FLUOROMONOMERS MANUFACTURING PROCESS VINYL ETHERS NORTH CARBON BED REMOVAL EFFICIENCY AND DIVISION STACK TEST REPORT TEST DATES: 25 AND 26 MARCH 2019

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1. INTRODUCTION

1.1 FACILITY AND BACKGROUND INFORMATION

The Chemours Fayetteville Works (Chemours) is located in Bladen County, North Carolina, approximately 10 miles south of the city of Fayetteville. Chemours operating areas on the site include the Fluoromonomers, IXM and Polymers Processing Aid (PPA) manufacturing areas, Wastewater Treatment, and Powerhouse.

Chemours contracted Weston Solutions, Inc. (Weston) to perform HFPO Dimer Acid Fluoride, captured as HFPO Dimer Acid, emission testing on the Vinyl Ethers North (VEN) Carbon Bed and Division stack at the facility. Testing was performed on 25 and 26 March 2019 and generally followed the "Emission Test Protocol" reviewed and approved by the North Carolina Department of Environmental Quality (NCDEQ). This report provides the results from the emission test program.

1.2 TEST OBJECTIVES

The specific objectives for this test program were as follows:

- Measure the emissions concentrations and mass emissions rates of HFPO Dimer Acid Fluoride from the Carbon Bed inlet and outlet and Division stack which are located in the Fluoromonomers process area.
- Calculate the Carbon Bed removal efficiency for HFPO Dimer Acid.
- Monitor and record process and emissions control data in conjunction with the test program.
- Provide representative emissions data.

1.3 TEST PROGRAM OVERVIEW

During the emissions test program, the concentrations and mass emissions rates of HFPO Dimer Acid were measured at three locations.

Tables 1-1 and 1-2 provide a summary of the test locations and the parameters that were measured along with the sampling/analytical procedures that were followed.

Section 2 provides a summary of test results. A description of the processes is provided in Section 3. Section 4 provides a description of the test locations. The sampling and analytical procedures are provided in Section 5. Detailed test results and discussion are provided in Section 6.

Appendix C includes the summary reports for the laboratory analytical results. The full laboratory data packages are provided in electronic format and on CD with each hard copy.

Table 1-1
Sampling Plan for VEN Carbon Bed Testing

Sampling Point & Location	**VEN Carbon Bed**				
Number of Tests:	6 (3 Carbon Bed inlet, 3 Carbon Bed outlet)				
Parameters To Be Tested:	HFPO Dimer Acid (HFPO-DA)	Volumetric Flow Rate and Gas Velocity	Carbon Dioxide	Oxygen	Water Content
Sampling or Monitoring Method	EPA M-0010	EPA M1, M2, M3A, and M4 in conjunction with M-0010 tests	EPA M3/3A		EPA M4 in conjunction with M-0010 tests
Sample Extraction/ Analysis Method(s):	LC/MS/MS	NA[6]	NA		NA
Sample Size	$\geq 1.5m^3$	NA	NA	NA	NA
Total Number of Samples Collected[1]	6	6	3	3	6
Reagent Blanks (Solvents, Resins)[1]	1 set	0	0	0	0
Field Blank Trains[1]	1 per source	0	0	0	0
Proof Blanks[1]	1 per train	0	0	0	0
Trip Blanks[1,2]	1 set	0	0	0	
Lab Blanks	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Samples (LCS)	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Sample Duplicate (LCSD)	1 per fraction[3]	0	0	0	0
Media Blanks	1 set[4]	0	0	0	0
Isotope Dilution Internal Standard Spikes	Each sample	0	0	0	0
Total No. of Samples	10[5]	6	3	3	6

Key:

[1] Sample collected in field.

[2] Trip blanks include one XAD-2 resin module and one methanol sample per sample shipment.

[3] Lab blank and LCS/LCSD includes one set per analytical fraction (front half, back half and condensate).

[4] One set of media blank archived at laboratory at media preparation.

[5] Actual number of samples collected in field.

[6] Not applicable.

Table 1-2
Sampling Plan for Division Stack

Sampling Point & Location	**Division Stack**				
Number of Tests:	3 (3 Division Stack)				
Parameters To Be Tested:	HFPO Dimer Acid (HFPO-DA)	Volumetric Flow Rate and Gas Velocity	Carbon Dioxide	Oxygen	Water Content
Sampling or Monitoring Method	EPA M-0010	EPA M1, M2, M3A, and M4 in conjunction with M-0010 tests	EPA M3/3A		EPA M4 in conjunction with M-0010 tests
Sample Extraction/ Analysis Method(s):	LC/MS/MS	NA[6]	NA		NA
Sample Size	≥ 1.5m^3	NA	NA	NA	NA
Total Number of Samples Collected[1]	3	3	3	3	3
Reagent Blanks (Solvents, Resins)[1]	1 set	0	0	0	0
Field Blank Trains[1]	1 per source	0	0	0	0
Proof Blanks[1]	1 per train	0	0	0	0
Trip Blanks[1,2]	1 set	0	0	0	
Lab Blanks	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Samples (LCS)	1 per fraction[3]	0	0	0	0
Laboratory or Batch Control Spike Sample Duplicate (LCSD)	1 per fraction[3]	0	0	0	0
Media Blanks	1 set[4]	0	0	0	0
Isotope Dilution Internal Standard Spikes	Each sample	0	0	0	0
Total No. of Samples	4[5]	3	3	3	3

Key:

[1] Sample collected in field.

[2] Trip blanks include one XAD-2 resin module and one methanol sample per sample shipment.

[3] Lab blank and LCS/LCSD includes one set per analytical fraction (front half, back half and condensate).

[4] One set of media blank archived at laboratory at media preparation.

[5] Actual number of samples collected in field.

[6] Not applicable.

2. SUMMARY OF TEST RESULTS

A total of three test runs each were performed on the VEN Carbon Bed inlet and outlet and Division stack. Table 2-1 provides a summary of the HFPO Dimer Acid emissions test results and Carbon Bed removal efficiencies. Detailed test results summaries are provided in Section 6.

It is important to note that emphasis is being placed on the characterization of the emissions based on the stack test results. Research conducted in developing the protocol for stack testing HFPO Dimer Acid Fluoride, HFPO Dimer Acid Ammonium Salt and HFPO Dimer Acid realized that the resulting testing, including collection of the air samples and extraction of the various fraction of the sampling train, would result in all three compounds being expressed as simply the HFPO Dimer Acid. However, it should be understood that the total HFPO Dimer Acid results provided in Table 2-1 and in this report include a percentage of each of the three compounds.

Table 2-1
Summary of HFPO Dimer Acid VEN Carbon Bed and Division Stack Test Results

	Inlet		Outlet		Removal Efficiency	Division Stack	
	g/sec	lb/hr	g/sec	lb/hr	%	g/sec	lb/hr
R1	7.75E-02	6.16E-01	7.84E-04	6.23E-03	99.0	1.03E-03	8.20E-03
R2	6.23E-03	4.95E-02	3.74E-04	2.97E-03	94.0	6.50E-04	5.16E-03
R3	1.13E-02	8.98E-02	8.67E-04	6.89E-03	92.3	1.36E-03	1.08E-02
Average	3.17E-02	2.52E-01	6.75E-04	5.36E-03	95.1	1.01E-03	8.05E-03

3. PROCESS DESCRIPTIONS

The Fluoromonomers area is included in the scope of this test program.

3.1 FLUOROMONOMERS

These facilities produce a family of fluorocarbon compounds used to produce Chemours products such as Nafion®, Krytox®, and Viton®, as well as sales to outside customers.

Process emissions are vented to the Division waste gas scrubber system (which includes the secondary scrubber) and vents to the Carbon Bed and then onto the Division Stack. The VE North building air systems are vented to the carbon bed and then onto the Division Stack.

3.2 PROCESS OPERATIONS AND PARAMETERS

The following table is a summary of the operation and products from the specific areas tested.

Source	Operation/Product	Batch or Continuous
VE North	PPVE	Condensation is continuous. Agitated Bed Reactor and Refining are batch.

During the test program, the following parameters were monitored by Chemours and are included in Appendix A.

- Fluoromonomers Process
  - VEN Precurser Rate
  - VEN Condensation Rate
  - VEN ABR Rate

4. DESCRIPTION OF TEST LOCATIONS

4.1 DIVISION STACK

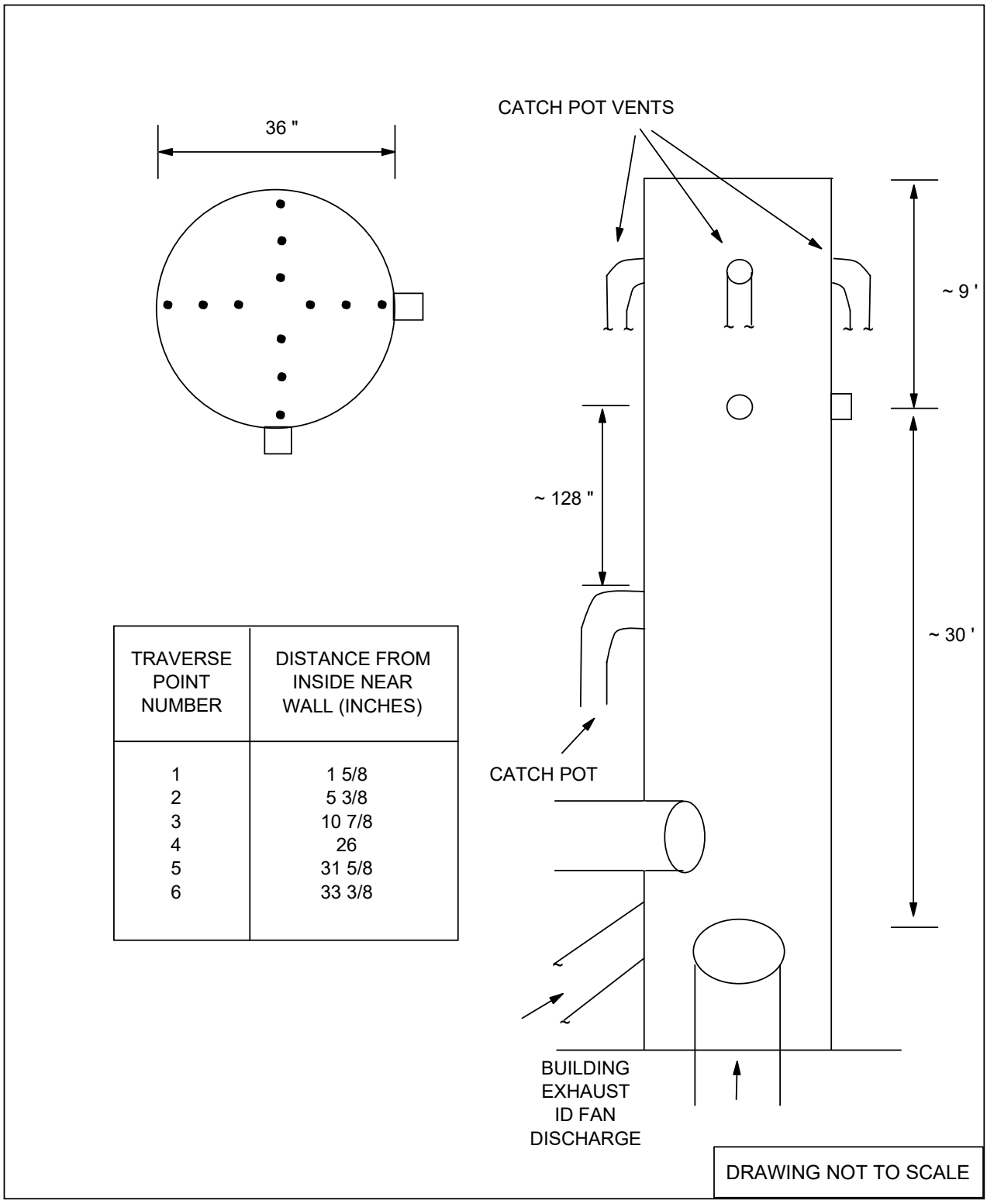
Two 6-inch ID test ports were installed on the 36-inch ID fiberglass stack as shown below. The four vents that enter the top of the stack and the one vent ~11 feet below are catch pots which, under normal process operations, do not discharge to the stack. They are used to vent process gas to the stack in the event of a process upset and are not considered a flow contributor or a disturbance.

Per EPA Method 1, a total of 12 traverse points (six per axis) were used for M-0010 isokinetic sampling. Figure 4-1 provides a schematic of the test ports and traverse point locations.

4.2 VINYL ETHERS NORTH CARBON BED INLET AND OUTLET

Each fiberglass reinforced plastic (FRP) duct at the inlet and outlet of the carbon bed is 34-inch ID. The test ports are located as shown below. Based on EPA Method 1, a total of 24 traverse points (12 per port) were required for HFPO Dimer Acid sampling at both locations. Figure 4-2 provides a schematic of the test port and traverse port locations.

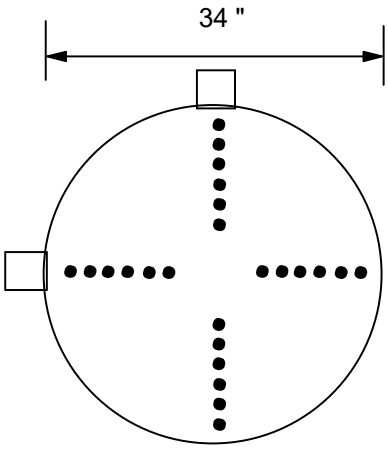
Location	Distance from Flow Disturbance	
	Downstream (B)	Upstream (A)
Carbon Bed Inlet	67 inches > 1.9 duct diameters	61 inches > 1.8 duct diameters
Carbon Bed Outlet	58 inches > 1.7 duct diameters	57 inches > 1.5 duct diameters
Division Stack	30 feet > 10 duct diameters	9 feet > 3 diameters



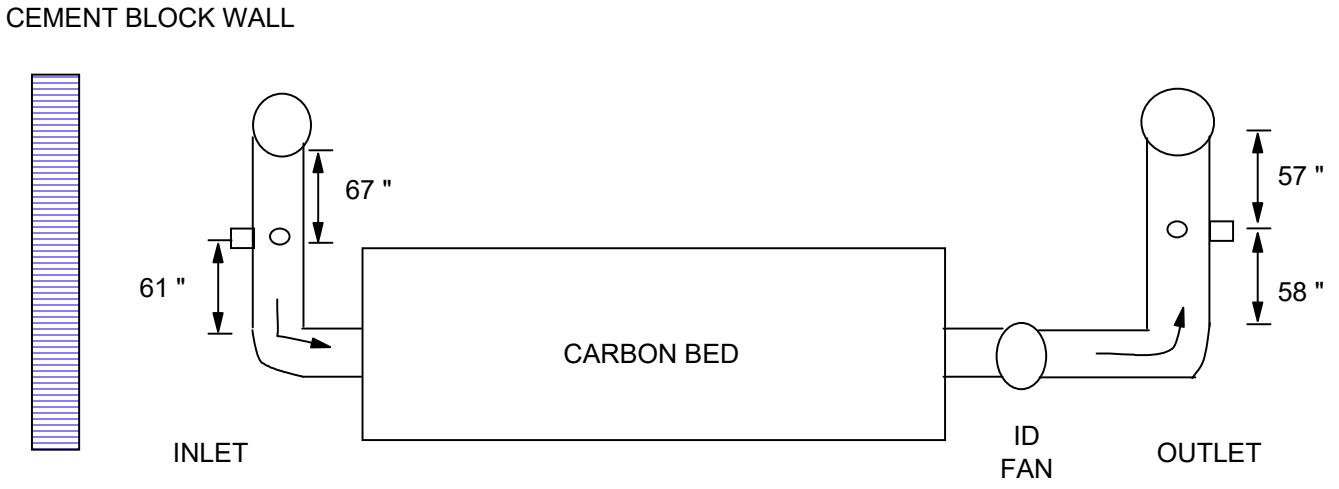
TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	1 5/8
2	5 3/8
3	10 7/8
4	26
5	31 5/8
6	33 3/8

FIGURE 4-1
DIVISION STACK TEST PORT
AND TRAVERSE POINT LOCATIONS

IASDATA\CHEMOURS\15418.002.011\FIGURE 4-1 DIVISION STACK



TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE NEAR WALL (INCHES)
1	3/4
2	2 1/4
3	4
4	6
5	8 1/2
6	12 1/8
7	21 5/8
8	25 1/2
9	28
10	30
11	31 3/4
12	33 1/4



DRAWING NOT TO SCALE

FIGURE 4-2
VE NORTH PROCESS CARBON BED INLET AND OUTLET SCHEMATIC

IASDATA\CHEMOURS\15418.002.011\FIGURE 4-2 VE NORTH PROCESS SCHEMATIC

5. SAMPLING AND ANALYTICAL METHODS

5.1 STACK GAS SAMPLING PROCEDURES

The purpose of this section is to describe the stack gas emissions sampling trains and to provide details of the stack sampling and analytical procedures utilized during the emissions test program.

5.1.1 Pre-Test Determinations

Preliminary test data were obtained at each test location. Stack geometry measurements were measured and recorded, and traverse point distances verified. A preliminary velocity traverse was performed utilizing a calibrated S-type pitot tube and an inclined manometer to determine velocity profiles. Flue gas temperatures were observed with a calibrated direct readout panel meter equipped with a chromel-alumel thermocouple. Preliminary water vapor content was estimated by wet bulb/dry bulb temperature measurements.

A check for the presence or absence of cyclonic flow was previously conducted at each test location. The cyclonic flow checks were negative (< 20°) verifying that the test locations were acceptable for testing.

Preliminary test data was used for nozzle sizing and sampling rate determinations for isokinetic sampling procedures.

Calibration of probe nozzles, pitot tubes, metering systems, and temperature measurement devices was performed as specified in Section 5 of EPA Method 5 test procedures.

5.2 STACK PARAMETERS

5.2.1 EPA Method 0010

The sampling train utilized to perform the HFPO Dimer Acid sampling at all three locations was an EPA Method 0010 train (see Figure 5-1). The Method 0010 consisted of a borosilicate nozzle that attached directly to a heated borosilicate probe. In order to minimize possible thermal degradation of the HFPO Dimer Acid, the probe and particulate filter were heated above stack temperature to minimize water vapor condensation before the filter. The probe was connected directly to a heated borosilicate filter holder containing a solvent extracted glass fiber filter.

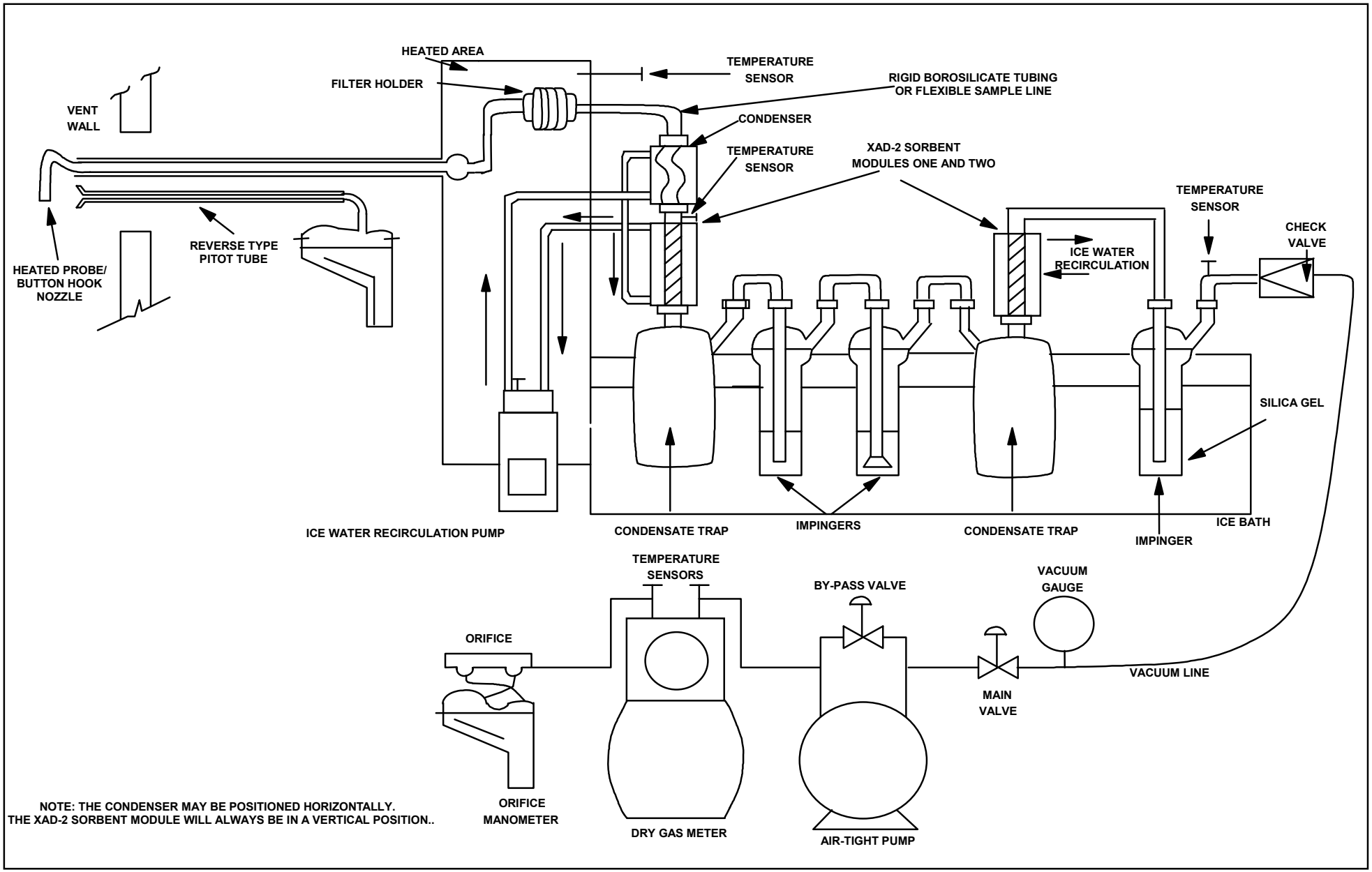


FIGURE 5-1
EPA METHOD 0010 SAMPLING TRAIN

IASDATA\CHEMOURS\15418.002.011\FIGURE 5-1 METHOD 0010

A section of borosilicate glass or flexible polyethylene tubing connected the filter holder exit to a Grahm (spiral) type ice water-cooled condenser, an ice water-jacketed sorbent module containing approximately 40 grams of XAD-2 resin. The XAD-2 resin tube was equipped with an inlet temperature sensor. The XAD-2 resin trap was followed by a condensate knockout impinger and a series of two impingers that contained 100 mL of high-purity distilled water. The train also included a second XAD-2 resin trap behind the impinger section to evaluate possible sampling train breakthrough. Each XAD-2 resin trap was connected to a 1-liter condensate knockout trap. The final impinger contained 300 grams of dry pre-weighed silica gel. All impingers and the condensate traps were maintained in an ice bath. Ice water was continuously circulated in the condenser and both XAD-2 modules to maintain method-required temperature. A control console with a leakless vacuum pump, a calibrated orifice, and dual inclined manometers was connected to the final impinger via an umbilical cord to complete the sample train.

