liquid volumetrically or gravimetrically

Transfer contents into 250 ml tared Teflon® beaker liner

Evaporate to dryness at room temperature (not to exceed 85 degrees F)

Dessicate for 24 hours

Weigh at intervals of 6 hours to constant weight and report results to nearest 0.1 mg

CPM Container 3 Filter Sample

Was sample collected by Method 17 or 201A with a stack temp < 85°F? Can the filter be brought to constant weight?

Yes

Transfer filter and loose PM from sample container to tared glass weighing dish

Dessicate for 24 hours

Weigh to constant weight and report results to nearest 0.1 mg

No

Extract the filter

Inorganic Extraction

Fold filter into quarters and place in 50 ml extraction tube

Add 10 ml deionized, distilled ultra-filtered water to extraction tube (or sufficient to cover the filter)

Extract for at least 2 minutes in sonication bath; add to separate inorganic fraction Container 1

Repeat extraction twice more for a total of three extractions; add to Container 1

Organic Extraction

Add 10 ml hexane to extraction tube (or sufficient to cover the filter)

Extract for at least 2 minutes in sonication bath; add to separate organic fraction Container 2

Repeat extraction twice more for a total of three extractions; add to Container 2

EPA Method 202
Analytical Flowchart (2 of 2)

- Log each sample in shipment and verify against chain-of-custody sheet
- Note liquid levels in the sample containers and confirm on the chain-of-custody sheet condition

CPM Container 4*
Cold Impinger Water

Measure liquid volumetrically or gravimetrically

CPM Container 5*
Silica Gel

Weigh to nearest 0.5 g

*May have been performed in the field during sample recovery

CPM Container 6
Acetone Field Reagent Blank

Transfer 150 ml of acetone to 250 ml tared Teflon® beaker liner and evaporate to dryness at room temperature (not to exceed 85 degrees F)

Dessicate for 24 hours

Weigh at intervals of 6 hours to constant weight and report results to nearest 0.1 mg

CPM Container 7
Water Field Reagent Blank

Transfer 150 ml of water to 250 ml tared Teflon® beaker liner and evaporate to dryness at room temperature (not to exceed 85 degrees F)

Dessicate for 24 hours

Weigh at intervals of 6 hours to constant weight and report results to nearest 0.1 mg

CPM Container 8
Hexane Field Reagent Blank

Transfer 150 ml of hexane to 250 ml tared Teflon® beaker liner and evaporate to dryness at room temperature (not to exceed 85 degrees F)

Dessicate for 24 hours

Weigh at intervals of 6 hours to constant weight and report results to nearest 0.1 mg

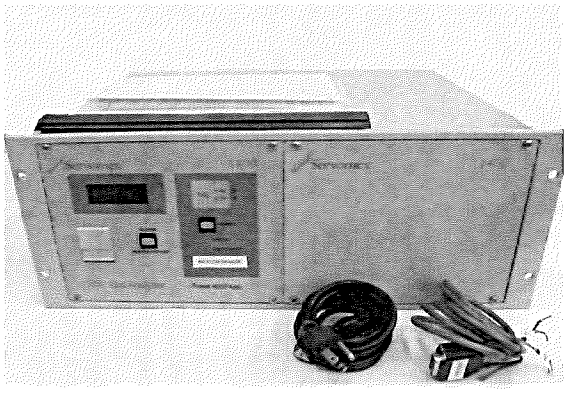
CleanAir

SPEC SHEET

Servomex 1420C O2 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 non-isolated or 4-20mA
Range	O2 0-25%, 0-100%
Response Time	<3 seconds
Accuracy	+/- 0.1%
Flow Rate	1 - 6 L/min
Inlet Pressure	1 - 10 psig
Vent Pressure	11.8-15.9 psia
Linearity	+/- 0.1%
Repeatability	+/- 0.1%
Zero Drift	< + 0.002% O2/hour
Span Drift	< + 0.002% O2/hour
Relative Humidity	0 - 90% non-condensing
Storage Temperature	-4° F to 158° F

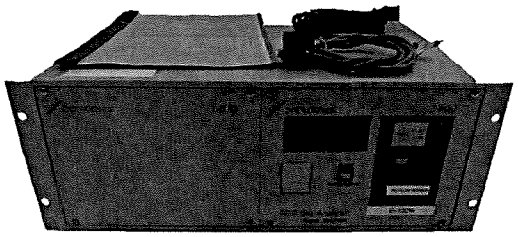
CleanAir

SPEC SHEET

Servomex 1415 CO2 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% CO2
Response Time	<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

End of Appendix Section