Consumers Energy
Count on Us®

40 CFR Part 75 CEMS Relative Accuracy Test Audit Report

EUBOILER3

Consumers Energy Company
J.H. Campbell Generating Complex
17000 Croswell Street
West Olive, Michigan 49460
SRN: B2835
FRS: 110000411108
ORIS: 1710

November 19, 2024

Test Date: October 23, 2024

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section
Air Emissions Testing Body
Laboratory Services Section
Work Order No. 41142205

CERTIFICATION FOR 40 CFR PART 75 TEST REPORT

(To be completed by authorized AETB firm representative and included in source test report)

Facility ID: ORIS 1710; SRN B2835 Date(s) Tested: October 23, 2024

Facility Name: Consumers Energy J.H. Campbell Generating Complex

Facility Address: 17000 Croswell Street, West Olive, Michigan 49460

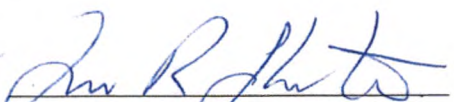
Equipment Tested: Flow CEMS

AETB Firm: CECo/RCTS AETB

Business Address: 135 W. Trail St., Jackson, MI 49201

Phone: (616) 738-3234 Email: thomas.schmelter@cmsenergy.com

As the legally authorized representative of the RCTS AETB, I certify that I have reviewed this test report in conjunction with the relevant Quality Manual Appendix D checklist. Having checked each item, the information provided in this test report is true, accurate, and complete.

Signature:  Date: November 19, 2024

Name: Thomas R. Schmelter Title: AETB Technical Director

Phone: (616) 738-3234 Email: thomas.schmelter@cmsenergy.com

RELATIVE ACCURACY TEST REPORT CHECKLIST

		Description (Typical location(s) in report) [ASTM D 7036-04 Section Reference]
	☑	Title (Title Page) [15.3.1]
	☑	AETB name & address (QM App. D pg. D-2) [15.3.2]
	☑	Unique identification number on each page and a clear identification of the end of the report (Headers & Footers; "End of Report" page) [15.3.3]
	☑	Name and address of the customer (Title Page; QM App. D pg. D-2) [15.3.4]
	☑	Date(s) the testing was performed (Title page; Introduction; QM App. D pg. D-2) [15.3.10]
	☑	Identification of the units tested (Title page; Introduction) [15.3.9]
	☑	Identification of regulatory personnel that observed testing (Introduction; Appendix D1) [Note 13]
	☑	Clear identification of the pollutants/parameters tested (Summary & Discussion) [15.3.5]
	☑	Identification of the test methods used (Sampling and Analytical Procedures) [15.3.8]
	☑	Identification of the sampling location, including diagrams, sketches, or photographs (Figures) [15.3.6]
	☑	Detailed process description and process operations for each test run (Source and Monitor Description; Appendix B CEMS data sheets) [15.3.7]
	☑	Reference to the test protocol and procedures used by the AETB (Introduction) [15.3.11]
	☑	Test results and units of measure (Summary and Discussion) [15.3.12]
	☑	Information on specific test conditions, including text description of process operations for each test run and description of any operational issues with the unit or the control device (Discussion of Test Results) [15.3.14]
	☑	Discussion of the test results including the uncertainty associated with the test and discussion of possible errors or limiting conditions (Quality Assurance Procedures) [15.3.15]
N/A	☐	Reference Method analyzer calibrations for each RM gas RATA run. (Appendix B) [15.3.16]
	☑	Raw plant CEMS data for each RATA run and each CEMS component (i.e., all gas analyzers, flow monitors). (Appendix B) [15.3.17]
N/A	☐	Raw Reference Method DAS data for each RM gas RATA run. (Appendix B) [15.3.17]
	☑	CEMS "Operating Load Analysis" report. (Appendix C) [15.3.11]
N/A	☐	Meter box post-test calibration results (Appendix C) [15.3.16]
N/A	☐	NO_x converter check results (Appendix C) [15.3.16]
	☑	Pitot calibrations and inspections (Appendix C) [15.3.16]
	☑	FRRS/manometer/Magnehelic gage calibration results (Appendix C) [15.3.16]
N/A	☐	Reference Method calibration gas certificates of analysis (Appendix C) [15.3.16]
	☑	RATA field data sheets verified against spreadsheet data (Field data sheets in project file) [15.3.17]
	☑	RCTS AETB Letter of Certification (Appendix D1) [15.3.19]
	☑	Completed QM Appendix F – "AETB Field Test Signature Form" (Appendix D1) [3.1.3; 3.1.9; 3.1.14; 8.3; Note 14; 12.2; 12.3; 12.4; 14.1.1]
	☑	Deviations from, additions to, or exclusions from the test protocol, test methods, or AETB Quality Manual entered on QM App. F pg. F-2 (Appendix D2) [15.3.13]
	☑	Names, titles, and signatures of persons authorizing the test report – "QM App. D pg. D-2" (After Title Page) [15.3.18]
	☑	QSTI certificates for Qualified Individuals overseeing/performing the test (Appendix D2)
	☑	Table of Contents is correct (Report Body) [Neatness & professionalism]
	☑	Report Headers & Footers are correct (Report Body) [Neatness & professionalism]
	☑	RM and CEMS run data in correct order (Appendix B) [Neatness & professionalism]