HFPO Dimer Acid Fluoride (CAS No. 2062-98-8) that is present in the stack gas is expected to be captured in the sampling train along with HFPO Dimer Acid (CAS No. 13252-13-6). HFPO Dimer Acid Fluoride underwent hydrolysis instantaneously in water in the sampling train and during the sample recovery step, and was converted to HFPO Dimer Acid such that the amount of HFPO Dimer Acid emissions represented a combination of both HFPO Dimer Acid Fluoride and HFPO Dimer Acid.

During sampling, gas stream velocities were measured by attaching a calibrated S-type pitot tube into the gas stream adjacent to the sampling nozzle. The velocity pressure differential was observed immediately after positioning the nozzle at each traverse point, and the sampling rate adjusted to maintain isokineticity at 100% ± 10. Flue gas temperature was monitored at each point with a calibrated panel meter and thermocouple. Isokinetic test data was recorded at each traverse point during all test periods, as appropriate. Leak checks were performed on the sampling apparatus according to reference method instructions, prior to and following each run, component change (if required) or during midpoint port changes.

5.2.2 EPA Method 0010 Sample Recovery

At the conclusion of each test, the sampling train was dismantled, the openings sealed, and the components transported to the field laboratory trailer for recovery.

A consistent procedure was employed for sample recovery:

1. The two XAD-2 covered (to minimize light degradation) sorbent modules (1 and 2) were sealed and labeled.

2. The glass fiber filter(s) were removed from the holder with tweezers and placed in a polyethylene container along with any loose particulate and filter fragments.

3. The particulate adhering to the internal surfaces of the nozzle, probe and front half of the filter holder were rinsed with a solution of methanol and ammonium hydroxide into a polyethylene container while brushing a minimum of three times until no visible particulate remained. Particulate adhering to the brush was rinsed with methanol/ ammonium hydroxide into the same container. The container was sealed.

4. The volume of liquid collected in the first condensate trap was measured, the value recorded, and the contents poured into a polyethylene container.

5. All train components between the filter exit and the first condensate trap were rinsed with methanol/ammonium hydroxide. The solvent rinse was placed in a separate polyethylene container and sealed.

6. The volume of liquid in impingers one and two, and the second condensate trap, were measured, the values recorded, and the sample was placed in the same container as Step 4 above, then sealed.

7. The two impingers, condensate trap, and connectors were rinsed with methanol/ ammonium hydroxide. The solvent sample was placed in a separate polyethylene container and sealed.

8. The silica gel in the final impinger was weighed and the weight gain value recorded.

9. Site (reagent) blank samples of the methanol/ammonium hydroxide, XAD resin, filter and distilled water were retained for analysis.

Each container was labeled to clearly identify its contents. The height of the fluid level was marked on the container of each liquid sample to provide a reference point for a leakage check during transport. All samples were maintained cool.

During the Carbon Bed inlet and outlet test campaign, a Method 0010 blank train was set up near the test location, leak-checked and recovered along with the respective sample train. Following sample recovery, all samples were transported to TestAmerica Laboratories, Inc. (TestAmerica) for sample extraction and analysis.

See Figure 5-2 for a schematic of the Method 0010 sample recovery process.

5.2.3 EPA Method 0010 Sample Analysis

Method 0010 sampling trains resulted in four separate analytical fractions for HFPO Dimer Acid analysis according to SW-846 Method 3542:

- Front-half Composite—comprised of the particulate filter, and the probe, nozzle, and front-half of the filter holder solvent rinses;
- Back-half Composite—comprised of the first XAD-2 resin material and the back-half of the filter holder with connecting glassware solvent rinses;
- Condensate Composite—comprised of the aqueous condensates and the contents of impingers one and two with solvent rinses;
- Breakthrough XAD-2 Resin Tube—comprised of the resin tube behind the series of impingers.

The second XAD-2 resin material was analyzed separately to evaluate any possible sampling train HFPO-DA breakthrough.

The front-half and back-half composites and the second XAD-2 resin material were placed in polypropylene wide-mouth bottles and tumbled with methanol containing 5% NH_4OH for 18 hours. Portions of the extracts were processed analytically for the HFPO dimer acid by liquid chromatography and duel mass spectroscopy (HPLC/MS/MS). The condensate composite was concentrated onto a solid phase extraction (SPE) cartridge followed by desorption from the cartridge using methanol. Portions of those extracts were also processed analytically by HPLC/MS/MS.

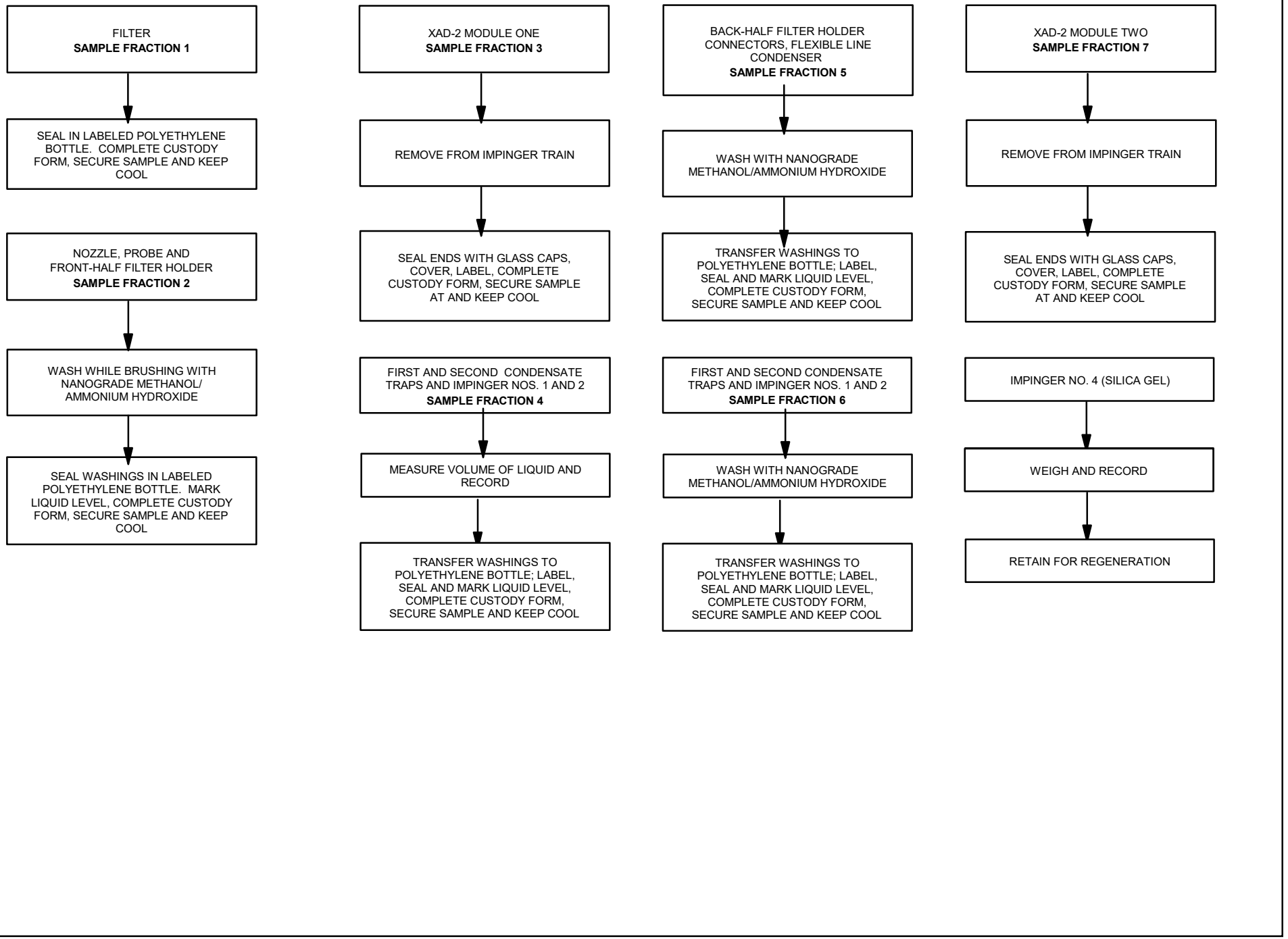


FIGURE 5-2
HFPO DIMER ACID SAMPLE RECOVERY PROCEDURES FOR METHOD 0010

IASDATA\CHEMOURS\15418.002.011\FIGURE 5-2 EPA 0010

Samples were spiked with isotope dilution internal standard (IDA) at the commencement of their preparation to provide accurate assessments of the analytical recoveries. Final data was corrected for IDA standard recoveries.

TestAmerica developed detailed procedures for the sample extraction and analysis for HFPO Dimer Acid. These procedures were incorporated into the test protocol.

5.3 GAS COMPOSITION

The Weston mobile laboratory equipped with instrumental analyzers was used to measure carbon dioxide (CO_2) and oxygen (O_2) concentrations. A diagram of the Weston sampling system is presented in Figure 5-3.

For the Division stack test campaign, the sample was collected at the exhaust of the Method 0010 sampling system. At the end of the line, a tee permitted the introduction of calibration gas. The sample was drawn through a heated Teflon® sample line to the sample conditioner. The output from the sampling system was recorded electronically, and one minute averages were recorded and displayed on a data logger.

Each analyzer was set up and calibrated internally by introduction of calibration gas standards directly to the analyzer from a calibration manifold. The calibration manifold is designed with an atmospheric vent to release excess calibration gas and maintained the calibration at ambient pressure. The direct calibration sequence consisted of alternate injections of zero and mid-range gases with appropriate adjustments until the desired responses were obtained. The high-range standards were then introduced in sequence without further adjustment.

The sample line integrity was verified by performing a bias test before and after each test period. The sampling system bias test consisted of introducing the zero gas and one up-range calibration standard in excess to the valve at the probe end when the system was sampling normally. The excess calibration gas flowed out through the probe to maintain ambient sampling system pressure. Calibration gas supply was regulated to maintain constant sampling rate and pressure. Instrument bias check response was compared to internal calibration responses to insure sample line integrity and to calculate a bias correction factor after each run using the ratio of the measured concentration of the bias gas certified by the calibration gas supplier.

The oxygen and carbon dioxide content of each stack gas was measured according to EPA Method 3A procedures which incorporate the latest updates of EPA Method 7E. A Servomex Model 4900 analyzer (or equivalent) was used to measure oxygen content. A Servomex Model 4900 analyzer (or equivalent) was used to measure carbon dioxide content of the stack gas. Both analyzers were calibrated with EPA Protocol gases prior to the start of the test program and performance was verified by sample bias checks before and after each test run.

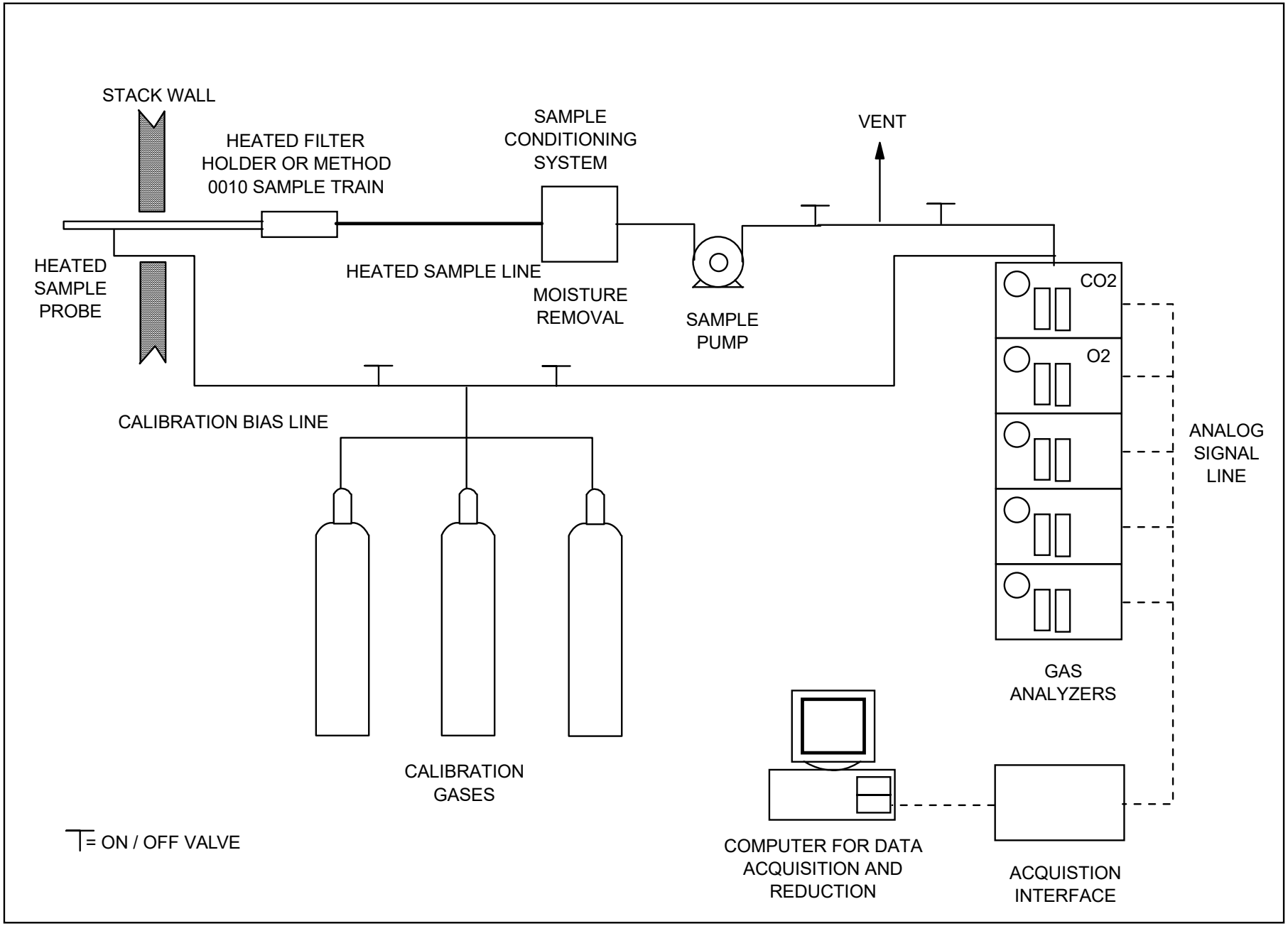


FIGURE 5-3
WESTON SAMPLING SYSTEM

IASDATA\CHEMOURS\15418.002.011\FIGURE 5-3 WESTON SAMPLING SYSTEM2

6. DETAILED TEST RESULTS AND DISCUSSION

Each test was a minimum of 96 minutes in duration. A total of three test runs were performed at each location.

Tables 6-1 through 6-3 provide detailed test data and test results for the Carbon Bed inlet, the Carbon Bed outlet and the Division stack, respectively.

The Method 3A sampling on all sources indicated that the O_2 and CO_2 concentrations were at ambient air levels (20.9% O_2, 0% CO_2), therefore, 20.9% O_2 and 0% CO_2 values were used in all calculations.

The carbon bed removal efficiency was calculated based upon the HFPO Dimer Acid inlet and outlet mass emission rates in lb/hr.

TABLE 6-1
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
CARBON BED INLET

Test Data			
Run number	1	2	3
Location	CBed Inlet	CBed Inlet	CBed Inlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.215	0.215	0.215
Cross sectional nozzle area, sq.ft.	0.000252	0.000252	0.000252
Barometric pressure, in. Hg	30.02	30.06	30.06
Avg. orifice press. diff., in H_2O	1.01	0.92	1.11
Avg. dry gas meter temp., deg F	78.0	53.5	64.5
Avg. abs. dry gas meter temp., deg. R	538	513	525
Total liquid collected by train, ml	30.1	24.6	31.7
Std. vol. of H_2O vapor coll., cu.ft.	1.4	1.2	1.5
Dry gas meter calibration factor	1.0001	0.9920	0.9920
Sample vol. at meter cond., dcf	57.651	49.926	55.610
Sample vol. at std. cond., dscf [(1)]	56.888	51.262	55.917
Percent of isokinetic sampling	109.4	100.4	99.6
GAS STREAM COMPOSITION DATA:			
CO_2, % by volume, dry basis	0.0	0.0	0.0
O_2, % by volume, dry basis	20.9	20.9	20.9
N_2, % by volume, dry basis	79.1	79.1	79.1
Molecular wt. of dry gas, lb/lb mole	28.84	28.84	28.84
H_20 vapor in gas stream, prop. by vol.	0.024	0.022	0.026
Mole fraction of dry gas	0.976	0.978	0.974
Molecular wt. of wet gas, lb/lb mole	28.57	28.60	28.55
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	-6.50	-6.50	-6.50
Absolute pressure, in. Hg	29.54	29.58	29.58
Avg. temperature, deg. F	83	62	69
Avg. absolute temperature, deg.R	543	522	529
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	38.3	36.0	40.2
Stack/duct cross sectional area, sq.ft.	6.31	6.31	6.31
Avg. gas stream volumetric flow, wacf/min.	14478	13610	15217
Avg. gas stream volumetric flow, dscf/min.	13551	13300	14624

[(1)] Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 in Hg (760 mm Hg)

TABLE 6-1 (cont.)
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
CARBON BED INLET

TEST DATA			
Run number	1	2	3
Location	CBed Inlet	CBed Inlet	CBed Inlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	19542.00	1442.31	2596.11
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	12128.59	993.39	1639.22
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	7.57E-07	6.20E-08	1.02E-07
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	6.16E-01	4.95E-02	8.98E-02
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	7.75E-02	6.23E-03	1.13E-02

TABLE 6-2
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
CARBON BED OUTLET

Test Data			
Run number	1	2	3
Location	CBed Outlet	CBed Outlet	CBed Outlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1529	0852-1052	1510-1709
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.215	0.215	0.215
Cross sectional nozzle area, sq.ft.	0.000252	0.000252	0.000252
Barometric pressure, in. Hg	30.02	30.06	30.06
Avg. orifice press. diff., in H_2O	1.43	1.38	1.46
Avg. dry gas meter temp., deg F	80.5	51.8	66.4
Avg. abs. dry gas meter temp., deg. R	541	512	526
Total liquid collected by train, ml	38.0	29.8	40.1
Std. vol. of H_2O vapor coll., cu.ft.	1.8	1.4	1.9
Dry gas meter calibration factor	1.0027	1.0027	1.0027
Sample vol. at meter cond., dcf	60.365	57.418	59.954
Sample vol. at std. cond., dscf [(1)]	59.509	59.852	60.776
Percent of isokinetic sampling	104.4	103.3	102.2
GAS STREAM COMPOSITION DATA:			
CO_2, % by volume, dry basis	0.0	0.0	0.0
O_2, % by volume, dry basis	20.9	20.9	20.9
N_2, % by volume, dry basis	79.1	79.1	79.1
Molecular wt. of dry gas, lb/lb mole	28.84	28.84	28.84
H_20 vapor in gas stream, prop. by vol.	0.029	0.023	0.030
Mole fraction of dry gas	0.971	0.977	0.970
Molecular wt. of wet gas, lb/lb mole	28.52	28.59	28.51
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	3.50	3.50	3.50
Absolute pressure, in. Hg	30.28	30.32	30.32
Avg. temperature, deg. F	86	68	72
Avg. absolute temperature, deg.R	546	528	532
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	24	24	24
Avg. gas stream velocity, ft./sec.	41.3	40.3	42.0
Stack/duct cross sectional area, sq.ft.	6.31	6.31	6.31
Avg. gas stream volumetric flow, wacf/min.	15630	15245	15895
Avg. gas stream volumetric flow, dscf/min.	14856	15097	15491

[(1)] Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 in Hg (760 mm Hg)

TABLE 6-2 (cont.)
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
CARBON BED OUTLET

TEST DATA			
Run number	1	2	3
Location	CBed Outlet	CBed Outlet	CBed Outlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1529	0852-1052	1510-1709
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	188.630	89.00	204.25
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	111.91	52.50	118.66
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	6.99E-09	3.28E-09	7.41E-09
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	6.23E-03	2.97E-03	6.89E-03
HFPO Dimer Acid (From Inlet Data)	6.16E-01	4.95E-02	8.98E-02
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	7.84E-04	3.74E-04	8.67E-04
Carbon Bed Removal Efficiency, %	99.0	94.0	92.3

TABLE 6-3
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
DIVISION STACK

Test Data			
Run number	1	2	3
Location	Divison Stack	Divison Stack	Divison Stack
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
SAMPLING DATA:			
Sampling duration, min.	96.0	96.0	96.0
Nozzle diameter, in.	0.160	0.160	0.160
Cross sectional nozzle area, sq.ft.	0.000140	0.000140	0.000140
Barometric pressure, in. Hg	29.92	29.96	29.96
Avg. orifice press. diff., in H_2O	1.34	1.39	1.42
Avg. dry gas meter temp., deg F	80.6	46.5	58.5
Avg. abs. dry gas meter temp., deg. R	541	507	519
Total liquid collected by train, ml	30.7	26.7	20.6
Std. vol. of H_2O vapor coll., cu.ft.	1.4	1.3	0.97
Dry gas meter calibration factor	1.0010	1.0010	1.0010
Sample vol. at meter cond., dcf	51.535	51.014	51.633
Sample vol. at std. cond., dscf [(1)]	50.532	53.465	52.864
Percent of isokinetic sampling	97.5	98.9	97.3
GAS STREAM COMPOSITION DATA:			
CO_2, % by volume, dry basis	0.1	0.0	0.0
O_2, % by volume, dry basis	21.0	21.0	21.2
N_2, % by volume, dry basis	79.1	79.1	79.1
Molecular wt. of dry gas, lb/lb mole	28.84	28.84	28.84
H_20 vapor in gas stream, prop. by vol.	0.028	0.023	0.018
Mole fraction of dry gas	0.972	0.977	0.982
Molecular wt. of wet gas, lb/lb mole	28.53	28.59	28.64
GAS STREAM VELOCITY AND VOLUMETRIC FLOW DATA:			
Static pressure, in. H_2O	-0.70	-0.70	-0.70
Absolute pressure, in. Hg	29.87	29.91	29.91
Avg. temperature, deg. F	83	63	69
Avg. absolute temperature, deg.R	543	523	529
Pitot tube coefficient	0.84	0.84	0.84
Total number of traverse points	12	12	12
Avg. gas stream velocity, ft./sec.	68.3	68.2	69.0
Stack/duct cross sectional area, sq.ft.	7.07	7.07	7.07
Avg. gas stream volumetric flow, wacf/min.	28976	28913	29265
Avg. gas stream volumetric flow, dscf/min.	27357	28516	28665

[(1)] Standard conditions = 68 deg. F. (20 deg. C.) and 29.92 in Hg (760 mm Hg)

TABLE 6-3 (cont.)
CHEMOURS - FAYETTEVILLE, NC
SUMMARY OF HFPO DIMER ACID TEST DATA AND TEST RESULTS
DIVISION STACK

TEST DATA			
Run number	1	2	3
Location	Divison Stack	Divison Stack	Divison Stack
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
LABORATORY REPORT DATA, ug.			
HFPO Dimer Acid	114.45	73.19	150.62
EMISSION RESULTS, ug/dscm.			
HFPO Dimer Acid	79.97	48.33	100.60
EMISSION RESULTS, lb/dscf.			
HFPO Dimer Acid	4.99E-09	3.02E-09	6.28E-09
EMISSION RESULTS, lb/hr.			
HFPO Dimer Acid	8.20E-03	5.16E-03	1.08E-02
EMISSION RESULTS, g/sec.			
HFPO Dimer Acid	1.03E-03	6.50E-04	1.36E-03

APPENDIX A
PROCESS OPERATIONS DATA

Date	3/25/2019
Time	800 900 1000 1100 1200 1300 1400 1500 1600
Stack Testing	Run 1 (1315 -1528)
HPPO	
VEN Product	PPVE
VEN Precursor	
VEN Condensation (HPPO)	
VEN ABR	
VEN Refining	
Stripper Column Vent	
Division WGS Recirculation Flow	15000 kg/h
Division WGS Inlet Flow	234 kg/h

Date	3/26/2019
Time	800 900 1000 1100 1200 1300 1400 1500 1600 1700
Stack Testing	Run 2 (852 - 1052) Run 3 (1510-1709)
HPPO	
VEN Product	PPVE
VEN Precursor	
VEN Condensation (HPPO)	
VEN ABR	Burnout
VEN Refining	
Stripper Column Vent	
Division WGS Recirculation Flow	15000 kg/h
Division WGS Inlet Flow	120 kg/h 140 kg/h 95 kg/h 63 kg/h

APPENDIX B
RAW AND REDUCED TEST DATA

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
CARBON BED INLET

Test Data			
Run number	1	2	3
Location	CBed Inlet	CBed Inlet	CBed Inlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
Operator	RS/JL	RS/JL	RS/JL
Inputs For Calcs.			
Sq. rt. delta P	0.66432	0.63766	0.70790
Delta H	1.0125	0.9221	1.1071
Stack temp. (deg.F)	83.2	62.2	68.8
Meter temp. (deg.F)	78.0	53.5	64.5
Sample volume (act.)	57.651	49.926	55.610
Barometric press. (in.Hg)	30.02	30.06	30.06
Volume H_2O imp. (ml)	14.4	7.9	16.2
Weight change sil. gel (g)	15.7	16.7	15.5
% CO_2	0.0	0.0	0.0
% O_2	20.9	20.9	20.9
% N_2	79.1	79.1	79.1
Area of stack (sq.ft.)	6.305	6.305	6.305
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	-6.50	-6.50	-6.50
Nozzle dia. (in.)	0.215	0.215	0.215
Meter box cal.	1.0001	0.9920	0.9920
Cp of pitot tube	0.84	0.84	0.84
Traverse points	24	24	24

- starting points for each port

CB IN

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Page 1 of 1

		Stack Conditions	Assumed	Actual
Client	Chemours	% Moisture	2	
W.O.#	15418.002.011	Impinger Vol (ml)		
Project ID	Chemours	Silica gel (g)		
Mode/Source ID	Carbon Bed	CO2, % by Vol	0 ✓	
Samp. Loc. ID	IN	O2, % by Vol	20.9 ✓	
Run No.ID	1	Temperature (°F)	85	
Test Method ID	M0010	Meter Temp (°F)	80	
Date ID	25MAR2019	Static Press (in H_2O)	-6.5	-6.5 ✓
Source/Location	VE North Inlet	Ambient Temp (°F)	78°	
Sample Date	3-25-2019 ✓			
Baro. Press (in Hg)	30.02 ✓			
Operator	RS / SL ✓			

Meter Box ID	RS 24	27	
Meter Box Y	RS ~~.9944~~	1.0001	
Meter Box Del H	RS ~~1.9231~~	1.9213	
Probe ID / Length	P706 / P707	707	
Probe Material	Boro		
Pitot / Thermocouple ID	pitot = 699 /		
Pitot Coefficient	0.84	✓	
Nozzle ID	.215		
Nozzle Measurements	.215	.215	.215
Avg Nozzle Dia (in)	.215 ✓		
Area of Stack (ft^2)	6.305 ✓		
Sample Time	96 ✓		
Total Traverse Pts	24 ✓		

K Factor 2.32

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.005	0.007	0.012
Leak Check @ (in Hg)	15"	15"	5"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	~~yes / no~~ N/A	~~yes / no~~	~~yes / no~~
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	13:15 ✓			~~340.344~~									
A 1	4		.40	.92	342.6	84	76	119	120	65	2.5	39		
2	8		.38	.88	344.9	85	76	121	121	65	2	39		
3	12		.39	.90	347.1	84	77	122	121	65	2.5	40		
4	16		.39	.90	349.4	84	78	120	120	65	2.5	40		
5	20		.38	.88	351.6	84	78	121	122	64	2	38		
6	24		.36	.83	353.8	84	78	120	119	61	2	38		
7	28		.36	.83	356.0	84	78	119	120	59	2	37		27.65
8	32		.40	.92	358.3	84	78	120	121	57	2.5	37		
9	36		.44	1.0	360.7	84	80	122	120	58	2.5	38		
10	40		.48	1.1	363.2	83	79	121	120	57	3	38		
11	44		.49	1.1	365.6	84	80	119	120	57	3	38		
12	48	14:03	.49	1.1	~~368.997~~	84	80	121	120	58	3	38		DGM = 367.997
B 1	4	14:40	.48	1.1	370.5	82	78	121	120	59	3.5	39		
2	8		.45	1.0	373.4	82	78	121	122	54	3	38		
3	12		.45	1.0	375.7	83	78	121	120	53	3	37		
4	16		.42	.97	377.9	82	78	121	122	54	3	37		
5	20		.42	.97	380.4	82	77	122	121	55	3	37		1
6	24		44	1.0	382.7	83	78	122	121	55	3	37		29,000
7	28		.56	1.3	385.4	83	78	121	120	57	4	37		
8	32		.53	1.2	388.1	83	78	121	121	53	3.5	37		
9	36		.51	1.2	390.8	83	78	120	120	54	3.5	37		
10	40		.49	1.1	393.3	82	78	120	120	53	3,5	36		104.4
11	44		.47	1.1	395.9	82	78	121	121	54	3.5	37		
12	48	15:28 ✓	.45	1.0	398.257	82 ✓	78 ✓	120	119	54	3.5	37		2.4
			Avg Delta P .4429 ✓	Avg Delta H 1.0125 ✓	Total Volume 57.651 ✓	Avg Ts 83.208	Avg Tm 78.0416	Min/Max 119/122	Min/Max 119/122	Max 65	Max Vac 4	Min/Max 36/40		13550
			Avg Sqrt Delta P .664323 ✓	Avg Sqrt Del H 1.00448	Comments:									56.9

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

// midpoint leak check

DGM = ~~368.997~~ → 368.

PS 367.997 → 368.259

* .262 *

probe change at midpoint

CB IN

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.011
Project ID	Chemours
Mode/Source ID	Carbon Bed
Samp. Loc. ID	IN
Run No.ID	2
Test Method ID	M0010
Date ID	26-26MAR2019
Source/Location	VE North Inlet
Sample Date	3-26-2019
Baro. Press (in Hg)	30.06
Operator	RS / JL

Stack Conditions

	Assumed	Actual
% Moisture	3	
Impinger Vol (ml)		
Silica gel (g)		
CO2, % by Vol	0 ✓	
O2, % by Vol	20.9 ✓	
Temperature (°F)	60	
Meter Temp (°F)	60	
Static Press (in H_2O)	-6.5	-6.5 ✓
Ambient Temp (°F)	50	

Meter Box ID	A0 29		
Meter Box Y	.992 ✓		
Meter Box Del H	1.868		
Probe ID / Length	P 707	7	
Probe Material	Born		
Pitot / Thermocouple ID			
Pitot Coefficient	0.84 ✓		
Nozzle ID	.215		
Nozzle Measurements	.215	.215	.215
Avg Nozzle Dia (in)	.215 ✓		
Area of Stack (ft^2)	6.305 ✓		
Sample Time	96 ✓		
Total Traverse Pts	24 ✓		

K Factor 2.24

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.014	0.011	0.009
Leak Check @ (in Hg)	15"	5"	5"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	N/A yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	8:52	PS	PS	536.858									
A 1	4		~~.34~~ .36	~~.76~~ .80	538.8	58	51	120	119	46	3	44		
2	8		.42	.94	540.9	60	52	119	119	46	3.5	46		
3	12		.41	.91	543.0	60	52	120	121	47	3.5	46		
4	16		.43	.96	545.1	61	53	119	119	51	3.5	46		
5	20		.43	.96	547.2	62	53	119	119	53	3.5	46		
6	24		.44	.98	549.4	62	54	120	120	53	3.5	46		
7	28		.44	.98	551.6	62	54	120	121	54	3.5	46		25.478
8	32		.44	.98	553.8	62	54	120	120	55	3.5	46		
9	36		.45	1.0	555.9	62	54	120	120	55	3.5	46		
10	40		.42	.94	558.0	62	54	120	120	56	3.5	46		
11	44		.45	1.0	560.2	62	54	120	120	56	3.5	47		
12	48	9:40	.43	.96	562.336	62	54	120	120	56	3.5	47		
B 1	4	10:04	.32	.71	564.3	62	51	119	120	48	3	44		
2	8		.34	.76	566.3	63	52	120	120	48	3	39		
3	12		.30	.67	568.0	63	53	119	120	47	3	37		
4	16		.30	.67	569.8	63	53	120	121	48	3	37		
5	20		.27	.60	571.4	63	53	120	121	48	3	37		
6	24		.25	.56	573.2	63	53	121	119	47	2.5	37		24.448
7	28		.29	.65	574.8	63	54	121	120	47	3	37		
8	32		.52	1.2	577.2	64	55	120	120	47	4	38		
9	36		.58	1.3	579.7	64	55	120	120	47	4	38		
10	40		.56	1.3	582.2	63	55	120	121	48	4	38		
11	44		.53	1.2	584.5	63	55	120	120	49	4	38		
12	48	10:52	.50	1.1	586.908	63	55	120	120	49	4	39		
			Avg Delta P ✓ .4116 ✓	Avg Delta H ✓ .9220 ✓	Total Volume ✓ 49.926	Avg Ts ✓ 62.16 ✓	Avg Tm 53.45 ✓	Min/Max 119/121	Min/Max 119/121	Max 56	Max Vac 4	Min/Max 37/46		
			Avg Sqrt Delta P ✓ .63765 ✓	Avg Sqrt Del H ✓ .9540 ✓	Comments: ✓✓ mid point leak check									

EPA Method 0010 from EPA SW-846

WESTON

✓✓ JJD

✓✓ ✓✓

DGM = 562.336 → 562.460

* .124 *

100.4 Tm
2.2 %m
13300

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.011
Project ID	Chemours
Mode/Source ID	Carbon Bed
Samp. Loc. ID	IN
Run No.ID	3
Test Method ID	M0010
Date ID	26 28MAR2019
Source/Location	VE North Inlet
Sample Date	3-26-2019 ✓
Baro. Press (in Hg)	30.06
Operator	RS / SL ✓

Stack Conditions

	Assumed	Actual
% Moisture	3	
Impinger Vol (ml)		
Silica gel (g)		
CO2, % by Vol	0 ✓	
O2, % by Vol	20.9 ✓	
Temperature (°F)	70	
Meter Temp (°F)	65	
Static Press (in H_2O)	-6.5	-6.5 ✓
Ambient Temp (°F)	58	

Meter Box ID	Ac 29
Meter Box Y	.992 ✓
Meter Box Del H	1.868
Probe ID / Length	P707
Probe Material	Boro
Pitot / Thermocouple ID	P767
Pitot Coefficient	0.84
Nozzle ID	.215
Nozzle Measurements	.215 / .215 / .215
Avg Nozzle Dia (in)	.215 ✓
Area of Stack (ft^2)	6.305 ✓
Sample Time	96 ✓
Total Traverse Pts	24

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.010	0.003	0.008
Leak Check @ (in Hg)	15"	6"	6"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

K Factor 2.21

TRAVERSE POINT NO.		SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
		0	15:10 ✓			587.615									
A	1	4		.43	.95	589.7	67	59	119	121	55	4	40		
	2	8		.41	.90	591.8	68	59	120	119	52	3.5	37		
	3	12		.47	1.0	594.0	68	60	119	120	51	4	38		
	4	16		.53	1.2	596.4	68	61	120	120	52	4	38		
	5	20		.55	1.2	598.8	68	62	120	121	53	4	38		
	6	24		.54	1.2	601.3	68	62	120	121	54	4	38		
	7	28		.54	1.2	603.7	68	63	120	120	54	4	38		
	8	32		.60	1.3	606.1	68	64	120	120	54	4	39		
	9	36		.57	1.3	608.7	68	64	120	121	54	4.5	39		
	10	40		.65	1.4	611.3	68	65	120	120	53	4.5	39		
	11	44		.67	1.5	614.0	68	66	120	119	53	5	39		
	12	48	15:58	.68	1.5	616.746	68	66	120	119	54	5	40		
B	1	4	16:21	.43	.95	619.0	70	64	120	120	57	3.5	41		
	2	8		.43	.95	621.2	70	65	120	120	54	3.5	39		
	3	12		.43	.95	623.3	70	66	119	121	53	3.5	37		
	4	16		.40	.88	625.4	70	67	120	120	55	3	37		
	5	20		.38	.83	627.4	70	67	120	121	56	3	36		
	6	24		.39	.86	629.5	70	67	120	119	56	3.5	36		
	7	28		.50	1.1	631.8	70	67	121	119	57	4	37		
	8	32		.51	1.1	634.1	70	67	120	120	57	4	37		
	9	36		.51	1.1	636.5	70	67	120	120	57	4	37		
	10	40		.52	1.1	638.9	69	67	120	120	56	4	38		
	11	44		.50	1.1	641.1	69	67	120	120	56	4.5	37		
	12	48	17:09 ✓	.47	1.0	643.335	69	67	120	118	56	4	37		
				Avg Delta P .5045 ✓	Avg Delta H 1.1070 ✓	Total Volume 55.616 ✓	Avg Ts 68.83 ✓	Avg Tm 64.54 ✓	Min/Max 119/121	Min/Max 118/121	Max 57	Max Vac 5	Min/Max 36/41		
				Avg Sqrt Delta P .7079 ✓	Avg Sqrt Del H 1.0484 ✓										

Comments: midpoint leak check
DGM = 616.746 → 616.856
* .110 *

EPA Method 0010 from EPA SW-846

CB IN

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours	W.O. #	15418.002.011
Location/Plant	Fayetteville, NC	Source & Location	VE North Inlet

Run No. 1 — Sample Date 3/25/19 — Recovery Date 3/25/19

Sample I.D. Chemours - Carbon Bed - IN - 1 - M0010 - — Analyst JMO / KS — Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	0	105	103	0		312.8	297.5		315.7	
Initial	0	100	100	0		306.9	297.0		300	
Gain	0	5	3	0		5.9	.5	14.4	15.7	30.1

Impinger Color all clear — Labeled? ✓ — 14.4 ✓ ✓

Silica Gel Condition blue 85% — Sealed?

Run No. 2 — Sample Date 3/26/19 — Recovery Date 3/26/19

Sample I.D. Chemours - Carbon Bed - IN - 2 - M0010 - — Analyst JMO / KS — Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	2	103	100	0		307.7	303.5		316.7	
Initial	0	100	100	0		304.8	303.6		300	
Gain	2	3	0	0		2.9	0	7.9	16.7	24.6

Impinger Color all clear — Labeled? ✓ — ✓ ✓

Silica Gel Condition blue 90% — Sealed? ✓

Run No. 3 — Sample Date 3/26/19 — Recovery Date 3/26/19

Sample I.D. Chemours - Carbon Bed - IN - 3 - M0010 - — Analyst JMO / KS — Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	5	105	100	0		300.7	299.1		315.5	
Initial	0	100	100	0		294.5	299.1		300	
Gain	5	5	0	0		6.2	0	16.2	15.5	

Impinger Color all clear — Labeled? ✓ — ✓ ✓

Silica Gel Condition blue 90% — Sealed? ✓

Check COC for Sample IDs of Media Blanks

WESTON SOLUTIONS

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours	W.O. #	15418.002.011
Location/Plant	Fayetteville, NC	Source & Location	VE North Inlet

Run No. BT — Sample Date 3/26/2019 — Recovery Date 3/26/19

Sample I.D. Chemours - Carbon Bed - IN - BT - M0010 - — Analyst — Filter Number —

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	8.0	98	~~94~~ 96	2					300.2	
Initial	0	100	100	0					300	
Gain	8	-2	-4	2				4	0.2	4.2

Impinger Color Clear — Labeled? YES

Silica Gel Condition Good — Sealed? YES

Run No. BT — Sample Date — — Recovery Date —

Sample I.D. Chemours - Carbon Bed - IN - BT - M0010 - — Analyst — Filter Number —

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final										
Initial		100	100						300	
Gain										

Impinger Color — — Labeled? —

Silica Gel Condition — — Sealed? —

Run No. BT — Sample Date — — Recovery Date —

Sample I.D. Chemours - Carbon Bed - IN - BT - M0010 - — Analyst — Filter Number —

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final										
Initial		100	100						300	
Gain										

Impinger Color — — Labeled? —

Silica Gel Condition — — Sealed? —

Check COC for Sample IDs of Media Blanks

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
CARBON BED OUTLET

Test Data			
Run number	1	2	3
Location	CBed Outlet	CBed Outlet	CBed Outlet
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1529	0852-1052	1510-1709
Operator	KA/AS	KA/AS	KA/AS
Inputs For Calcs.			
Sq. rt. delta P	0.72388	0.71922	0.74565
Delta H	1.4258	1.3846	1.4621
Stack temp. (deg.F)	85.5	67.7	72.2
Meter temp. (deg.F)	80.5	51.8	66.4
Sample volume (act.)	60.365	57.418	59.954
Barometric press. (in.Hg)	30.02	30.06	30.06
Volume H_2O imp. (ml)	18.7	14.8	20.3
Weight change sil. gel (g)	19.3	15.0	19.8
% CO_2	0.0	0.0	0.0
% O_2	20.9	20.9	20.9
% N_2	79.1	79.1	79.1
Area of stack (sq.ft.)	6.305	6.305	6.305
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	3.50	3.50	3.50
Nozzle dia. (in.)	0.215	0.215	0.215
Meter box cal.	1.0027	1.0027	1.0027
Cp of pitot tube	0.84	0.84	0.84
Traverse points	24	24	24

CB OUT

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

		Stack Conditions	Assumed	Actual
Client	Chemours	% Moisture	4	
W.O.#	15418.002.011	Impinger Vol (ml)		
Project ID	Chemours	Silica gel (g)		
Mode/Source ID	Carbon Bed	CO2, % by Vol	0.0 ✓	
Samp. Loc. ID	OUT	O2, % by Vol	20.9 ✓	
Run No.ID	1	Temperature (°F)	80	85.5
Test Method ID	M0010	Meter Temp (°F)	67	80.5
Date ID	25MAR2019	Static Press (in H_2O)	3.5	3.5 ✓
Source/Location	VE North Outlet	Ambient Temp (°F)	76	
Sample Date	3/25/19 ✓			
Baro. Press (in Hg)	30.02 ✓			
Operator	KA/AS ✓			

Meter Box ID	28
Meter Box Y	1.0027 ✓
Meter Box Del H	2.0895
Probe ID / Length	~~P694~~ P710 6'
Probe Material	Boro
Pitot / Thermocouple ID	~~P694~~ P710
Pitot Coefficient	0.84 ✓
Nozzle ID	.215
Nozzle Measurements	.215 .215 ✓ .215
Avg Nozzle Dia (in)	.215 ✓
Area of Stack (ft^2)	6.305 ✓
Sample Time	96 ✓
Total Traverse Pts	24 ✓

Sample Train (ft^3)	0.017	0.010	0.015
Leak Check @ (In Hg)	15"	5"	6"
Pitot leak check good	(yes) / no	(yes) / no	(yes) / no
Pitot Inspection good	(yes) / no	(yes) / no	(yes) / no
Method 3 System good	yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

K Factor ~~KA 2.5~~ 2.6

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (In H2O)	ORIFICE PRESSURE Delta H (In H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (In Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1315 ✓			110.033									
A 1	4		~~.47.52~~ KA	~~6.2~~ 1.41 KA	112.5	86	78	120	120	66	3	66		
2	8		.57	1.5	115.2	86	79	121	121	64	3	59		
3	12		.52	1.4	117.7	87	80	121	120	62	3	55		
4	16		.47	1.2	120.1	86	80	119	120	59	3	55		
5	20		.52	1.4	122.7	86	80	121	119	56	3	53		
6	24		.57	1.5	125.3	KA ~~85~~ 86	80	120	121	58	3	55		29.622
7	28		.52	1.4	127.5	86	81	121	119	57	3	56		
8	32		.50	1.3	130.3	86	81	120	121	58	3	56		
9	36		.49	1.3	132.7	86	82	120	119	59	3	56		
10	40		.49	1.3	135.2	86	82	120	119	60	3	56		
11	44		.44	1.1	137.5	86	83	121	120	60	3	54		
12	48	1403	.39	1.0	139.655	86	83	121	119	60	3	52		139.717
														139.885 785
B 1	04	1440	.23	.60	141.5	84	81	121	121	65	1	55		0.068
2	4 8		.25	.65	~~143.2~~ KA 143.2	85	81	121	121	65	1	54		MPLC
3	8 12		.27	.70	145.0	85	81	121	120	63	1	53		
4	12 16		.30	.78	146.0	85	80	121	120	61	1	52		743
5	16 20		.33	.89	149.0	85	80	119	120	60	2	53		
KA 6	2024		.40	1.0	151.2	85	80	119	120	59	2	53		30.811
7	24 28		.74	1.9	154.0	85	80	120	121	59	5	52		
8	~~28~~ 32		.84	2.2	157.2	85	80	121	120	58	5	52		
9	~~32~~ 36		.90	2.3	160.5	85	80	121	119	57	5	53		
10	36 40		.94	2.4	163.6	KA 85	80	120	121	59	5	55		124.164
11	~~40~~ 44		.95	~~2.5~~ 2.42.5	167.2	~~85~~ 85	80	119	120	61	5	55		
12	48	1528 ✓	.95 KA	~~2.5~~ 2.425	170.528	85	80	121	120	63	5	56		2.91
			Avg Delta P ✓	Avg Delta H ✓	Total Volume	Avg Ts ✓	Avg Tm ✓	Min/Max	Min/Max	Max	Max Vac	Min/Max		
			.546 ✓	1.426 ✓	60.495	85.5 ✓	80.5 ✓	119/121	119/121	66	5	52/66		14860
			Avg Sqrt Delta P	Avg Sqrt Del H ✓	Comments:									
			~~.729~~ .72388 ✓✓	1.179 ✓✓	60.365 ✓✓									59.6

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

CB OUT

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

		Stack Conditions	Assumed	Actual
Client	Chemours			
W.O.#	15418.002.011			
Project ID	Chemours	% Moisture	2	
Mode/Source ID	Carbon Bed	Impinger Vol (ml)		
Samp. Loc. ID	OUT	Silica gel (g)		
Run No.ID	2	CO2, % by Vol	0.0 ✓	
Test Method ID	M0010	O2, % by Vol	20.9 ✓	
Date ID	25MAR2019	Temperature (°F)	73	67.667
Source/Location	VE North Outlet	Meter Temp (°F)	65	54.792
Sample Date	3/26/19 ✓	Static Press ($in H_2O$)	3.5	3.5 ✓
Baro. Press (in Hg)	KA 30.06 ✓	Ambient Temp (°F)	49	
Operator	KA/AS ✓			

Meter Box ID	28		
Meter Box Y	1.0027 ✓		
Meter Box Del H	2.0895		
Probe ID / Length	P710	6'	Sample Train (ft^3)
Probe Material	Boro		Leak Check @ (in Hg)
Pitot / Thermocouple ID	P710		Pitot leak check good
Pitot Coefficient	0.84 ✓		Pitot Inspection good
Nozzle ID	.215		Method 3 System good
Nozzle Measurements	.215	.215 .215	Temp Check
Avg Nozzle Dia (in)	.215 ✓		Meter Box Temp
Area of Stack (ft^2)	6.305 ✓		Reference Temp
Sample Time	96 ✓		Pass/Fail (+/- 2°)
Total Traverse Pts	24 ✓		Temp Change Response ?

K Factor 2.5

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.009	.010	0.011
Leak Check @ (in Hg)	15"	5"	7"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	yes / no	yes / no	yes / no
	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	0852 ✓			176.708									
A 1	4		.50	1.3	174.1	67	51	121	119	48	3	46		
2	8		.50	1.3	176.5	67	51	120	121	46	3	46		
3	12		.48	1.2	178.9	68	51	120	119	45	3	45		
4	16		.50	1.3	181.2	68	51	119	118	45	3	41		
5	20		.51	1.3	183.6	68	51	119	120	44	3	40		
6	24		.50	KA 1.2 1.3	186.0	68	51	120	120	44	3	40		23.544
7	28		.51	1.3	188.4	68	51	120	120	44	3	40		
8	32		.52	1.3	190.8	68	52	121	120	45	3	40		
9	36		.50	1.3	193.2	68	52	119	121	45	3	41		
10	40		.49	1.2	195.5	68	52	120	119	45	3	41		
11	44		.52	1.3	197.9	68	52	121	121	43	3	41		
12	48	0940	.50	1.3	200.252	68	52	122	119	43	3	41		MPLC
														200.373
B 1	4	1004	.22	.55	202.0	62	51	121	119	45	1	42		0.121
2	8		.24	~~.60~~ KA .60	203.6	68	52	120	120	43	1	39		
3	12		.24	.60	205.3	68	51	120	121	44	1	40		
4	16		.20	.50	206.8	68	52	120	119	44	1	40		
5	20		.19	.48	208.2	68	52	119	120	45	1	41		
6	24		~~.17~~ .44	~~.43~~ 1.1	210.2	68	52	120	121	45	1	41		#Blew out P. ports
7	28		.78	2.0	213.1	68	52	120	120	43	4	40		
8	32		.87	2.2	216.2	68	52	121	120	42	5	41		
9	36		.94	2.4	219.4	68	53	119	119	43	5	41		28.874
10	40		.95	2.4	222.6	68	53	119	120	44	5	41		
11	44		1.0	2.5	225.7	68	53	120	120	44	5	41		
12	48	1052 ✓	1.0	2.5	229.247	68	53	121	120	44	5	41		
			Avg Delta P ✓ .546	Avg Delta H ✓ 1.385	Total Volume 57.418 ✓	Avg Ts ✓ 67.667	Avg Tm ✓ 51.792 ✓	Min/Max 119/121	Min/Max 119/121	Max 48	Max Vac 5	Min/Max 46		
			Avg Sqrt Delta P ✓ .71922 ✓	Avg Sqrt Del H ✓ 1.145 ✓	Comments:									

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

103.3 ID
2.3%
15040 dscf

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.011
Project ID	Chemours
Mode/Source ID	Carbon Bed
Samp. Loc. ID	OUT
Run No.ID	3
Test Method ID	M0010
Date ID	25MAR2019
Source/Location	VE North Outlet
Sample Date	3/26/19 ✓
Baro. Press (In Hg)	30.06 ✓
Operator	KA/AS ✓

Stack Conditions

	Assumed	Actual
% Moisture	2	
Impinger Vol (ml)		
Silica gel (g)		
CO2, % by Vol	0.0 ✓	
O2, % by Vol	20.9 ✓	
Temperature (°F)	82	72.208
Meter Temp (°F)	69	66.375
Static Press (in H_2O)	3.5	3.5
Ambient Temp (°F)	55	

Meter Box ID	28		
Meter Box Y	1.0027 ✓		
Meter Box Del H	2.0895		
Probe ID / Length	P710	6'	
Probe Material	Boro		
Pitot / Thermocouple ID	P710		
Pitot Coefficient	0.84 ✓		
Nozzle ID	.215		
Nozzle Measurements	.215	.215	.215
Avg Nozzle Dia (in)	.215 ✓		
Area of Stack (ft^2)	6.305 ✓		
Sample Time	96 ✓		
Total Traverse Pts	24 ✓		

K Factor 2.5

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.011	0.002	0.008
Leak Check @ (in Hg)	5"	5"	5"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp			
Reference Temp			
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1510 ✓			229.614									
A 1	4		.50	1.3	232.1	71	62	119	119	62	3	47		
2	8		.49	1.2	234.4	72	62	121	121	58	3	45		
3	12		.52	1.3	236.9	72	63	120	120	53	3	39		
4	16		~~.48.60 KA~~	~~1.2 KA.3~~	239.4	71	63	119	119	51	3	43		
5	20		.50	1.3	241.7	72	64	121	120	52	3	43		
6	24		.40	1.0	244.0	72	64	121	120	52	3	42		
7	28		.50	1.3	248.7	72	64	119	119	53	3	~~44~~ 44		
8	32		.63	1.6	251.3	72	65	119	119	54	3	44		
9	36		.74	1.9	254.2	71	64	121	121	53	4	43		
10	40		.64	1.6	256.9	72	65	121	119	54	4	43		
11	44		.68	~~1.7 KA 1.58.2~~	~~259.645~~	72	66	120	121	55	4	45		
12	48	1558	.68	1.7	259.685	72	66	120	121	55	4	45		MPLC 259.786 .141
B 1	4	1621	.24	.60	261.5	73	68	120	121	66	1	58		
2	8		.25	.63	263.2	72	68	119	119	62	1	48		
3	12		.27	.68	264.9	72	68	119	121	60	1	46		
4	16		.29	.73	266.7	72	69	118	119	59	1	47		
5	20		.34	.85	268.7	72	69	120	121	58	2	47		
6	24		.41	1.0	270.9	72	68	121	121	56	3	47		
7	28		.74	1.9	273.7	73	69	121	119	56	4	48		
8	32		.84	2.1	276.8	74	70	122	120	58	5	50		
9	36		.88	2.2	280.0	73	69	120	121	61	5	50		
10	40		.95	2.4	283.2	73	69	119	120	62	5	51		
11	44		.95	2.4	286.5	73	69	119	120	62	5	52		
12	48	1709 ✓	.95	2.4	289.709	73	69	121	121	63	5	53		
			Avg Delta P .579 ✓	Avg Delta H 1.462 ✓	Total Volume 60.095	Avg Ts 72.208 ✓	Avg Tm 66.375	Min/Max 118/122	Min/Max 119/121	Max 66	Max Vac 5	Min/Max 39/58		
			Avg Sqrt Delta P .746 ✓	Avg Sqrt Del H 1.185 ✓	Comments: 59.954 ✓		66.4							

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

AMd

CB OUT

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client: Chemours | W.O. #: 15418.002.011
Location/Plant: Fayetteville, NC | Source & Location: VE North Outlet

Run No. 1 | Sample Date 3/25/19 | Recovery Date 3/25/19
Sample I.D. Chemours - Carbon Bed - OUT - 1 - M0010 - | Analyst DNO / AS | Filter Number NR

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H2O	HPLC H2O						Silica Gel	
Final	7	100	100	2		307.5	289.3		319.3	
Initial	0	100	100	0		297.8	289.3		300	
Gain	7	0	0	2		9.7	0	18.7	19.3	38.0

Impinger Color: all clear | Labeled? ✓ | ✓ ✓
Silica Gel Condition: Sl. 90% | Sealed? ✓

Run No. 2 | Sample Date 3/26/19 | Recovery Date 3/26/19
Sample I.D. Chemours - Carbon Bed - OUT - 2 - M0010 - | Analyst DNO / AS | Filter Number NR

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H2O	HPLC H2O						Silica Gel	
Final	5	100	100	2		309.3	300.3		315.0	
Initial	0	100	100	0		302.0	299.8		300	
Gain	5	0	0	2		7.3	6.5	14.9	15.0	29.9

Impinger Color: all clear | Labeled? ✓ | ✓ ✓
Silica Gel Condition: Sl. 80% | Sealed? ✓

Run No. 3 | Sample Date 3/26/19 | Recovery Date 3/26/19
Sample I.D. Chemours - Carbon Bed - OUT - 3 - M0010 - | Analyst DNO / AS | Filter Number NR

	Impinger 1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H2O	HPLC H2O						Silica Gel	
Final	5	107	100	0		299.4	302.7		319.8	
Initial	0	100	100	0					300	
Gain	5	7	0	0		291.1	302.7	20.3	19.8	

Impinger Color: all clear | Labeled? 8.3 ✓ | 0 ✓ ✓
Silica Gel Condition: Sl. 90% | Sealed? ✓

Check COC for Sample IDs of Media Blanks

WESTON SOLUTIONS

CHEMOURS - FAYETTEVILLE, NC
INPUTS FOR HFPO DIMER ACID CALCULATIONS
DIVISION STACK

Test Data			
Run number	1	2	3
Location	Divison Stack	Divison Stack	Divison Stack
Date	3/25/2019	3/26/2019	3/26/2019
Time period	1315-1528	0852-1052	1510-1709
Operator	CH	CH	CH
Inputs For Calcs.			
Sq. rt. delta P	1.19221	1.21398	1.22257
Delta H	1.3433	1.3925	1.4192
Stack temp. (deg.F)	82.5	62.6	68.9
Meter temp. (deg.F)	80.6	46.5	58.5
Sample volume (act.)	51.535	51.014	51.633
Barometric press. (in.Hg)	29.92	29.96	29.96
Volume H_2O imp. (ml)	12.0	10.0	7.0
Weight change sil. gel (g)	18.7	16.7	13.6
% CO_2	0.0	0.0	0.0
% O_2	20.9	20.9	20.9
% N_2	79.1	79.1	79.1
Area of stack (sq.ft.)	7.070	7.070	7.070
Sample time (min.)	96.0	96.0	96.0
Static pressure (in.H_2O)	-0.70	-0.70	-0.70
Nozzle dia. (in.)	0.160	0.160	0.160
Meter box cal.	1.0010	1.0010	1.0010
Cp of pitot tube	0.84	0.84	0.84
Traverse points	12	12	12

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

			Stack Conditions	
Client	Chemours		Assumed	Actual
W.O.#	15418.002.011	% Moisture	2.0	
Project ID	Chemours	Impinger Vol (ml)		12
Mode/Source ID	Division	Silica gel (g)		18.7
Samp. Loc. ID	STK	CO2, % by Vol	0.1	0.1
Run No.ID	1	O2, % by Vol	20.8	21.0
Test Method ID	M0010	Temperature (°F)	70 ~~80~~	
Date ID	25MAR2019	Meter Temp (°F) (4)	~~80~~	
Source/Location	Division Stack	Static Press (in H_2O)	-0.70	✓
Sample Date	3-25-19 ✓			
Baro. Press (in Hg)	29.92 ✓	Ambient Temp (°F)	75	
Operator	CH ✓			

Meter Box ID	22	
Meter Box Y	1.0010 ✓	
Meter Box Del H	2.4674	
Probe ID / Length	P701	5'
Probe Material	Boro	
Pitot / Thermocouple ID	P701	
Pitot Coefficient	0.84 ✓	
Nozzle ID	G160	
Nozzle Measurements		
Avg Nozzle Dia (in)	0.160 ✓	
Area of Stack (ft^2)	7.07 ✓	
Sample Time	96 ✓	
Total Traverse Pts	12 ✓	

	Initial	Mid-Point	Final
K Factor ~~0.95~~ 0.97 (4) 0.94			
Sample Train (ft^3)	0.006	0.000	0.000
Leak Check @ (in Hg)	15"	12"	10"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp	73		75
Reference Temp	72		74
Pass/Fail (+/- 2°)	Pass / Fail		Pass / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O) (4)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1315 ✓			97.935									
A 1	4		1.2	~~1.16~~ 1.13	100.0	83	80	100	100	64	4.0	64		
1	8		1.2	1.13	102.0	83	81	100	100	62	4.0	63		
2	12		1.5	1.41	104.2	83	81	100	99	61	4.5	61		
2	16		1.5	1.41	106.4	83	81	101	105	63	4.5	63		25.660
3	20		1.6	1.50	108.6	83	81	102	105	62	4.5	62		
3	24		1.6	1.50	110.9	83	81	100	101	62	4.5	62		
4	28		1.7	1.60	113.3	83	82	100	100	62	5.0	62		
4	32		1.7	1.60	115.6	83	82	100	100	61	5.0	61		
5	36		1.3	1.22	117.7	83	82	100	102	58	4.0	59		
5	40		1.3	1.22	119.7	83	82	100	104	58	4.0	59		
6	44		1.1	1.00	121.6	83	82	100	102	57	3.5	58		
6	48	1403	1.1	1.00	123.595	83	83	100	100	57	3.5	58		0.000 *H3Q (4) @ 12" Hg
		1440			123.786									
B 1	4		1.3	1.22	125.8	82	80	100	100	60	4.0	60		
1	8		1.3	1.22	127.8	83	80	100	99	56	4.0	56		
2	12		1.6	1.50	130.1	82	80	100	100	54	5.0	55		
2	16		1.6	1.50	132.3	82	80	100	101	55	5.0	56		
3	20		1.8	1.69	134.8	82	80	100	102	55	5.0	56		25.875
3	24		1.8	1.69	137.1	82	80	100	105	56	5.0	57		
4	28		1.8	1.69	139.5	82	80	100	98	57	5.5	58		
4	32		1.8	1.69	141.9	82	80	100	100	58	5.5	59		
5	36		1.3	1.22	144.0	82	79	100	100	60	4.5	61		
5	40		1.3	1.22	146.0	82	79	100	101	61	4.5	62		
6	44		1.0	0.94	147.8	82	79	100	103	62	4.0	63		
6	48	1528 ✓	1.0	0.94	149.661	82 ✓	79	100	99	63	4.0	64		
			Avg Delta P ✓ 1.4333	Avg Delta H ✓ 1.3433	Total Volume ✓ 51.535	Avg Ts ✓ 82.5	Avg Tm ✓ 80.6	Min/Max 100/102	Min/Max 98/105	Max 64	Max Vac 5.5	Min/Max 64		
			Avg Sqrt Delta P ✓ 1.1922	Avg Sqrt Del H ✓ 1.1540	Comments:									

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

amd

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Page 1 of 1

		Stack Conditions	Assumed	Actual
Client	Chemours	% Moisture	2.0	
W.O.#	15418.002.011	Impinger Vol (ml)		
Project ID	Chemours	Silica gel (g)		
Mode/Source ID	Division	CO2, % by Vol	0.1	
Samp. Loc. ID	STK	O2, % by Vol	20.8	
Run No.ID	2	Temperature (°F)	60	
Test Method ID	M0010	Meter Temp (°F)	60	
Date ID	25MAR2019	Static Press (in H_2O)	-0.70 ✓	
Source/Location	Division Stack	Ambient Temp (°F)	55	
Sample Date	03/25/19 ✓			
Baro. Press (in Hg)	29.96 ✓			
Operator	4 ✓			

Meter Box ID	22		
Meter Box Y	1.0010 ✓		
Meter Box Del H	2.4674		
Probe ID / Length	P701	Sample Train (ft^3)	0.015 / 0.015 / 0.615
Probe Material	Boro	Leak Check @ (in Hg)	15 / 12 / 8
Pitot / Thermocouple ID		Pitot leak check good	yes / no
Pitot Coefficient	0.84 ✓	Pitot Inspection good	yes / no
Nozzle ID	G160	Method 3 System good	yes / no
Nozzle Measurements		**Temp Check**	Pre-Test Set / Post-Test Set
Avg Nozzle Dia (in)	0.160 ✓	Meter Box Temp	50 / 52
Area of Stack (ft^2)	7.07 ✓	Reference Temp	50 / 52
Sample Time	96 ✓	Pass/Fail (+/- 2°)	Pass / Fail
Total Traverse Pts	12 ✓	Temp Change Response ?	yes / no

K Factor 0.94

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	0852 ✓			149.908									
A 1	4		1.5	1.41	152.1	62	45	100	94	46	4.0	38		
1	8		1.5	1.41	154.2	62	45	100	103	46	4.0	36		
2	12		1.6	1.50	156.5	62	45	100	100	46	4.5	36		
2	16		1.6	1.50	158.7	62	45	100	107	46	4.5	36		25.615
3	20		1.6	1.50	160.9	62	45	100	95	46	4.5	36		
3	24		1.6	1.50	163.1	62	45	100	108	41	4.5	37		
4	28		1.8	1.69	165.4	62	46	100	110	41	4.5	36		
4	32		1.8	1.69	167.7	62	46	100	105	41	4.5	36		
5	36		1.3	1.22	169.8	63	46	100	110	42	3.5	37		
5	40		1.3	1.22	171.8	63	46	100	93	43	3.5	38		
6	44		1.1	1.03	173.6	62	46	100	114	43	3.5	38		0.015
6	48		1.1	1.03	175.523	63	46	101	102	44	3.5	39		0.015 @ 12" H
		1004			175.803									
B 1	4		1.4	1.32	177.9	63	47	100	102	46	4.0	42		
1	8		1.4	1.32	180.0	63	47	100	102	48	4.0	43		
2	12		1.6	1.50	182.2	63	47	100	99	48	4.0	43		
2	16		1.6	1.50	184.3	63	47	100	102	49	4.0	44		
3	20		1.8	1.69	186.6	63	47	100	101	50	5.0	45		25.399
3	24		1.8	1.69	189.1	63	47	100	102	50	5.0	46		
4	28		1.7	1.60	191.3	63	48	100	109	50	5.0	46		
4	32		1.7	1.60	193.5	63	48	100	99	51	5.0	46		
5	36		1.3	1.22	195.6	63	48	100	100	51	4.0	47		
5	40		1.3	1.22	197.6	63	48	100	107	52	4.0	48		
6	44		1.1	1.03	199.4	63	48	100	103	52	3.5	48		
6	48	1052 ✓	1.1	1.03	201.202	63	48	100	103	53	3.5	49		
			Avg Delta P ✓ 1.4833	Avg Delta H ✓ 1.3925	Total Volume ✓ 51.014	Avg Ts ✓ 62.0	Avg Tm ✓ 46.5	Min/Max 100/100	Min/Max 93/114	Max 53	Max Vac 5.0	Min/Max 49		
			Avg Sqrt Delta P ~~1.2134~~ 1.2140 ✓	Avg Sqrt Del H ✓ 1.1762	Comments:									

WESTON SOLUTIONS

(4)

EPA Method 0010 from EPA SW-846

AMM

ISOKINETIC FIELD DATA SHEET

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours
W.O.#	15418.002.011
Project ID	Chemours
Mode/Source ID	Division
Samp. Loc. ID	STK
Run No.ID	3
Test Method ID	M0010
Date ID	25MAR2019
Source/Location	Division Stack
Sample Date	03/~~25~~19 ✓
Baro. Press (in Hg)	29.96 ✓
Operator	AL ✓

Stack Conditions	Assumed	Actual
% Moisture	2	
Impinger Vol (ml)		
Silica gel (g)		
CO2, % by Vol	0.1	
O2, % by Vol	20.8	
Temperature (°F)	60	
Meter Temp (°F)	60	
Static Press (In H_2O)	-0.70 ✓	
Ambient Temp (°F)	55	

Meter Box ID	22
Meter Box Y	1.0010 ✓
Meter Box Del H	2.4674
Probe ID / Length	P701 / 5'
Probe Material	Boro
Pitot / Thermocouple ID	
Pitot Coefficient	0.84 ✓
Nozzle ID	6-160
Nozzle Measurements	0.160 / 0.160 / 0.160
Avg Nozzle Dia (in)	0.160 ✓
Area of Stack (ft^2)	7.07 ✓
Sample Time	96 ✓
Total Traverse Pts	12 ✓

K Factor 0.94

	Initial	Mid-Point	Final
Sample Train (ft^3)	0.017	0.015	~~0.000~~ 0.010
Leak Check @ (In Hg)	15"	10"	8"
Pitot leak check good	yes / no	yes / no	yes / no
Pitot Inspection good	yes / no	yes / no	yes / no
Method 3 System good	yes / no	yes / no	yes / no
Temp Check	Pre-Test Set		Post-Test Set
Meter Box Temp	54		55
Reference Temp	53		55
Pass/Fail (+/- 2°)	~~Pass~~ / Fail		~~Pass~~ / Fail
Temp Change Response ?	yes / no		yes / no

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (plant time)	VELOCITY PRESSURE Delta P (in H2O)	ORIFICE PRESSURE Delta H (in H2O)	DRY GAS METER READING (ft^3)	STACK TEMP (°F)	DGM OUTLET TEMP (oF)	PROBE TEMP (oF)	FILTER BOX TEMP (F)	IMPINGER EXIT TEMP (oF)	SAMPLE TRAIN VAC (in Hg)	XAD EXIT TEMP (F)		COMMENTS
	0	1510 ✓			201.538									
A 1	4		1.5	1.41	203.6	68	57	100	103	58	5.0	52		
1	8		1.5	1.41	205.9	69	57	100	108	53	5.0	48		
2	12		1.7	1.60	208.1	69	58	100	106	49	5.0	46		
2	16		1.7	1.60	210.4	69	58	100	104	50	5.0	46		26.100
3	20		1.9	1.79	212.8	68	58	100	98	51	5.5	48		
3	24		1.9	1.79	215.2	69	58	103	106	51	5.5	50		
4	28		1.7	1.60	217.5	68	58	100	100	52	5.0	50		
4	32		1.7	1.66	219.8	69	58	100	106	52	5.0	51		
5	36		1.4	1.32	221.9	69	58	100	110	53	4.5	52		
5	40		1.4	1.32	224.0	69	58	100	109	52	4.5	52		
6	44		1.0	0.94	225.8	69	59	100	96	51	3.5	51		0.0150@10" Hg
6	48	1558	1.0	0.94	227.638	69	59	100	102	51	3.5	51		
		1621			227.860									
B 1	4		1.4	1.32	230.0	68	59	100	110	56	4.0	54		
1	8		1.4	1.32	232.0	69	59	100	110	50	4.0	50		
2	12		1.6	1.50	234.3	70	59	100	109	49	4.5	49		
2	16		1.6	1.50	236.4	69	59	100	112	49	4.5	49		
3	20		1.8	1.69	238.7	69	59	100	103	50	5.0	50		25.533
3	24		1.8	1.69	241.1	69	59	100	108	51	5.0	50		
4	28		1.7	1.60	243.4	69	59	100	99	51	5.0	51		
4	32		1.7	1.60	245.6	69	59	100	100	52	5.0	52		
5	36		1.4	1.32	247.7	70	59	100	101	52	4.5	52		
5	40		1.4	1.32	249.8	69	59	100	100	53	4.5	53		
6	44		1.0	0.94	251.6	69	59	100	103	53	3.5	53		
6	48	1709 ✓	1.0	0.94	253.393	69	59	100	100	54	3.5	54		
			Avg Delta P ✓ 1.5083	Avg Delta H ✓ 1.4192	Total Volume ✓ 51.633	Avg Ts ✓ 68.9	Avg Tm 58.6	Min/Max 100/103	Min/Max 96/112	Max 58	Max Vac 5.5	Min/Max 48/54		
			Avg Sqrt Delta P ✓ 1.2226	Avg Sqrt Del H ✓ 1.1859	Comments:		58.5 ✓							

WESTON SOLUTIONS

EPA Method 0010 from EPA SW-846

SAMPLE RECOVERY FIELD DATA

EPA Method 0010 - HFPO Dimer Acid

Client	Chemours	W.O. #	15418.002.011
Location/Plant	Fayetteville, NC	Source & Location	Division Stack

Run No. 1 — Sample Date 3/25/19 — Recovery Date 3/26/19

Sample I.D. Chemours - Division - STK - 1 - M0010 - — Analyst PMM — Filter Number 44

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	7	97	105	3					316.7	
Initial	0	100	100	0					300	
Gain	7	-3	5	3				12	16.7	30.7

Impinger Color: clear — Labeled? ✓ ✓ ✓

Silica Gel Condition: Good — Sealed? ✓

Run No. 2 — Sample Date 3/26/19 — Recovery Date 3/26/19

Sample I.D. Chemours - Division - STK - 2 - M0010 - — Analyst PMM — Filter Number 44

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	7	101	101	2					316.7	
Initial	0	100	100	0					300	
Gain	7	0	1	2				10	16.7	26.7

Impinger Color: clear — Labeled? ✓ ✓ ✓

Silica Gel Condition: Good — Sealed? ✓

Run No. 3 — Sample Date 3/26/19 — Recovery Date 3/30/19

Sample I.D. Chemours - Division - STK - 3 - M0010 - — Analyst PMM — Filter Number NA

	Impinger									
	1	2	3	4	5	6	7	Imp.Total	8	Total
Contents	Empty	HPLC H20	HPLC H20						Silica Gel	
Final	2	94	103	3					313.6	
Initial	0	100	100	0					300	
Gain	2	-1	3	3				7	13.6	20.6

Impinger Color: clear — Labeled? ✓ ✓ ✓

Silica Gel Condition: Good — Sealed? ✓

Check COC for Sample IDs of Media Blanks

WESTON SOLUTIONS

Balance Chk #1 500 g = 499.8

METHODS AND ANALYZERS

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

\Client Folders.A-F\Chemours Fayetteville\15418.002.011 Fayetteville March 2019 VEN Test\Data\15418 Chemours

Program Version: 2.1, built 19 May 2017 **File Version:** 2.03
Computer: WSWCAIRSERVICES **Trailer:** 27
Analog Input Device: Keithley KUSB-3108

Channel 1

Analyte	**O_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**25.0**
Span Concentration, %	**21.0**

Channel 2

Analyte	**CO_2**
Method	**EPA 3A**, Using Bias
Analyzer Make, Model & Serial No.	**Servomex 4900**
Full-Scale Output, mv	**10000**
Analyzer Range, %	**20.0**
Span Concentration, %	**16.6**

CALIBRATION DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Start Time: 09:26

O_2

Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	Cylinder ID
12.0	CC18055
21.0	SG9169108

Calibration Results

Zero	4 mv
Span, 21.0 %	7991 mv

Curve Coefficients

Slope	Intercept
380.3	4

CO_2

Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	Cylinder ID
8.9	CC18055
16.6	SG9169108

Calibration Results

Zero	1 mv
Span, 16.6 %	8293 mv

Curve Coefficients

Slope	Intercept
500.1	1

CALIBRATION ERROR DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Start Time: 09:26

O_2

Method: EPA 3A
Span Conc. 21.0 %
Slope 380.3 **Intercept** 4.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.0	0.0	0.0	Pass
21.0	21.0	0.0	0.0	Pass

CO_2

Method: EPA 3A
Span Conc. 16.6 %
Slope 500.1 **Intercept** 1.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
8.9	8.9	0.0	0.0	Pass
16.6	16.6	0.0	0.0	Pass

BIAS

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Start Time: 12:14

O_2

Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

CO_2

Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.1	0.1	0.6	Pass
Span	8.9	8.9	0.0	0.0	Pass

RUN DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Time	O_2 %	CO_2 %
RUN 1 START		
PORT 1		
13:15	21.0	0.1
13:16	21.0	0.1
13:17	21.0	0.1
13:18	21.0	0.1
13:19	21.0	0.1
13:20	21.0	0.1
13:21	21.0	0.1
13:22	21.0	0.1
13:23	21.0	0.1
13:24	21.0	0.1
13:25	21.0	0.1
13:26	21.0	0.1
13:27	21.0	0.1
13:28	21.0	0.1
13:29	21.0	0.1
13:30	21.0	0.1
13:31	21.0	0.1
13:32	21.0	0.1
13:33	21.0	0.1
13:34	21.0	0.1
13:35	21.0	0.1
13:36	21.0	0.1
13:37	21.0	0.1
13:38	21.0	0.1
13:39	21.0	0.1
13:40	21.0	0.1
13:41	21.0	0.1
13:42	21.0	0.1
13:43	21.0	0.1
13:44	21.0	0.1
13:45	21.0	0.1
13:46	21.0	0.1
13:47	21.0	0.1
13:48	21.0	0.1
13:49	21.0	0.1
13:50	21.0	0.1
13:51	21.0	0.1
13:52	21.0	0.1

WESTON SOLUTIONS℠

RUN DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Time	O_2 %	CO_2 %
13:53	21.0	0.1
13:54	21.0	0.1
13:55	21.0	0.1
13:56	21.0	0.1
13:57	21.0	0.1
13:58	21.0	0.1
13:59	21.0	0.1
14:00	21.0	0.1
14:01	21.0	0.1
14:02	21.0	0.1
14:03	21.0	0.1
PORT CHANGE		
PORT 2		
14:40	21.0	0.1
14:41	21.0	0.1
14:42	21.0	0.1
14:43	21.0	0.1
14:44	21.0	0.1
14:45	21.0	0.1
14:46	21.0	0.1
14:47	21.0	0.1
14:48	21.0	0.1
14:49	21.0	0.1
14:50	21.0	0.1
14:51	21.0	0.1
14:52	21.0	0.1
14:53	21.0	0.1
14:54	21.0	0.1
14:55	21.0	0.1
14:56	21.0	0.1
14:57	21.0	0.1
14:58	21.0	0.1
14:59	21.0	0.1
15:00	21.1	0.1
15:01	21.1	0.1
15:02	21.1	0.1
15:03	21.1	0.1
15:04	21.1	0.1
15:05	21.1	0.1
15:06	21.1	0.1

WESTON SOLUTIONS

RUN DATA

Number 1

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Time	O_2 %	CO_2 %
15:07	21.1	0.1
15:08	21.1	0.1
15:09	21.1	0.1
15:10	21.1	0.1
15:11	21.1	0.1
15:12	21.1	0.1
15:13	21.1	0.1
15:14	21.1	0.1
15:15	21.1	0.1
15:16	21.1	0.1
15:17	21.1	0.1
15:18	21.1	0.1
15:19	21.1	0.1
15:20	21.1	0.1
15:21	21.1	0.1
15:22	21.1	0.1
15:23	21.1	0.1
15:24	21.1	0.1
15:25	21.1	0.1
15:26	21.1	0.1
15:27	21.1	0.1
15:28	21.1	0.1
Avgs	**21.0**	**0.1**

RUN SUMMARY

Number 1

Client:	**Chemours**	Project Number:	**15418.002.011.0001**
Location:	**Fayetteville, NC**	Operator:	**Dryden**
Source:	**Division Stack**	Calibration **1**	Date: **25 Mar 2019**

	O_2	CO_2
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 13:14 to 15:28

Run Averages

21.0	0.1

Pre-run Bias at 12:14

Zero Bias	0.0	0.1
Span Bias	12.0	8.9
Span Gas	12.0	8.9

Post-run Bias at 15:30

Zero Bias	0.0	0.0
Span Bias	12.0	8.9
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

21.0	0.1

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **25 Mar 2019**

Start Time: 15:30

O_2

Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

*Bias No. 1

CO_2

Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.9	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.1	0.0	-0.1	-0.6	Pass
Span	8.9	8.9	0.0	0.0	Pass

*Bias No. 1

WESTON SOLUTIONS

CALIBRATION DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Start Time: 07:40

O_2

Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	**Cylinder ID**
12.0	CC18055
21.0	SG9169108

Calibration Results

Zero	16 mv
Span, 21.0 %	7985 mv

Curve Coefficients

Slope	**Intercept**
379.5	16

CO_2

Method: EPA 3A
Calibration Type: Linear Zero and High Span

Calibration Standards

%	**Cylinder ID**
8.9	CC18055
16.6	SG9169108

Calibration Results

Zero	53 mv
Span, 16.6 %	8288 mv

Curve Coefficients

Slope	**Intercept**
496.7	53

CALIBRATION ERROR DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **1**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Start Time: 07:40

O_2

Method: EPA 3A
Span Conc. 21.0 %
Slope 380.3 **Intercept** 4.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
12.0	12.0	0.0	0.0	Pass
21.0	21.0	0.0	0.0	Pass

CO_2

Method: EPA 3A
Span Conc. 16.6 %
Slope 500.1 **Intercept** 1.0

Standard %	Result %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	Pass
8.9	8.9	0.0	0.0	Pass
16.6	16.6	0.0	0.0	Pass

BIAS AND CALIBRATION DRIFT

Number 3

Client: **Chemours** | Project Number: **15418.002.011.0001**
Location: **Fayetteville, NC** | Operator: **Dryden**
Source: **Division Stack** | Calibration **2** | Date: **26 Mar 2019**

Start Time: 07:44

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

*Bias No. 2

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.9	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.9	0.0	0.0	Pass

*Bias No. 2

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
RUN 2 START		
PORT 1		
08:53	21.0	0.0
08:54	21.0	0.0
08:55	21.0	0.0
08:56	21.0	0.0
08:57	21.0	0.0
08:58	21.0	0.0
08:59	21.0	0.0
09:00	21.0	0.0
09:01	21.0	0.0
09:02	21.0	0.0
09:03	21.0	0.0
09:04	21.0	0.0
09:05	21.0	0.0
09:06	21.0	0.0
09:07	21.0	0.0
09:08	21.0	0.0
09:09	21.0	0.0
09:10	21.0	0.0
09:11	21.0	0.0
09:12	21.0	0.0
09:13	21.0	0.0
09:14	21.0	0.0
09:15	21.0	0.0
09:16	21.0	0.0
09:17	21.0	0.0
09:18	21.0	0.0
09:19	21.0	0.0
09:20	21.0	0.0
09:21	21.0	0.0
09:22	21.0	0.0
09:23	21.0	0.0
09:24	21.0	0.0
09:25	21.0	0.0
09:26	21.0	0.0
09:27	21.0	0.0
09:28	21.1	0.0
09:29	21.1	0.0
09:30	21.1	0.0

WESTON SOLUTIONS℠

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
09:31	21.1	0.0
09:32	21.1	0.0
09:33	21.1	0.0
09:34	21.1	0.0
09:35	21.1	0.0
09:36	21.1	0.0
09:37	21.1	0.0
09:38	21.1	0.0
09:39	21.1	0.0
09:40	21.1	0.0
PORT CHANGE		
PORT 2		
10:04	21.1	0.0
10:05	21.1	0.0
10:06	21.1	0.0
10:07	21.1	0.0
10:08	21.0	0.0
10:09	21.1	0.0
10:10	21.1	0.0
10:11	21.1	0.0
10:12	21.1	0.0
10:13	21.1	0.0
10:14	21.1	0.0
10:15	21.1	0.0
10:16	21.1	0.0
10:17	21.1	0.0
10:18	21.1	0.0
10:19	21.1	0.0
10:20	21.1	0.0
10:21	21.1	0.0
10:22	21.1	0.0
10:23	21.1	0.0
10:24	21.1	0.0
10:25	21.1	0.0
10:26	21.2	0.0
10:27	21.2	0.0
10:28	21.1	0.0
10:29	21.2	0.0
10:30	21.2	0.0
10:31	21.2	0.0

WESTON SOLUTIONS

RUN DATA

Number 2

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
10:32	21.2	0.0
10:33	21.2	0.0
10:34	21.2	0.0
10:35	21.2	0.0
10:36	21.2	0.0
10:37	21.2	0.0
10:38	21.2	0.0
10:39	21.2	0.0
10:40	21.2	0.0
10:41	21.2	0.0
10:42	21.2	0.0
10:43	21.2	0.0
10:44	21.2	0.0
10:45	21.2	0.0
10:46	21.2	0.0
10:47	21.2	0.0
10:48	21.2	0.0
10:49	21.2	0.0
10:50	21.2	0.0
10:51	21.2	0.0
10:52	21.2	0.0
Avgs	**21.1**	**0.0**

RUN SUMMARY

Number 2

Client: **Chemours**		Project Number:	**15418.002.011.0001**
Location: **Fayetteville, NC**		Operator:	**Dryden**
Source: **Division Stack**	Calibration **2**	Date:	**26 Mar 2019**

	O_2	CO_2
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 08:52 to 10:52

Run Averages

21.1	0.0

Pre-run Bias at 07:44

Zero Bias	0.0	0.0
Span Bias	12.0	8.9
Span Gas	12.0	8.9

Post-run Bias at 10:54

Zero Bias	0.0	0.0
Span Bias	12.1	8.9
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

21.0	0.0

BIAS AND CALIBRATION DRIFT

Number 4

Client: **Chemours** | Project Number: **15418.002.011.0001**
Location: **Fayetteville, NC** | Operator: **Dryden**
Source: **Division Stack** | Calibration **2** | Date: **26 Mar 2019**

Start Time: 10:54

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.1	0.1	0.5	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.1	0.1	0.5	Pass

*Bias No. 3

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.9	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.9	0.0	0.0	Pass

*Bias No. 3

WESTON SOLUTIONS

BIAS AND CALIBRATION DRIFT

Number 5

Client: **Chemours** | Project Number: **15418.002.011.0001**
Location: **Fayetteville, NC** | Operator: **Dryden**
Source: **Division Stack** | Calibration **2** | Date: **26 Mar 2019**

Start Time: 14:22

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.1	12.0	-0.1	-0.5	Pass

*Bias No. 4

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.8	8.8	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.9	8.8	-0.1	-0.6	Pass

*Bias No. 4

WESTON SOLUTIONS

RUN DATA

Number 3

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
RUN 3 START		
PORT 1		
15:10	21.1	0.0
15:11	21.1	0.0
15:12	21.0	0.0
15:13	21.1	0.0
15:14	21.1	0.0
15:15	21.1	0.0
15:16	21.1	0.0
15:17	21.1	0.0
15:18	21.1	0.0
15:19	21.1	0.0
15:20	21.2	0.0
15:21	21.1	0.0
15:22	21.1	0.0
15:23	21.2	0.0
15:24	21.2	0.0
15:25	21.2	0.0
15:26	21.2	0.0
15:27	21.2	0.0
15:28	21.2	0.0
15:29	21.2	0.0
15:30	21.1	0.0
15:31	21.2	0.0
15:32	21.2	0.0
15:33	21.2	0.0
15:34	21.2	0.0
15:35	21.2	0.0
15:36	21.2	0.0
15:37	21.2	0.0
15:38	21.2	0.0
15:39	21.2	0.0
15:40	21.1	0.0
15:41	21.1	0.0
15:42	21.2	0.0
15:43	21.2	0.0
15:44	21.2	0.0
15:45	21.2	0.0
15:46	21.2	0.0
15:47	21.2	0.0

WESTON SOLUTIONS℠

RUN DATA

Number 3

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
15:48	21.2	0.0
15:49	21.2	0.0
15:50	21.2	0.0
15:51	21.2	0.0
15:52	21.2	0.0
15:53	21.2	0.0
15:54	21.2	0.0
15:55	21.2	0.0
15:56	21.2	0.0
15:57	21.2	0.0
15:58	21.2	0.0
PORT CHANGE		
PORT 2		
16:21	21.1	0.0
16:22	21.1	0.0
16:23	21.1	0.0
16:24	21.1	0.0
16:25	21.1	0.0
16:26	21.1	0.0
16:27	21.1	0.0
16:28	21.2	0.0
16:29	21.2	0.0
16:30	21.2	0.0
16:31	21.2	0.0
16:32	21.2	0.0
16:33	21.2	0.0
16:34	21.2	0.0
16:35	21.2	0.0
16:36	21.2	0.0
16:37	21.2	0.0
16:38	21.2	0.0
16:39	21.2	0.0
16:40	21.2	0.0
16:41	21.2	0.0
16:42	21.2	0.0
16:43	21.2	0.0
16:44	21.2	0.0
16:45	21.2	0.0
16:46	21.2	0.0
16:47	21.2	0.0

WESTON SOLUTIONS

RUN DATA

Number 3

Client: **Chemours**
Location: **Fayetteville, NC**
Source: **Division Stack**

Calibration **2**

Project Number: **15418.002.011.0001**
Operator: **Dryden**
Date: **26 Mar 2019**

Time	O_2 %	CO_2 %
16:48	21.2	0.0
16:49	21.2	0.0
16:50	21.2	0.0
16:51	21.2	0.0
16:52	21.2	0.0
16:53	21.2	0.0
16:54	21.2	0.0
16:55	21.2	0.0
16:56	21.2	0.0
16:57	21.2	0.0
16:58	21.2	0.0
16:59	21.2	0.0
17:00	21.2	0.0
17:01	21.2	0.0
17:02	21.2	0.0
17:03	21.2	0.0
17:04	21.2	0.0
17:05	21.2	0.0
17:06	21.2	0.0
17:07	21.2	0.0
17:08	21.2	0.0
17:09	21.2	0.0
Avgs	**21.2**	**0.0**

WESTON SOLUTIONS

RUN SUMMARY

Number 3

Client: **Chemours**		Project Number:	**15418.002.011.0001**
Location: **Fayetteville, NC**		Operator:	**Dryden**
Source: **Division Stack**	Calibration **2**	Date:	**26 Mar 2019**

	O_2	CO_2
Method	EPA 3A	EPA 3A
Conc. Units	%	%

Time: 15:09 to 17:09

Run Averages

21.2	0.0

Pre-run Bias at 14:22

Zero Bias	0.0	0.0
Span Bias	12.0	8.8
Span Gas	12.0	8.9

Post-run Bias at 17:11

Zero Bias	0.0	0.0
Span Bias	12.0	8.9
Span Gas	12.0	8.9

Run averages corrected for the average of the pre-run and post-run bias

21.2	0.0

BIAS AND CALIBRATION DRIFT

Number 6

Client: **Chemours** | Project Number: **15418.002.011.0001**
Location: **Fayetteville, NC** | Operator: **Dryden**
Source: **Division Stack** | Calibration **2** | Date: **26 Mar 2019**

Start Time: 17:11

O_2
Method: EPA 3A
Span Conc. 21.0 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	12.0	12.0	0.0	0.0	Pass

*Bias No. 5

CO_2
Method: EPA 3A
Span Conc. 16.6 %

Bias Results

Standard Gas	Cal. %	Bias %	Difference %	Error %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.8	8.9	0.1	0.6	Pass

Calibration Drift

Standard Gas	Initial* %	Final %	Difference %	Drift %	Status
Zero	0.0	0.0	0.0	0.0	Pass
Span	8.8	8.9	0.1	0.6	Pass

*Bias No. 5

WESTON SOLUTIONS

APPENDIX C
LABORATORY ANALYTICAL REPORT

Note: The analytical report is included on the attached CD.

Chemours VEN Carbon Bed Inlet Test Analytical Report
TestAmerica Job No. 140-14725-1
April 10, 2019

The following samples exceeded the Method 8321A calibration range for HFPO-DA and required that dilution of the extracts be performed:

- K-2072,2073,2075 CB INLET R1 M0010 Back Half Composite (XAD-2 Resin and Glassware Rinses)

The original analysis concentration which displays the "E" flag is provided with the data set indicating that the value provided is estimated. The $^{13}C_3$ – HFPO-DA isotope dilution internal standard (IDA) recovery percentage (%) however, is provided with this analysis run.

A second analysis concentration displays an accurate concentration of the HFPO-DA in the diluted sample extract, but the value is uncorrected for the IDA recovery percentage from the original matrix. The recovery percentage presented with the second concentration represents a post-spike of IDA to benchmark the instrument quantification of native HFPO-DA.

Final recovery-corrected concentrations of the native HFPO-DA are provided by calculation using the original recovery value of the IDA and the diluted extract values of the native HFPO-DA. The final concentrations are calculated as follows:

- K-2072,2073,2075 CB INLET R1 M0010 Back Half Composite (XAD-2 Resin and Glassware Rinses)

$$(22800\,ug) \times \left(\frac{74}{117}\right) = 14421\,ug$$

Client Sample ID: K-2070,2071 CB INLET R1 M0010 FH

Lab Sample ID: 140-14725-1

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	223		1.51	0.163	ug/Sample		03/29/19 07:19	04/03/19 13:36	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*70*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:36*	*10*

Client Sample ID: K-2072,2073,2075 CB INLET R1 M0010 BH

Lab Sample ID: 140-14725-2

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	17800	E	25.0	5.00	ug/Sample		03/28/19 08:51	04/03/19 11:58	100
HFPO-DA	22800	H	200	40.0	ug/Sample		04/08/19 07:39	04/10/19 07:58	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*117*	*D*	*50 - 200*	*03/28/19 08:51*	*04/03/19 11:58*	*100*
13C3 HFPO-DA	*74*	*D*	*50 - 200*	*04/08/19 07:39*	*04/10/19 07:58*	*10*

Client Sample ID: K-2074 CB INLET R1 M0010 IMP 1,2&3

Lab Sample ID: 140-14725-3

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	3910		22.0	1.12	ug/Sample		03/29/19 07:34	04/03/19 14:51	100

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*139*	*D*	*50 - 200*	*03/29/19 07:34*	*04/03/19 14:51*	*100*

Client Sample ID: K-2076 CB INLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14725-4

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	988		10.0	2.00	ug/Sample		03/28/19 08:51	04/03/19 12:01	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*69*	*D*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:01*	*50*

Client Sample ID: K-2077,2078 CB INLET R2 M0010 FH

Lab Sample ID: 140-14725-5

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	77.3		1.01	0.109	ug/Sample		03/29/19 07:19	04/03/19 13:39	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*78*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:39*	*10*

Client Sample ID: K-2079,2080,2082 CB INLET R2 M0010 BH

Lab Sample ID: 140-14725-6

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1310		15.0	3.00	ug/Sample		03/28/19 08:51	04/03/19 12:04	50

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*71*	*D*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:04*	*50*

Client Sample ID: K-2081 CB INLET R2 M0010 IMP 1,2&3

Lab Sample ID: 140-14725-7

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	52.8		0.800	0.0408	ug/Sample		03/29/19 07:34	04/03/19 14:28	4

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*82*	*D*	*50 - 200*	*03/29/19 07:34*	*04/03/19 14:28*	*4*

Client Sample ID: K-2083 CB INLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14725-8

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	2.21		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 12:08	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*13*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:08*	*1*

Client Sample ID: K-2084,2085 CB INLET R3 M0010 FH

Lab Sample ID: 140-14725-9

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	108		1.26	0.136	ug/Sample		03/29/19 07:19	04/03/19 13:46	10

Client Sample ID: K-2084,2085 CB INLET R3 M0010 FH

Lab Sample ID: 140-14725-9

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	73	D	50 - 200	03/29/19 07:19	04/03/19 13:46	10

Client Sample ID: K-2086,2087,2089 CB INLET R3 M0010 BH

Lab Sample ID: 140-14725-10

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	2450		25.0	5.00	ug/Sample		03/28/19 08:51	04/03/19 12:14	100

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	105	D	50 - 200	03/28/19 08:51	04/03/19 12:14	100

Client Sample ID: K-2088 CB INLET R3 M0010 IMP 1,2&3

Lab Sample ID: 140-14725-11

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	30.0		0.205	0.0105	ug/Sample		03/29/19 07:34	04/03/19 14:31	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	71		50 - 200	03/29/19 07:34	04/03/19 14:31	1

Client Sample ID: K-2090 CB INLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14725-12

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	8.11		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 12:17	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	25	X	50 - 200	03/28/19 08:51	04/03/19 12:17	1

Client Sample Results

Client: Chemours Company FC, LLC The
Project/Site: Fayetteville Emissions CB Outlet

Job ID: 140-14729-1

Client Sample ID: E-2070,2071 CB OUTLET R1 M0010 FH

Lab Sample ID: 140-14729-1

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	140		1.26	0.136	ug/Sample		03/29/19 07:19	04/03/19 13:49	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*73*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:49*	*10*

Client Sample ID: E-2072,2073,2075 CB OUTLET R1 M0010 BH

Lab Sample ID: 140-14729-2

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	39.3		0.250	0.0500	ug/Sample		03/28/19 08:51	04/03/19 12:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*17*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:21*	*1*

Client Sample ID: E-2074 CB OUTLET R1 M0010 IMP 1,2&3

Lab Sample ID: 140-14729-3

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	9.33		0.210	0.0107	ug/Sample		03/29/19 07:34	04/03/19 14:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*69*		*50 - 200*	*03/29/19 07:34*	*04/03/19 14:34*	*1*

Client Sample ID: E-2076 CB OUTLET R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE

Lab Sample ID: 140-14729-4

Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 12:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*18*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:24*	*1*

Client Sample ID: E-2077,2078 CB OUTLET R2 M0010 FH

Lab Sample ID: 140-14729-5

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	68.9		1.01	0.109	ug/Sample		03/29/19 07:19	04/03/19 13:52	10

Client Sample Results

Client: Chemours Company FC, LLC The
Job ID: 140-14729-1
Project/Site: Fayetteville Emissions CB Outlet

Client Sample ID: E-2077,2078 CB OUTLET R2 M0010 FH
Lab Sample ID: 140-14729-5

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*75*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:52*	*10*

Client Sample ID: E-2079,2080,8082 CB OUTLET R2 M0010 BH
Lab Sample ID: 140-14729-6

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**20.1**		0.250	0.0500	ug/Sample		03/28/19 08:51	04/03/19 12:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*13*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:27*	*1*

Client Sample ID: E-2081 CB OUTLET R2 M0010 IMP 1,2&3
Lab Sample ID: 140-14729-7

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.205	0.0105	ug/Sample		03/29/19 07:34	04/03/19 14:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*71*		*50 - 200*	*03/29/19 07:34*	*04/03/19 14:38*	*1*

Client Sample ID: E-2081 CB OUTLET R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-14729-8

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 12:34	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*12*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:34*	*1*

Client Sample ID: E-2084,2085 CB OUTLET R3 M0010 FH
Lab Sample ID: 140-14729-9

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	**192**		1.26	0.136	ug/Sample		03/29/19 07:19	04/03/19 13:55	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*72*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:55*	*10*

Client Sample Results

Client: Chemours Company FC, LLC The
Job ID: 140-14729-1
Project/Site: Fayetteville Emissions CB Outlet

Client Sample ID: E-2086,2087,2089 CB OUTLET R3 M0010 BH
Lab Sample ID: 140-14729-10

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	12.0		0.225	0.0450	ug/Sample		03/28/19 08:51	04/03/19 12:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*25*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:37*	*1*

Client Sample ID: E-2088 CB OUTLET R3 M0010 IMP 1,2&3
Lab Sample ID: 140-14729-11

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.210	0.0107	ug/Sample		03/29/19 07:34	04/03/19 14:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*73*		*50 - 200*	*03/29/19 07:34*	*04/03/19 14:41*	*1*

Client Sample ID: E-2090 CB OUTLET R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-14729-12

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.253		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 12:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*21*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 12:40*	*1*

Client Sample Results

Client: Chemours Company FC, LLC The
Job ID: 140-14723-1
Project/Site: Fayetteville Emissions Division Stack

Client Sample ID: Q-1470,1471 DIV STACK R1 M0010 FH
Lab Sample ID: 140-14723-1
Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	89.2		1.51	0.163	ug/Sample		03/29/19 07:19	04/03/19 13:26	10

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*76*	*D*	*50 - 200*	*03/29/19 07:19*	*04/03/19 13:26*	*10*

Client Sample ID: Q-1472,1473,1475 DIV STACK R1 M0010 BH
Lab Sample ID: 140-14723-2
Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	23.4		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*19*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 11:35*	*1*

Client Sample ID: Q-1474 DIV STACK R1 M0010 IMP 1,2&3
Lab Sample ID: 140-14723-3
Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	1.85		0.202	0.0103	ug/Sample		03/29/19 07:34	04/03/19 14:12	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*70*		*50 - 200*	*03/29/19 07:34*	*04/03/19 14:12*	*1*

Client Sample ID: Q-1476 DIV STACK R1 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-14723-4
Date Collected: 03/25/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*23*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 11:38*	*1*

Client Sample ID: Q-1477,1478 DIV STACK R2 M0010 FH
Lab Sample ID: 140-14723-5
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	60.0		1.02	0.110	ug/Sample		03/29/19 07:19	04/03/19 13:29	10

Client Sample Results

Client: Chemours Company FC, LLC The
Job ID: 140-14723-1
Project/Site: Fayetteville Emissions Division Stack

Client Sample ID: Q-1477,1478 DIV STACK R2 M0010 FH
Lab Sample ID: 140-14723-5
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	81	D	50 - 200	03/29/19 07:19	04/03/19 13:29	10

Client Sample ID: Q-1479,1480,1482 DIV STACK R2 M0010 BH
Lab Sample ID: 140-14723-6
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	12.8		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:42	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	18	X	50 - 200	03/28/19 08:51	04/03/19 11:42	1

Client Sample ID: Q-1481 DIV STACK R2 M0010 IMP 1,2&3
Lab Sample ID: 140-14723-7
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.0783	J	0.202	0.0103	ug/Sample		03/29/19 07:34	04/03/19 14:15	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	77		50 - 200	03/29/19 07:34	04/03/19 14:15	1

Client Sample ID: Q-1483 DIV STACK R2 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-14723-8
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	0.309		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:45	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	16	X	50 - 200	03/28/19 08:51	04/03/19 11:45	1

Client Sample ID: Q-1484,1485 DIV STACK R3 M0010 FH
Lab Sample ID: 140-14723-9
Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	144		1.02	0.110	ug/Sample		03/29/19 07:19	04/03/19 13:32	10

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
13C3 HFPO-DA	78	D	50 - 200	03/29/19 07:19	04/03/19 13:32	10

Client Sample Results

Client: Chemours Company FC, LLC The
Job ID: 140-14723-1
Project/Site: Fayetteville Emissions Division Stack

Client Sample ID: Q-1486,1487,1489 DIV STACK R3 M0010 BH
Lab Sample ID: 140-14723-10

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	6.62		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*23*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 11:48*	*1*

Client Sample ID: Q-1488 DIV STACK R3 M0010 IMP 1,2&3
Lab Sample ID: 140-14723-11

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - HFPO-DA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.198	0.0101	ug/Sample		03/29/19 07:34	04/03/19 14:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*76*		*50 - 200*	*03/29/19 07:34*	*04/03/19 14:21*	*1*

Client Sample ID: Q-1490 DIV STACK R3 M0010 BREAKTHROUGH XAD-2 RESIN TUBE
Lab Sample ID: 140-14723-12

Date Collected: 03/26/19 00:00
Matrix: Air
Date Received: 03/27/19 08:55
Sample Container: Air Train

Method: 8321A - PFOA and PFOS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
HFPO-DA	ND		0.200	0.0400	ug/Sample		03/28/19 08:51	04/03/19 11:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C3 HFPO-DA	*24*	*X*	*50 - 200*	*03/28/19 08:51*	*04/03/19 11:51*	*1*

APPENDIX D
SAMPLE CALCULATIONS

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours | **Plant: Fayetteville, NC**
Test Number: Run 1 | **Test Date: 3/25/2019**
Test Location: CBed Inlet | **Test Period: 1315-1528**

1. HFPO Dimer Acid concentration, lbs/dscf.

$$Conc1 = \frac{W \times 2.2046 \times 10^{-9}}{Vm(std)}$$

$$Conc1 = \frac{19542.0 \times 2.2046 \times 10\text{-}9}{56.888}$$

Conc1 = 7.57E-07

Where:

W = Weight of HFPO Dimer Acid collected in sample in ug

Conc1 = HFPO Dimer Acid concentration, lbs/dscf.

2.2046×10^{-9} = Conversion factor from ug to lbs.

2. HFPO Dimer Acid concentration, ug/dscm.

Conc2 = W / (Vm(std) x 0.02832)

Conc2 = 19542.0 / (56.888 x 0.02832)

Conc2 = 12128.6

Where:

Conc2 = HFPO Dimer Acid concentration, ug/dscm.

0.02832 = Conversion factor from cubic feet to cubic meters.

3. HFPO Dimer Acid mass emission rate, lbs/hr.

$MR1_{(Inlet)}$ = Conc1 x Qs(std) x 60 min/hr

$MR1_{(Inlet)}$ = 7.57E-07 x 13551 x 60

$MR1_{(Inlet)}$ = 6.16E-01

Where:

$MR1_{(Inlet)}$ = HFPO Dimer Acid mass emission rate, lbs/hr.

4. HFPO Dimer Acid mass emission rate, g/sec.

$MR2_{(Inlet)}$ = $MR1_{(Inlet)}$ x 453.59 / 3600

$MR2_{(Inlet)}$ = 6.16E-01 x 453.59 /3600

$MR2_{(Inlet)}$ = 7.75E-02

Where:

$MR2_{(Inlet)}$ = HFPO Dimer Acid mass emission rate, g/sec.

453.59 = Conversion factor from pounds to grams.

3600 = Conversion factor from hours to seconds.

5. HFPO Dimer Acid Removal Efficiency, %

$$RE = \frac{MR1_{(Inlet)} - MR1_{(Outlet)}}{MR1_{(Inlet)}}$$

$$RE = \frac{(7.22E\text{-}01) - (6.23E\text{-}03)}{7.22E\text{-}01}$$

RE = 99.0

Where:

RE = Carbon Bed Removal Efficiency.

$MR1_{(Inlet)}$ = Carbon Bed Inlet HFPO Dimer Acid mass rate, lbs/hr.

$MR1_{(Outlet)}$ = Carbon Bed Outlet HFPO Dimer Acid mass rate, lbs/hr.

EXAMPLE CALCULATIONS FOR
VOLUMETRIC FLOW AND MOISTURE AND ISOKINETICS

Client: Chemours	Facility: Fayetteville, NC
Test Number: Run 1	Test Date: 3/25/19
Test Location: VEN-Carbon Bed Inlet	Test Period: 1315-1528

1. Volume of dry gas sampled at standard conditions (68 deg F, 29.92 in. Hg), dscf.

$$Vm(std) = \frac{17.64 \times Y \times Vm \times \left(Pb + \frac{delta\ H}{13.6} \right)}{(Tm + 460)}$$

$$Vm(std) = \frac{17.64 \times 1.0001 \times 57.651 \times \left(30.02 + \frac{1.013}{13.6} \right)}{78.04 + 460} = 56.888$$

Where:

Vm(std) =	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscf.
Vm =	Volume of gas sample measured by the dry gas meter at meter conditions, dcf.
Pb =	Barometric Pressure, in Hg.
delt H =	Average pressure drop across the orifice meter, in H_2O
Tm =	Average dry gas meter temperature , deg F.
Y =	Dry gas meter calibration factor.
17.64 =	Factor that includes ratio of standard temperature (528 deg R) to standard pressure (29.92 in. Hg), deg R/in. Hg.
13.6 =	Specific gravity of mercury.

2. Volume of water vapor in the gas sample corrected to standard conditions, scf.

$$Vw(std) = (0.04707 \times Vwc) + (0.04715 \times Wwsg)$$

$$Vw(std) = (0.04707 \times 14.4) + (0.04715 \times 15.7) = 1.42$$

Where:

Vw(std) =	Volume of water vapor in the gas sample corrected to standard conditions, scf.
Vwc =	Volume of liquid condensed in impingers, ml.
Wwsg =	Weight of water vapor collected in silica gel, g.
0.04707 =	Factor which includes the density of water (0.002201 lb/ml), the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), ft^3/ml.
0.04715 =	Factor which includes the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), and 453.6 g/lb, ft^3/g.

3. Moisture content

$$bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$$bws = \frac{1.42}{1.42 + 56.888} = 0.024$$

Where:

bws = Proportion of water vapor, by volume, in the gas stream, dimensionless.

4. Mole fraction of dry gas.

$$Md = 1 - bws$$

$$Md = 1 - 0.024 = 0.976$$

Where:

Md = Mole fraction of dry gas, dimensionless.

5. Dry molecular weight of gas stream, lb/lb-mole.

$$MWd = (0.440 \times \%\ CO_2) + (0.320 \times \%\ O_2) + (0.280 \times (\%\ N_2 + \%\ CO))$$

$$MWd = (0.440 \times 0.0) + (0.320 \times 20.9) + (0.280 \times (79.1 + 0.00))$$

$$MWd = 28.84$$

Where:

MWd = Dry molecular weight , lb/lb-mole.
% CO2 = Percent carbon dioxide by volume, dry basis.
$\%\ O_2$ = Percent oxygen by volume, dry basis.
$\%\ N_2$ = Percent nitrogen by volume, dry basis.
% CO = Percent carbon monoxide by volume, dry basis.
0.440 = Molecular weight of carbon dioxide, divided by 100.
0.320 = Molecular weight of oxygen, divided by 100.
0.280 = Molecular weight of nitrogen or carbon monoxide, divided by 100.

6. Actual molecular weight of gas stream (wet basis), lb/lb-mole.

$$MWs = (MWd \times Md) + (18 \times (1 - Md))$$

$$MWs = (28.84 \times 0.976) +(18 (1 - 0.976)) = 28.57$$

Where:

MWs = Molecular weight of wet gas, lb/lb-mole.
18 = Molecular weight of water, lb/lb-mole.

7. Average velocity of gas stream at actual conditions, ft/sec.

$$Vs = 85.49 \times Cp \times ((\text{delt } p)^{1/2})avg \times \left(\frac{Ts\ (avg)}{Ps \times MWs} \right)^{1/2}$$

$$Vs = 85.49 \times 0.84 \times 0.66432 \times \left(\frac{543}{29.54 \times 28.57} \right)^{\wedge}1/2 = 38.3$$

Where:

Vs = Average gas stream velocity, ft/sec.

85.49 = Pitot tube constant, ft/sec x $\frac{(lb/lb\text{-}mole)(in.\ Hg)^{1/2}}{(deg\ R)(in\ H_2O)}$

Cp = Pitot tube coefficient, dimensionless.

Ts = Absolute gas stream temperature, deg R = Ts, deg F + 460.

Ps = Absolute gas stack pressure, in. Hg. = Pb + $\frac{P(static)}{13.6}$

delt p = Velocity head of stack, in. H_2O.

8. Average gas stream volumetric flow rate at actual conditions, wacf/min.

$$Qs(act) = 60 \times Vs \times As$$

$$Qs(act) = 60 \times 38.3 \times 6.31 = 14478$$

Where:

Qs(act) = Volumetric flow rate of wet stack gas at actual conditions, wacf/min.

As = Cross-sectional area of stack, ft^2.

60 = Conversion factor from seconds to minutes.

9. Average gas stream dry volumetric flow rate at standard conditions, dscf/min.

$$Qs(std) = 17.64 \times Md \times \frac{Ps}{Ts} \times Qs(act)$$

$$Qs(std) = 17.64 \times 0.976 \times \frac{29.54}{543.2} \times 14478$$

$$Qs(std) = 13551$$

Where:

Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min.

10. Isokinetic variation calculated from intermediate values, percent.

$$I = \frac{17.327 \times Ts \times Vm(std)}{Vs \times O \times Ps \times Md \times (Dn)^2}$$

$$I = \frac{17.327 \times 543 \times 56.888}{38.3 \times 96 \times 29.54 \times 0.976 \times (0.215)^{\wedge}2} = 109.4$$

Where:

I =	Percent of isokinetic sampling.
O =	Total sampling time, minutes.
Dn =	Diameter of nozzle, inches.
17.327 =	Factor which includes standard temperature (528 deg R), standard pressure (29.92 in. Hg), the formula for calculating area of circle $D^{2/4}$, conversion of square feet to square inches (144), conversion of seconds to minutes (60), and conversion to percent (100), $\frac{(\text{in. Hg})(\text{in}^2)(\text{min})}{(\text{deg R})(\text{ft}^2)(\text{sec})}$

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours | **Plant: Fayetteville, NC**
Test Number: Run 1 | **Test Date: 3/25/19**
Test Location: CBed Outlet | **Test Period: 1315-1529**

1. HFPO Dimer Acid concentration, lbs/dscf.

$$C_1 = \frac{W \times 2.2046 \times 10^{-9}}{Vm(std)}$$

$$C_1 = \frac{188.6 \times 2.2046 \times 10\text{-}9}{59.509}$$

$$= 6.99E\text{-}09$$

Where:

W = Weight of HFPO Dimer Acid collected in sample in ug.

C_1 = HFPO Dimer Acid concentration, lbs/dscf.

2.2046×10^{-9} = Conversion factor from ug to lbs.

2. HFPO Dimer Acid concentration, ug/dscm.

$C_2 = W / (Vm(std) \times 0.02832)$

$C_2 = 188.6 / (59.509 \times 0.02832)$

$= 1.12E+02$

Where:

C_2 = HFPO Dimer Acid concentration, ug/dscm.

0.02832 = Conversion factor from cubic feet to cubic meters.

3. HFPO Dimer Acid mass emission rate, lbs/hr.

PMR1 = C_1 x Qs(std) x 60 min/hr

PMR1 = 6.99E-09 x 14856 x 60

= 6.23E-03

Where:

PMR1 = HFPO Dimer Acid mass emission rate, lbs/hr.

4. HFPO Dimer Acid mass emission rate, g/sec.

PMR2 = PMR1 x 453.59 / 3600

PMR2 = 6.23E-03 x 453.59 /3600

= 7.84E-04

Where:

PMR2 = HFPO Dimer Acid mass emission rate, g/sec.

453.6 = Conversion factor from pounds to grams.

3600 = Conversion factor from hours to seconds.

SAMPLE CALCULATIONS FOR
HFPO DIMER ACID (METHOD 0010)

Client: Chemours | **Plant: Fayetteville, NC**
Test Number: Run 3 | **Test Date: 3/26/2019**
Test Location: Divison Stack | **Test Period: 1510-1709**

1. HFPO Dimer Acid concentration, lbs/dscf.

$$Conc1 = \frac{W \times 2.2046 \times 10^{-9}}{Vm(std)}$$

$$Conc1 = \frac{150.6 \times 2.2046 \times 10\text{-}9}{52.864}$$

Conc1 = 6.28E-09

Where:

W = Weight of HFPO Dimer Acid collected in sample in ug.

Conc1 = Division Stack HFPO Dimer Acid concentration, lbs/dscf.

2.2046×10^{-9} = Conversion factor from ug to lbs.

2. HFPO Dimer Acid concentration, ug/dscm.

Conc2 = W / (Vm(std) x 0.02832)

Conc2 = 150.6 / (52.864 x 0.02832)

Conc2 = 1.01E+02

Where:

Conc2 = Division Stack HFPO Dimer Acid concentration, ug/dscm.

0.02832 = Conversion factor from cubic feet to cubic meters.

3. HFPO Dimer Acid mass emission rate, lbs/hr.

$MR1_{(Outlet)}$ = Conc1 x Qs(std) x 60 min/hr

$MR1_{(Outlet)}$ = 6.28E-09 x 28665 x 60

$MR1_{(Outlet)}$ = 1.08E-02

Where:

$MR1_{(Outlet)}$ = Division Stack HFPO Dimer Acid mass emission rate, lbs/hr.

4. HFPO Dimer Acid mass emission rate, g/sec.

$MR2_{(Outlet)}$ = PMR1 x 453.59 / 3600

$MR2_{(Outlet)}$ = 1.08E-02 x 453.59 /3600

$MR2_{(Outlet)}$ = 1.36E-03

Where:

$MR2_{(Outlet)}$ = Division Stack HFPO Dimer Acid mass emission rate, g/sec.

453.6 = Conversion factor from pounds to grams.

3600 = Conversion factor from hours to seconds.

EXAMPLE CALCULATIONS FOR
VOLUMETRIC FLOW AND MOISTURE AND ISOKINETICS

Client: Chemours	Facility: Fayetteville, NC
Test Number: Run 3	Test Date: 3/26/2019
Test Location: Division Stack	Test Period: 1510-1709

1. Volume of dry gas sampled at standard conditions (68 deg F, 29.92 in. Hg), dscf.

$$Vm(std) = \frac{17.64 \times Y \times Vm \times \left(Pb + \frac{delta\ H}{13.6} \right)}{(Tm + 460)}$$

$$Vm(std) = \frac{17.64 \times 1.0010 \times 51.633 \times \left(29.96 + \frac{1.419}{13.6} \right)}{58.50 + 460} = 52.864$$

Where:

Vm(std) =	Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscf.
Vm =	Volume of gas sample measured by the dry gas meter at meter conditions, dcf.
Pb =	Barometric Pressure, in Hg.
delt H =	Average pressure drop across the orifice meter, in H_2O
Tm =	Average dry gas meter temperature , deg F.
Y =	Dry gas meter calibration factor.
17.64 =	Factor that includes ratio of standard temperature (528 deg R) to standard pressure (29.92 in. Hg), deg R/in. Hg.
13.6 =	Specific gravity of mercury.

2. Volume of water vapor in the gas sample corrected to standard conditions, scf.

$$Vw(std) = (0.04707 \times Vwc) + (0.04715 \times Wwsg)$$

$$Vw(std) = (0.04707 \times 7.0) + (0.04715 \times 13.6) = 0.97$$

Where:

Vw(std) =	Volume of water vapor in the gas sample corrected to standard conditions, scf.
Vwc =	Volume of liquid condensed in impingers, ml.
Wwsg =	Weight of water vapor collected in silica gel, g.
0.04707 =	Factor which includes the density of water (0.002201 lb/ml), the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), ft^3/ml.
0.04715 =	Factor which includes the molecular weight of water (18.0 lb/lb-mole), the ideal gas constant 21.85 (in. Hg) (ft^3)/lb-mole)(deg R); absolute temperature at standard conditions (528 deg R), absolute pressure at standard conditions (29.92 in. Hg), and 453.6 g/lb, ft^3/g.

3. Moisture content

$$bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$$bws = \frac{0.97}{0.97 + 52.864} = 0.018$$

Where:

bws = Proportion of water vapor, by volume, in the gas stream, dimensionless.

4. Mole fraction of dry gas.

Md = 1 - bws

Md = 1 - 0.018 = 0.982

Where:

Md = Mole fraction of dry gas, dimensionless.

5. Dry molecular weight of gas stream, lb/lb-mole.

MWd = (0.440 x % CO_2) + (0.320 x % O_2) + (0.280 x (% N_2 + % CO))

MWd = (0.440 x 0.0) + (0.320 x 20.9) + (0.280 x (79.1 + 0.00))

MWd = 28.84

Where:

MWd = Dry molecular weight , lb/lb-mole.
% CO2 = Percent carbon dioxide by volume, dry basis.
% O_2 = Percent oxygen by volume, dry basis.
% N_2 = Percent nitrogen by volume, dry basis.
% CO = Percent carbon monoxide by volume, dry basis.
0.440 = Molecular weight of carbon dioxide, divided by 100.
0.320 = Molecular weight of oxygen, divided by 100.
0.280 = Molecular weight of nitrogen or carbon monoxide, divided by 100.

6. Actual molecular weight of gas stream (wet basis), lb/lb-mole.

MWs = (MWd x Md) + (18 x (1 - Md))

MWs = (28.84 x 0.982) +(18 (1 - 0.982)) = 28.64

Where:

MWs = Molecular weight of wet gas, lb/lb-mole.
18 = Molecular weight of water, lb/lb-mole.

7. Average velocity of gas stream at actual conditions, ft/sec.

$$Vs = 85.49 \times Cp \times ((\text{delt } p)^{1/2})avg \times \left(\frac{Ts\ (avg)}{Ps \times MWs} \right)^{1/2}$$

$$Vs = 85.49 \times 0.84 \times 1.22257 \times \left(\frac{529}{29.91 \times 28.64} \right)^{\wedge}1/2 = 69.0$$

Where:

Vs = Average gas stream velocity, ft/sec.

85.49 = Pitot tube constant, ft/sec $\times \frac{(\text{lb/lb-mole})(\text{in. Hg})^{1/2}}{(\text{deg R})(\text{in } H_2O)}$

Cp = Pitot tube coefficient, dimensionless.

Ts = Absolute gas stream temperature, deg R = Ts, deg F + 460.

Ps = Absolute gas stack pressure, in. Hg. = Pb + $\frac{P(\text{static})}{13.6}$

delt p = Velocity head of stack, in. H_2O.

8. Average gas stream volumetric flow rate at actual conditions, wacf/min.

$$Qs(act) = 60 \times Vs \times As$$

$$Qs(act) = 60 \times 69.0 \times 7.07 = 29265$$

Where:

Qs(act) = Volumetric flow rate of wet stack gas at actual conditions, wacf/min.

As = Cross-sectional area of stack, ft^2.

60 = Conversion factor from seconds to minutes.

9. Average gas stream dry volumetric flow rate at standard conditions, dscf/min.

$$Qs(std) = 17.64 \times Md \times \frac{Ps}{Ts} \times Qs(act)$$

$$Qs(std) = 17.64 \times 0.982 \times \frac{29.91}{528.9} \times 29265$$

$$Qs(std) = 28665$$

Where:

Qs(std) = Volumetric flow rate of dry stack gas at standard conditions, dscf/min.

10. Isokinetic variation calculated from intermediate values, percent.

$$I = \frac{17.327 \times Ts \times Vm(std)}{Vs \times O \times Ps \times Md \times (Dn)^2}$$

$$I = \frac{17.327 \times 529 \times 52.864}{69.0 \times 96 \times 29.91 \times 0.982 \times (0.160)^{\wedge}2} = 97.3$$

Where:

I =	Percent of isokinetic sampling.
O =	Total sampling time, minutes.
Dn =	Diameter of nozzle, inches.
17.327 =	Factor which includes standard temperature (528 deg R), standard pressure (29.92 in. Hg), the formula for calculating area of circle $D^{2/4}$, conversion of square feet to square inches (144), conversion of seconds to minutes (60), and conversion to percent (100), $\frac{(\text{in. Hg})(\text{in}^2)(\text{min})}{(\text{deg R})(\text{ft}^2)(\text{sec})}$

APPENDIX E
EQUIPMENT CALIBRATION RECORDS

INTERFERENCE CHECK

Date: 12/4/14-12/5/14
Analyzer Type: Servomex - O_2
Model No: 4900
Serial No: 49000-652921
Calibration Span: 21.09 %
Pollutant: 21.09% O_2 - CC418692

INTERFERENT GAS	ANALYZER RESPONSE		% OF CALIBRATION SPAN[(a)]
	INTERFERENT GAS RESPONSE (%)	INTERFERENT GAS RESPONSE, WITH BACKGROUND POLLUTANT (%)	
CO_2 (30.17% CC199689)	0.00	-0.01	0.00
NO (445 ppm CC346681)	0.00	0.02	0.11
NO_2 (23.78 ppm CC500749)	NA	NA	NA
N_2O (90.4 ppm CC352661)	0.00	0.05	0.24
CO (461.5 ppm XC006064B)	0.00	0.02	0.00
SO_2 (451.2 ppm CC409079)	0.00	0.05	0.23
CH_4 (453.1 ppm SG901795)	NA	NA	NA
H_2 (552 ppm ALM048043)	0.00	0.09	0.44
HCl (45.1 ppm CC17830)	0.00	0.03	0.14
NH_3 (9.69 ppm CC58181)	0.00	0.01	0.03
TOTAL INTERFERENCE RESPONSE			**1.20**
METHOD SPECIFICATION			**< 2.5%**

[(a)] The larger of the absolute values obtained for the interferent tested with and without the pollutant present was used in summing the interferences.

Chad Walker

INTERFERENCE CHECK

Date: 12/4/14-12/5/14
Analyzer Type: Servomex - CO_2
Model No: 4900
Serial No: 49000-652921
Calibration Span: 16.65%
Pollutant: 16.65% CO_2 - CC418692

INTERFERENT GAS	ANALYZER RESPONSE		% OF CALIBRATION SPAN[(a)]
	INTERFERENT GAS RESPONSE (%)	INTERFERENT GAS RESPONSE, WITH BACKGROUND POLLUTANT (%)	
CO_2 (30.17% CC199689)	NA .	NA	NA
NO (445 ppm CC346681)	0.00	0.02	0.10
NO_2 (23.78 ppm CC500749)	0.00	0.00	0.02
N_2O (90.4 ppm CC352661)	0.00	0.01	0.04
CO (461.5 ppm XC006064B)	0.00	0.01	0.00
SO_2 (451.2 ppm CC409079)	0.00	0.11	0.64
CH_4 (453.1 ppm SG901795)	0.00	0.07	0.44
H_2 (552 ppm ALM048043)	0.00	0.04	0.22
HCl (45.1 ppm CC17830)	0.10	0.06	0.60
NH_3 (9.69 ppm CC58181)	0.00	0.02	0.14
TOTAL INTERFERENCE RESPONSE			**2.19**
METHOD SPECIFICATION			**< 2.5%**

[(a)] The larger of the absolute values obtained for the interferent tested with and without the pollutant present was used in summing the interferences.

Chad Walker

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI79E15A00E4	Reference Number:	82-401288926-1
Cylinder Number:	CC18055	Cylinder Volume:	150.5 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52018	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Sep 04, 2018

Expiration Date: Sep 04, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	9.000 %	8.864 %	G1	+/- 0.7% NIST Traceable	09/04/2018
OXYGEN	12.00 %	12.00 %	G1	+/- 0.4% NIST Traceable	09/04/2018
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060629	CC413730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA 510-CO2-19GYCXEG	NDIR	Aug 09, 2018
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Aug 09, 2018

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI62E15A0224	Reference Number:	82-401044874-1
Cylinder Number:	SG9169108	Cylinder Volume:	157.2 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52017	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 18, 2017

Expiration Date: Nov 18, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	17.00 %	16.58 %	G1	+/- 0.7% NIST Traceable	11/18/2017
OXYGEN	21.00 %	21.00 %	G1	+/- 0.5% NIST Traceable	11/18/2017
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061336	CC360792	11.002 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2018
NTRM	09061415	CC273526	22.53 % OXYGEN/NITROGEN	+/- 0.4%	Mar 08, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA 510-CO2-19GYCXEG	NDIR	Oct 30, 2017
Horiba MPA 510-O2-7TWMJ041	Paramagnetic	Oct 27, 2017

Triad Data Available Upon Request

Signature on file

Approved for Release

Long Cal and Temperature Cal Datasheet for Standard Dry Gas Meter Console

Calibrator MDW | **Meter Box Number** 27 | **Ambient Temp** 72

Date 21-Feb-19 | **Wet Test Meter Number** P-2952 | **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 16787479

Baro Press, in Hg (Pb)	29.16

Setting	Gas Volume		Temperatures					Calibration Results	
Orifice Manometer	Wet Test Meter	Dry gas Meter	Wet Test Meter	Dry Gas Meter					
in H_20 (ΔH)	ft^3 (Vw)	ft^3 (Vd)	°F (Tw)	Outlet, °F (Td_o)	Inlet, °F (Td_i)	Average, °F (Td)	Time, min (O)	Y	ΔH
0.5	5.0	272.601	72.0	75.00	75.00	75.0	12.7	1.0006	1.8551
		277.620		75.00	75.00				
		5.019		75.00	75.00				
1.0	5.0	278.620	72.0	75.00	75.00	75.0	9.0	1.0011	1.8633
		283.630		75.00	75.00				
		5.010		75.00	75.00				
1.5	10.0	284.300	72.0	75.00	75.00	75.0	15.2	1.0012	1.9931
		294.306		75.00	75.00				
		10.006		75.00	75.00				
2.0	10.0	295.740	72.0	76.00	76.00	76.0	13.0	1.0017	1.9402
		305.748		76.00	76.00				
		10.008		76.00	76.00				
3.0	10.0	307.745	70.0	76.00	76.00	76.5	10.7	0.9957	1.9550
		317.835		77.00	77.00				
		10.090		76.50	76.50				
							Average	**1.0001**	**1.9213**

Vw - Gas Volume passing through the wet test meter
Vd - Gas Volume passing through the dry gas meter
Tw - Temp of gas in the wet test meter
Tdi - Temp of the inlet gas of the dry gas meter
Tdo - Temp of the outlet gas of the dry gas meter
Td - Average temp of the gas in the dry gas meter

0 - Time of calibration run
Pb - Barometric Pressure
ΔH - Pressure differential across orifice
Y - Ratio of accuracy of wet test meter to dry gas meter

$$Y = \frac{Vw * Pb * (td + 460)}{Vd * \left[Pb + \frac{(\Delta H)}{13.6} \right] * (tw + 460)}$$

$$\Delta H = \left[\frac{0.0317 * \Delta H}{Pb * (td + 460)} \right] * \left[\frac{(tw + 460) * O}{Vw} \right]^2$$

Reference Temperature	Temperature Reading from Individual Thermocouple Input [1]						Average Temperature Reading	Temp Difference [2] (%)
Select Temperature ○ °C ◉ °F	Channel Number							
	1	2	3	4	5	6		
32	32	32	32	31	31		31.6	0.1%
212	212	212	212	211	211		211.6	0.1%
932	932	932	932	931	931		931.6	0.0%
1832	1831	1831	1831	1830	1830		1830.6	0.1%

1 - Channel Temps must agree with +/- 5°F or 3°C

2 - Acceptable Temperature Difference less than 1.5 %

$$\text{Temp Diff} = \left[\frac{(\text{Reference Temp}(^\circ F) + 460) - (\text{Test Temp}(^\circ F) + 460)}{\text{Reference Temp}(^\circ F) + 460} \right]$$

Y Factor Calibration Check Calculation

METHOD 0010 TEST TRAIN CARBON BED INLET

METER BOX NO. 27

RUN NO. 1 3/25/2019

MWd = Dry molecular weight source gas, lb/lb-mole.	
0.32 = Molecular weight of oxygen, divided by 100.	
0.44 = Molecular weight of carbon dioxide, divided by 100.	
0.28 = Molecular weight of nitrogen or carbon monoxide, divided by 100.	
% CO_2 = Percent carbon dioxide by volume, dry basis.	0.0
% O_2 = Percent oxygen by volume, dry basis.	20.9

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWd = (0.32 * 20.9) + (0.44 * 0) + (0.28 * (100 - (0 + 20.9)))$$

$$MWd = (6.69) + (0.00) + (22.15)$$

MWd = 28.84

Tma = Source Temperature, absolute(^oR)	
Tm = Average dry gas meter temperature , deg F.	78.0

$$Tma = Ts + 460$$

$$Tma = 78.0 + 460$$

Tma = 538.04

Ps = Absolute meter pressure, inches Hg.	
13.6 = Specific gravity of mercury.	
delta H = Avg pressure drop across the orifice meter during sampling, in H2O	1.01
Pb = Barometric Pressure, in Hg.	30.02

$$Pm = Pb + (delta\ H / 13.6)$$

$$Pm = 30.02 + (1.0125 / 13.6)$$

Pm = 30.09

Yqa = dry gas meter calibration check value, dimensionless.	
0.0319 = (29.92/528)(0.75)2 (in. Hg/°/R) cfm2.	
29 = dry molecular weight of air, lb/lb-mole.	
Vm = Volume of gas sample measured by the dry gas meter at meter conditions, dcf.	57.651
Y = Dry gas meter calibration factor (based on full calibration)	1.0001
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	1.9213
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.0484
O = Total sampling time, minutes.	96

$$Yqa = (O / Vm) * SQRT[(0.0319 * Tma * 29) / (Delta\ H@ * Pm * MWd)] * avg\ SQRT\ Delta\ H$$

$$Yqa = (96.00 / 57.65) * SQRT[(0.0319 * 538.04 * 29) / (1.92 * 30.09 * 28.84)] * 1.05$$

$$Yqa = 1.665 * SQRT[497.742 / 1,667.064] * 1.05$$

Yqa = 0.954

Diff = Absolute difference between Yqa and Y	

$$Diff = ((Y - Yqa) / Y) * 100$$

$$Diff = ((1.0001 - 0.954) / 1.0001) * 100$$

Diff = 4.61

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Integrated Air Services

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record readings in colored boxes below, other columns are automatically calculated.

DATE: 12/12/18
METER PART #: AO29
METER SERIAL #: 17096207
CRITICAL ORIFICE SET SERIAL #: 1331s & 1825

	INITIAL	FINAL	AVG (P_{bar})
BAROMETRIC PRESSURE (in Hg):	29.52	29.50	29.51
Calibrated by:	JAW		

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	AMBIENT F°	DGM F° INITIAL	DGM F° FINAL	Avg DGM F° T_m	ELAPSED TIME (MIN) θ	DGM ΔH ($in H_2O$)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	(4) $\Delta H_@$
8	1	0.2313	24	46.326	57.923	11.597	73	73	73	73	38	0.29	11.341	11.238	0.991	1.826
12	2	0.3277	22.5	35.503	46.326	10.823	73	74	73	74	25	0.59	10.582	10.475	0.990	1.852
16	3	0.4349	21.5	20.574	35.503	14.929	73	74	74	74	26	1.10	14.602	14.458	0.990	1.963
19	4	0.5142	20.5	9.748	20.574	10.826	71	74	74	74	16	1.40	10.596	10.539	0.995	1.783
25	5	0.6742	18.5	999.126	1009.748	10.622	71	74	74	74	12	2.50	10.425	10.364	0.994	1.863
31	6	0.8108	17	945.000	999.126	54.126	70	70	75	73	51	3.70	53.431	53.02	0.992	1.919
														AVG =	0.992	1.868

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

Individual Y's .02 from average? **PASS**
Individual $\Delta H_@$ values 0.15 from average? **PASS**
Average Y value +/-.02 of 1.000? **PASS**

(1) $V_m\,(std) = K_1\,V_m\,\dfrac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}\,(std) = K'\sqrt{\dfrac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \dfrac{V_{cr}\,(std)}{V_m\,(std)}$ = DGM calibration factor

(4) $\Delta H_@ = \dfrac{\Delta H\,0.0319\,T_m\,\theta^2}{P_{bar}\,Y^2\,V_m^2}$

Next Calibration Due By: 12/12/2019

Y Factor Calibration Check Calculation

METHOD 0010 TEST TRAIN CARBON BED INLET

METER BOX NO. AO29

RUN NO. 3 3/26/2019

MWd = Dry molecular weight source gas, lb/lb-mole.	
0.32 = Molecular weight of oxygen, divided by 100.	
0.44 = Molecular weight of carbon dioxide, divided by 100.	
0.28 = Molecular weight of nitrogen or carbon monoxide, divided by 100.	
% CO_2 = Percent carbon dioxide by volume, dry basis.	0.0
% O_2 = Percent oxygen by volume, dry basis.	20.9

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWd = (0.32 * 20.9) + (0.44 * 0) + (0.28 * (100 - (0 + 20.9)))$$

$$MWd = (6.69) + (0.00) + (22.15)$$

MWd = 28.84

Tma = Source Temperature, absolute(^oR)	
Tm = Average dry gas meter temperature , deg F.	64.5

$$Tma = Ts + 460$$

$$Tma = 64.5 + 460$$

Tma = 524.54

Ps = Absolute meter pressure, inches Hg.	
13.6 = Specific gravity of mercury.	
delta H = Avg pressure drop across the orifice meter during sampling, in H2O	1.11
Pb = Barometric Pressure, in Hg.	30.06

$$Pm = Pb + (delta\ H / 13.6)$$

$$Pm = 30.06 + (1.1071 / 13.6)$$

Pm = 30.14

Yqa = dry gas meter calibration check value, dimensionless.	
0.0319 = (29.92/528)(0.75)2 (in. Hg/°/R) cfm2.	
29 = dry molecular weight of air, lb/lb-mole.	
Vm = Volume of gas sample measured by the dry gas meter at meter conditions, dcf.	55.610
Y = Dry gas meter calibration factor (based on full calibration)	0.992
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	1.868
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.0484
O = Total sampling time, minutes.	96

$$Yqa = (O / Vm) * SQRT[(0.0319 * Tma * 29) / (Delta\ H@ * Pm * MWd)] * avg\ SQRT\ Delta\ H$$

$$Yqa = (96.00 / 55.61) * SQRT[(0.0319 * 524.54 * 29) / (1.87 * 30.14 * 28.84)] * 1.05$$

$$Yqa = 1.726 * SQRT[485.253 / 1,623.511] * 1.05$$

Yqa = 0.990

Diff = Absolute difference between Yqa and Y	

$$Diff = ((Y - Yqa) / Y) * 100$$

$$Diff = ((0.992 - 0.990) / 0.992) * 100$$

Diff = 0.2

Long Cal and Temperature Cal Datasheet for Standard Dry Gas Meter Console

Calibrator MDW | **Meter Box Number** 28 | **Ambient Temp** 70

Date 27-Mar-18 | **Wet Test Meter Number** P-2952 | **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 15042594

Baro Press, in Hg (Pb)	30.16

Setting	Gas Volume		Temperatures					Calibration Results	
Orifice Manometer	Wet Test Meter	Dry gas Meter	Wet Test Meter	Dry Gas Meter					
in H_20 (ΔH)	ft^3 (Vw)	ft^3 (Vd)	°F (Tw)	Outlet, °F (Td_o)	Inlet, °F (Td_i)	Average, °F (Td)	Time, min (O)	Y	ΔH
0.5	5.0	728.890	71.0	72.00	72.00	72.5	13.3	1.0060	1.9689
		733.868		73.00	73.00				
		4.978		72.50	72.50				
1.0	5.0	734.860	70.0	73.00	73.00	73.5	9.5	1.0052	1.9978
		739.855		74.00	74.00				
		4.995		73.50	73.50				
1.5	10.0	740.852	70.0	74.00	74.00	74.5	16.7	1.0035	2.3108
		750.865		75.00	75.00				
		10.013		74.50	74.50				
2.0	10.0	751.869	70.0	75.00	75.00	75.5	13.7	1.0009	2.0696
		761.915		76.00	76.00				
		10.046		75.50	75.50				
3.0	10.0	762.921	69.0	76.00	76.00	76.5	11.3	0.9980	2.1001
		773.009		77.00	77.00				
		10.088		76.50	76.50				
							Average	**1.0027**	**2.0895**

Vw - Gas Volume passing through the wet test meter
Vd - Gas Volume passing through the dry gas meter
Tw - Temp of gas in the wet test meter
Tdi - Temp of the inlet gas of the dry gas meter
Tdo - Temp of the outlet gas of the dry gas meter
Td - Average temp of the gas in the dry gas meter

0 - Time of calibration run
Pb - Barometric Pressure
ΔH - Pressure differential across orifice
Y - Ratio of accuracy of wet test meter to dry gas meter

$$Y = \frac{Vw * Pb * (td + 460)}{Vd * \left[Pb + \frac{(\Delta H)}{13.6}\right] * (tw + 460)}$$

$$\Delta H = \left[\frac{0.0317 * \Delta H}{Pb * (td + 460)}\right] * \left[\frac{(tw + 460) * O}{Vw}\right]^2$$

Reference Temperature	Temperature Reading from Individual Thermocouple Input [1]						Average Temperature Reading	Temp Difference [2] (%)
Select Temperature ○ °C ◉ °F	Channel Number							
	1	2	3	4	5	6		
32	32	32	32	32	33		32.2	0.0%
212	213	213	213	213	214		213.2	-0.2%
932	932	933	932	932	932		932.2	0.0%
1832	1832	1832	1831	1832	1834		1832.2	0.0%

1 - Channel Temps must agree with +/- 5°F or 3°C

2 - Acceptable Temperature Difference less than 1.5 %

$$\text{Temp Diff} = \left[\frac{(\text{Reference Temp}(^\circ F) + 460) - (\text{Test Temp}(^\circ F) + 460)}{\text{Reference Temp}(^\circ F) + 460}\right]$$

Y Factor Calibration Check Calculation

MODIFIED METHOD 0010 TEST TRAIN

CARBON BED OUTLET

METER BOX NO. WC 28

3/25/2019 + 3/26/2019

	Run 1	Run 2	Run 3
MWd = Dry molecular weight source gas, lb/lb-mole.			
0.32 = Molecular weight of oxygen, divided by 100.			
0.44 = Molecular weight of carbon dioxide, divided by 100.			
0.28 = Molecular weight of nitrogen or carbon monoxide, divided by 100.			
% CO_2 = Percent carbon dioxide by volume, dry basis.	0.0	0.0	0.0
% O_2 = Percent oxygen by volume, dry basis.	20.9	20.9	20.9

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWd = (0.32 * 20.9) + (0.44 * 0) + (0.28 * (100 - (0 + 20.9)))$$

$$MWd = (6.69) + (0.00) + (22.15)$$

MWd =	28.84	28.84	28.84

Tma = Source Temperature, absolute(^{o}R)			
Tm = Average dry gas meter temperature , deg F.	80.5	51.8	66.4

$$Tma = Ts + 460$$

$$Tma = 80.50 + 460$$

Tma =	540.50	511.79	526.38

Ps = Absolute meter pressure, inches Hg.			
13.60 = Specific gravity of mercury.			
delta H = Avg pressure drop across the orifice meter during sampling, in H2O	1.43	1.38	1.46
Pb = Barometric Pressure, in Hg.	30.02	30.06	30.06

$$Pm = Pb + (delta\ H / 13.6)$$

$$Pm = 30.02 + (1.42583333333333 / 13.6)$$

Pm =	30.12	30.16	30.17

Yqa = dry gas meter calibration check value, dimensionless.			
0.03 = (29.92/528)(0.75)2 (in. Hg/°/R) cfm2.			
29.00 = dry molecular weight of air, lb/lb-mole.			
Vm = Volume of gas sample measured by the dry gas meter at meter conditions, dcf.	60.365	57.418	59.954
Y = Dry gas meter calibration factor (based on full calibration)	1.0027	1.0027	1.0027
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	2.0895	2.0895	2.0895
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.1700	1.1454	1.1850
O = Total sampling time, minutes.	96	96	96

$$Yqa = (O / Vm) * SQRT (0.0319 * Tma * 29) / (Delta\ H@ * Pm * MWd) * avg\ SQRT\ Delta\ H$$

$$Yqa = (96.00 / 60.37) * SQRT (0.0319 * 540.50 * 29) / (2.09 * 30.12 * 28.84) * 1.17$$

$$Yqa = 1.590 * SQRT 500.017 / 1,814.815 * 1.17$$

Yqa =	0.9767	0.9775	0.9821

Diff = Absolute difference between Yqa and Y	2.59	2.51	2.05

$$Diff = ((Y - Yqa) / Y) * 100$$

$$Diff = ((1.0027 - 0.977) / 1.0027) * 100$$

Average Diff = 2.38

Allowable = 5.0

Long Cal and Temperature Cal Datasheet for Standard Dry Gas Meter Console

Calibrator MDW | **Meter Box Number** 22 | **Ambient Temp** 72

Date 23-May-18 | **Wet Test Meter Number** P-2952 | **Temp Reference Source** Thermocouple Simulator (Accuracy +/- 1°F)

Dry Gas Meter Number 15550528

Baro Press, in Hg (Pb)	29.5

Setting	Gas Volume		Temperatures					Calibration Results	
Orifice Manometer	Wet Test Meter	Dry gas Meter	Wet Test Meter	Dry Gas Meter					
in H_20 (ΔH)	ft^3 (Vw)	ft^3 (Vd)	°F (Tw)	Outlet, °F (Td_o)	Inlet, °F (Td_i)	Average, °F (Td)	Time, min (O)	Y	ΔH
0.5	5.0	973.135	72.0	75.00	75.00	75.5	15.2	0.9905	2.6243
		978.210		76.00	76.00				
		5.075		75.50	75.50				
1.0	5.0	985.000	72.0	76.00	76.00	76.5	10.4	1.0039	2.4525
		990.010		77.00	77.00				
		5.010		76.50	76.50				
1.5	10.0	990.810	72.0	76.00	76.00	76.5	17.1	1.0077	2.4864
		1000.780		77.00	77.00				
		9.970		76.50	76.50				
2.0	10.0	4.162	72.0	77.00	77.00	77.5	14.6	1.0005	2.4122
		14.210		78.00	78.00				
		10.048		77.50	77.50				
3.0	10.0	26.680	72.0	78.00	78.00	78.0	11.80	1.0023	2.3614
		36.695		78.00	78.00				
		10.015		78.00	78.00				
							Average	**1.0010**	**2.4674**

Vw - Gas Volume passing through the wet test meter
Vd - Gas Volume passing through the dry gas meter
Tw - Temp of gas in the wet test meter
Tdi - Temp of the inlet gas of the dry gas meter
Tdo - Temp of the outlet gas of the dry gas meter
Td - Average temp of the gas in the dry gas meter

0 - Time of calibration run
Pb - Barometric Pressure
ΔH - Pressure differential across orifice
Y - Ratio of accuracy of wet test meter to dry gas meter

$$Y = \frac{Vw * Pb * (td + 460)}{Vd * \left[Pb + \frac{(\Delta H)}{13.6} \right] * (tw + 460)}$$

$$\Delta H = \left[\frac{0.0317 * \Delta H}{Pb * (td + 460)} \right] * \left[\frac{(tw + 460) * O}{Vw} \right]^2$$

Reference Temperature	Temperature Reading from Individual Thermocouple Input [1]						Average Temperature Reading	Temp Difference [2] (%)
Select Temperature ○ °C ◉ °F	Channel Number							
	1	2	3	4	5	6		
32	33	33	32	33	33		32.8	-0.2%
212	212	213	211	211	211		211.6	0.1%
932	933	933	933	933	932		932.8	-0.1%
1832	1833	1833	1833	1832	1832		1832.6	0.0%

1 - Channel Temps must agree with +/- 5°F or 3°C

2 - Acceptable Temperature Difference less than 1.5 %

$$\text{Temp Diff} = \left[\frac{(\text{Reference Temp}(^\circ F) + 460) - (\text{Test Temp}(^\circ F) + 460)}{\text{Reference Temp}(^\circ F) + 460} \right]$$

Y Factor Calibration Check Calculation

MODIFIED METHOD 0010 TEST TRAIN

DIVISION STACK

METER BOX NO. 22

3/25/2019 + 3/26/2019

	Run 1	Run 2	Run 3
MWd = Dry molecular weight source gas, lb/lb-mole.			
0.32 = Molecular weight of oxygen, divided by 100.			
0.44 = Molecular weight of carbon dioxide, divided by 100.			
0.28 = Molecular weight of nitrogen or carbon monoxide, divided by 100.			
% CO_2 = Percent carbon dioxide by volume, dry basis.	0.1	0.0	0.0
% O_2 = Percent oxygen by volume, dry basis.	21.0	21.0	21.2

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWd = (0.32 * 21) + (0.44 * 0.1) + (0.28 * (100 - (0.1 + 21)))$$

$$MWd = (6.72) + (0.04) + (22.09)$$

MWd =	28.86	28.84	28.85

Tma = Source Temperature, absolute(^{o}R)			
Tm = Average dry gas meter temperature , deg F.	80.6	46.5	58.5

$$Tma = Ts + 460$$

$$Tma = 80.58 + 460$$

Tma =	540.58	506.50	518.50

Ps = Absolute meter pressure, inches Hg.			
13.60 = Specific gravity of mercury.			
delta H = Avg pressure drop across the orifice meter during sampling, in H2O	1.34	1.39	1.42
Pb = Barometric Pressure, in Hg.	29.92	29.96	29.96

$$Pm = Pb + (delta\ H / 13.6)$$

$$Pm = 29.92 + (1.34333333333333 / 13.6)$$

Pm =	30.02	30.06	30.06

Yqa = dry gas meter calibration check value, dimensionless.			
0.03 = (29.92/528)(0.75)2 (in. Hg/°/R) cfm2.			
29.00 = dry molecular weight of air, lb/lb-mole.			
Vm = Volume of gas sample measured by the dry gas meter at meter conditions, dcf.	51.535	51.014	51.633
Y = Dry gas meter calibration factor (based on full calibration)	1.0010	1.0010	1.0010
Delta H@ = Dry Gas meter orifice calibration coefficient, in. H2O.	2.4674	2.4674	2.4674
avg SQRT Delta H = Avg SQRT press. drop across the orifice meter during sampling , in. H_2O	1.1540	1.1762	1.1859
O = Total sampling time, minutes.	96	96	96

$$Yqa = (O / Vm) * SQRT (0.0319 * Tma * 29) / (Delta\ H@ * Pm * MWd) * avg\ SQRT\ Delta\ H$$

$$Yqa = (96.00 / 51.54) * SQRT (0.0319 * 540.58 * 29) / (2.47 * 30.02 * 28.86) * 1.15$$

$$Yqa = 1.863 * SQRT\ 500.094 / 2{,}137.403 * 1.15$$

Yqa =	1.0398	1.0359	1.0440

Diff = Absolute difference between Yqa and Y	3.88	3.49	4.30

$$Diff = ((Y - Yqa) / Y) * 100$$

$$Diff = ((1.001 - 1.040) / 1.001) * 100$$

Average Diff = 3.89

Allowable = 5.0

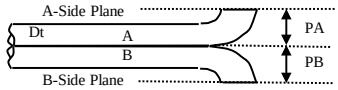
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-699**

Inspection Date 2/22/19 Individual Conducting Inspection ks

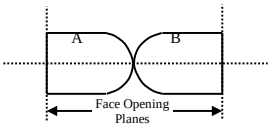
If all Criteria PASS
Cp is equal to 0.84

		PASS/FAIL
Distance to A Plane (PA) - inches	0.463	PASS
Distance to B Plane (PB) - inches	0.463	PASS
Pitot OD (D_t) - inches	0.375	

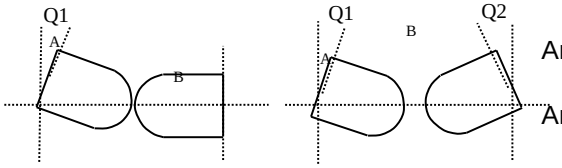


$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB

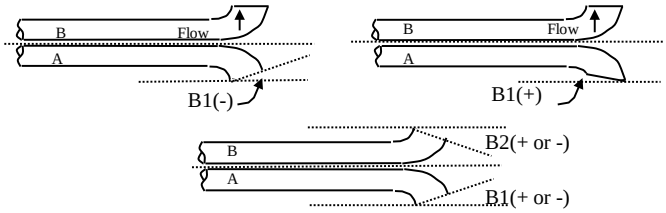


Are Open Faces Aligned Perpendicular to the Tube Axis: (●) YES ( ) NO — PASS



Angle of Q1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of Q2 from vertical B Tube- degrees (absolute)	0	PASS

Q1 and Q2 must be $\leq 10^o$

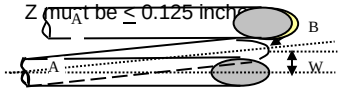


Angle of B1 from vertical A Tube- degrees (absolute)	0	PASS
Angle of B1 from vertical B Tube- degrees (absolute)	0	PASS

B1 or B2 must be $\leq 5^o$

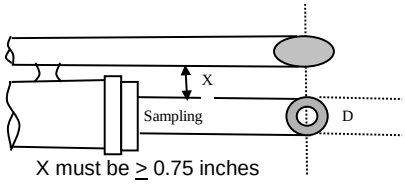
Horizontal offset between A and B Tubes (Z) - inches	0.005	PASS

Z must be $\leq$ 0.125 inches



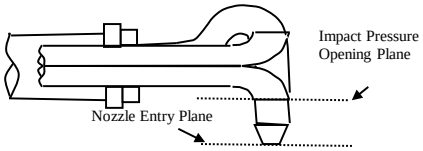
Vertical offset between A and B Tubes (W) - inches	0.016	PASS

W must be $\leq$ 0.03125 inches

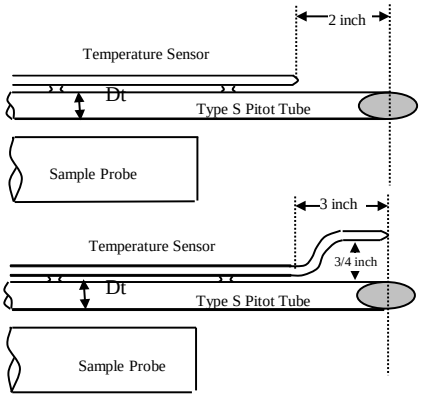


Distance between Sample Nozzle and Pitot (X) - inches	0.85	PASS

X must be $\geq$ 0.75 inches



Impact Pressure Opening Plane is above the Nozzle Entry Plane: (●) YES ( ) NO ( ) NA



Thermocouple meets the Distance Criteria in the adjacent figure: (●) YES ( ) NO ( ) NA

Thermocouple meets the Distance Criteria in the adjacent figure: ( ) YES ( ) NO (●) NA

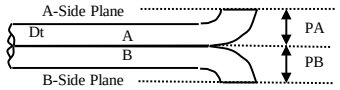
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-707**

Inspection Date 6/15/18 Individual Conducting Inspection KS

If all Criteria PASS
Cp is equal to 0.84

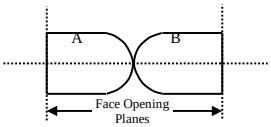
PASS/FAIL



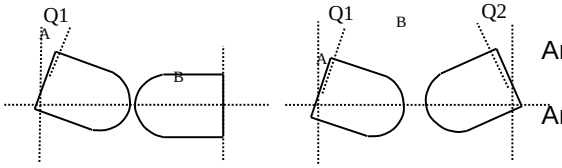
Distance to A Plane (PA) - inches 0.44 PASS
Distance to B Plane (PB) - inches 0.44 PASS
Pitot OD (D_t) - inches 0.375

$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB

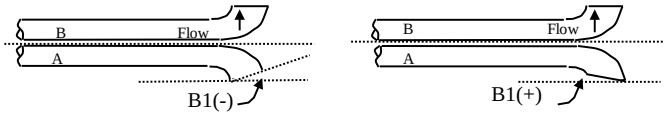


Are Open Faces Aligned Perpendicular to the Tube Axis (●) YES ( ) NO PASS

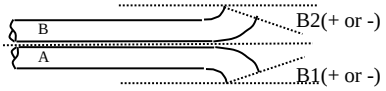


Angle of Q1 from vertical A Tube- degrees (absolute) 0 PASS
Angle of Q2 from vertical B Tube- degrees (absolute) 0 PASS

Q1 and Q2 must be $\leq 10^o$



Angle of B1 from vertical A Tube- degrees (absolute) 0 PASS

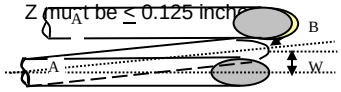


Angle of B1 from vertical B Tube- degrees (absolute) 0 PASS

B1 or B2 must be $\leq 5^o$

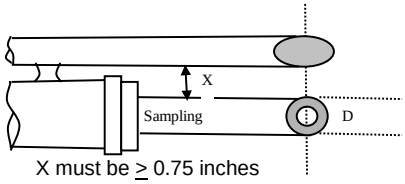
Horizontal offset between A and B Tubes (Z) - inches 0.007 PASS

Z must be $\leq$ 0.125 inches



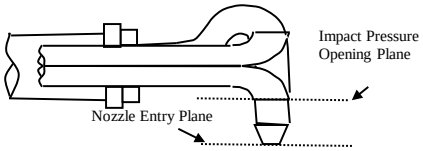
Vertical offset between A and B Tubes (W) - inches 0.018 PASS

W must be $\leq$ 0.03125 inches

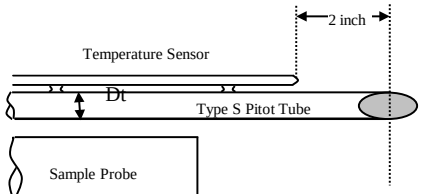


Distance between Sample Nozzle and Pitot (X) - inches 0.86 PASS

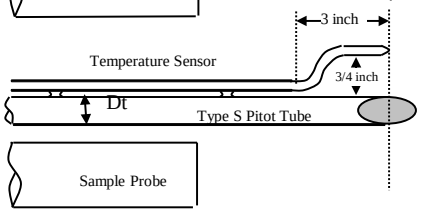
X must be $\geq$ 0.75 inches



Impact Pressure Opening Plane is above the Nozzle Entry Plane (●) YES ( ) NO ( ) NA



Thermocouple meets the Distance Criteria in the adjacent figure (●) YES ( ) NO ( ) NA



Thermocouple meets the Distance Criteria in the adjacent figure ( ) YES ( ) NO (●) NA

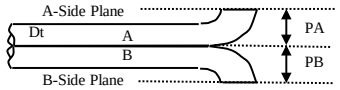
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-710**

Inspection Date 2/19/19 Individual Conducting Inspection ks

If all Criteria PASS
Cp is equal to 0.84

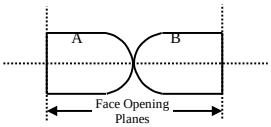
PASS/FAIL



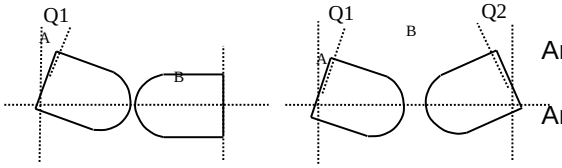
Distance to A Plane (PA) - inches 0.453 PASS
Distance to B Plane (PB) - inches 0.453 PASS
Pitot OD (D_t) - inches 0.375

$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB

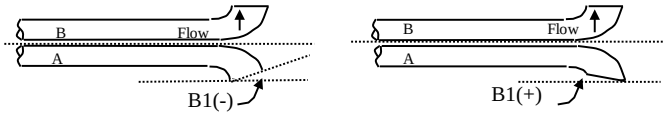


Are Open Faces Aligned Perpendicular to the Tube Axis (●) YES ( ) NO PASS

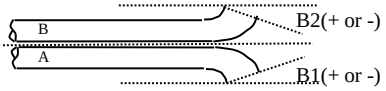


Angle of Q1 from vertical A Tube- degrees (absolute) 0 PASS
Angle of Q2 from vertical B Tube- degrees (absolute) 0 PASS

Q1 and Q2 must be $\leq 10^o$



Angle of B1 from vertical A Tube- degrees (absolute) 0 PASS

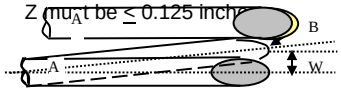


Angle of B1 from vertical B Tube- degrees (absolute) 0 PASS

B1 or B2 must be $\leq 5^o$

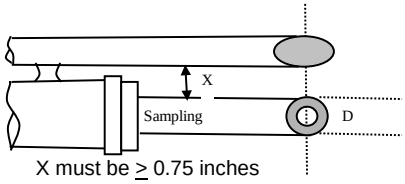
Horizontal offset between A and B Tubes (Z) - inches 0.012 PASS

Z must be $\leq$ 0.125 inches



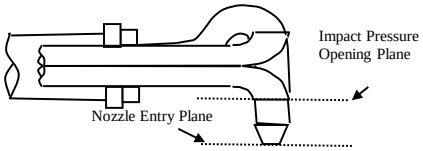
Vertical offset between A and B Tubes (W) - inches 0.022 PASS

W must be $\leq$ 0.03125 inches

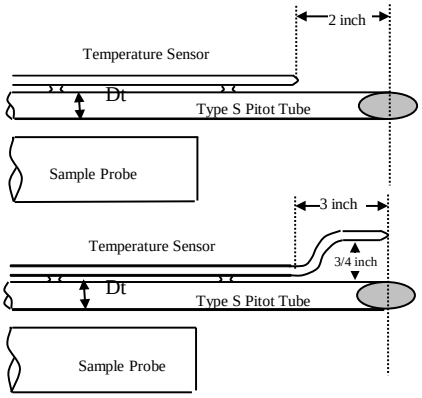


Distance between Sample Nozzle and Pitot (X) - inches 0.87 PASS

X must be $\geq$ 0.75 inches



Impact Pressure Opening Plane is above the Nozzle Entry Plane (●) YES ( ) NO ( ) NA



Thermocouple meets the Distance Criteria in the adjacent figure (●) YES ( ) NO ( ) NA

Thermocouple meets the Distance Criteria in the adjacent figure ( ) YES ( ) NO (●) NA

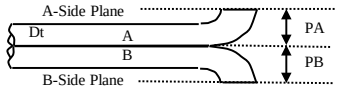
Type S Pitot Tube Inspection Data Form

Pitot Tube Identification Number: **P-701**

Inspection Date 5/30/18 Individual Conducting Inspection SR

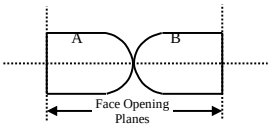
If all Criteria PASS
Cp is equal to 0.84

		PASS/FAIL
Distance to A Plane (PA) - inches	0.466	PASS
Distance to B Plane (PB) - inches	0.466	PASS
Pitot OD (D_t) - inches	0.375	

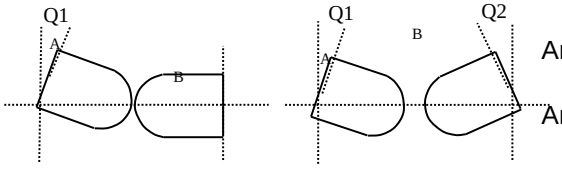


$1.05\ D_t < P < 1.5\ D_t$

PA must Equal PB



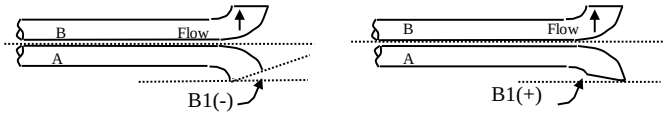
Are Open Faces Aligned Perpendicular to the Tube Axis: (●) YES ( ) NO — PASS



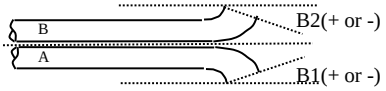
Angle of Q1 from vertical A Tube- degrees (absolute): 0 — PASS

Angle of Q2 from vertical B Tube- degrees (absolute): 0 — PASS

Q1 and Q2 must be ≤ 10°



Angle of B1 from vertical A Tube- degrees (absolute): 0 — PASS

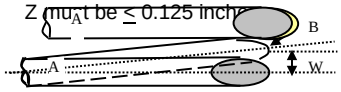


Angle of B1 from vertical B Tube- degrees (absolute): 0 — PASS

B1 or B2 must be ≤ 5°

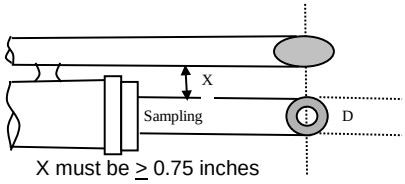
Horizontal offset between A and B Tubes (Z) - inches: 0.008 — PASS

Z must be ≤ 0.125 inches



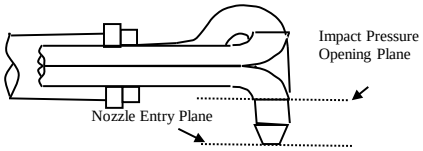
Vertical offset between A and B Tubes (W) - inches: 0.02 — PASS

W must be ≤ 0.03125 inches

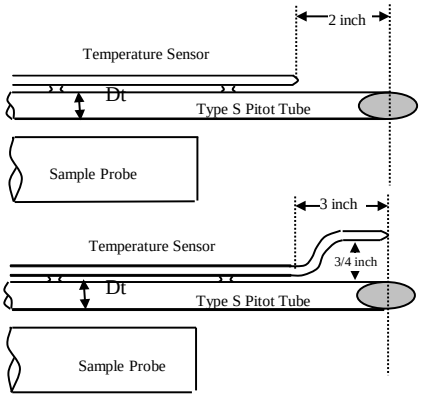


Distance between Sample Nozzle and Pitot (X) - inches: 0.89 — PASS

X must be ≥ 0.75 inches



Impact Pressure Opening Plane is above the Nozzle Entry Plane: (●) YES ( ) NO ( ) NA



Thermocouple meets the Distance Criteria in the adjacent figure: (●) YES ( ) NO ( ) NA

Thermocouple meets the Distance Criteria in the adjacent figure: ( ) YES ( ) NO (●) NA

APPENDIX F
LIST OF PROJECT PARTICIPANTS

The following WESTON employees participated in this project.

Paul Meeter	Senior Project Manager
Jeff O'Neill	Senior Project Manager
Steve Rathfon	Team Member
Robert Scroggins	Team Member
Jacob Little	Team Member
Austin Squires	Team Member
Kris Ansley	Team Member