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

The Regulatory Compliance Testing Section (RCTS) of Consumers Energy conducted a continuous emission monitoring systems (CEMS) quality assurance (QA) audit associated with emission unit EUBOILER3 (Unit 3) operating at the J.H. Campbell Generating Complex in West Olive, Michigan.

The volumetric airflow relative accuracy test audit (RATA) was conducted at a single operating level (high load) on October 23, 2024, to satisfy requirements in Michigan Department of Environment, Great Lakes and Energy (EGLE) Renewable Operating Permit (ROP) No. MI-ROP-B2835-2020b, and United States Environmental Protection Agency (USEPA) Title 40, Code of Federal Regulations (40 CFR) Part 75, Appendices A and B. The Unit 3 40 CFR Part 75 monitoring plan designates EUBOILER3 as Unit/Stack 3. Note that due to turbine bearing vibration issues, Unit 3 is currently restricted to operating within the high operating level only for normal production purposes, so this flow RATA was postponed from the week of September 9, 2024, to October 23, 2024, which falls within the 720-hour grace period allowed by 40 CFR Part 75, Appendix B, Section 2.3.3. This postponement allowed Unit 3 to continue extended operations at high load, such that the Operating Load Analysis generated no more than 21 days prior to this test event as described in 40 CFR Part 75, Appendix B, Section 2.3.1.3(c)(3), qualified the unit for a single operating level flow RATA conducted at high load.

A test protocol describing the USEPA sampling, calibration, and QA procedures in Reference Methods (RM) 1, 2, Conditional Test Method (CTM)-041, 3, and 4, 40 CFR Part 60, Performance Specification (PS) 2 and 40 CFR Part 75, Appendices A and B was submitted on August 9, 2024, to the USEPA Region 5 and EGLE offices. The protocol was subsequently approved in a letter dated August 30, 2024, by EGLE representative Jeremy Howe. The approved test protocol also contained provisions for sulfur dioxide, carbon dioxide, and oxides of nitrogen RATA testing which was conducted on September 10, 2024; the results of which were submitted in a separate report dated October 21, 2024. A 7-day Notice specific to the rescheduled timing of this flow RATA was submitted to EGLE on October 16, 2024. No deviations, additions to, or exclusions from the test protocol were encountered. Representatives from USEPA or EGLE did not witness the test program.

The CEMS audit was performed by RCTS representatives Thomas Schmelter and David Kawasaki. Joe Mason, Senior Equipment Technician with the Consumers Energy J.H. Campbell Generating Complex, coordinated the tests with applicable plant personnel and provided CEMS data.

RCTS operates as a self-accredited Air Emission Testing Body (AETB) as described in the AETB Letter of Certification contained in Appendix D1 of this report and is accordingly qualified to conduct 40 CFR Part 75 test programs. RCTS' AETB program is developed in accordance with the American Society for Testing and Materials (ASTM) D 7036-04, *Standard Practice for Competence of Air Emissions Testing Bodies*, in which the AETB is required during test projects to provide at least one qualified individual (QI), qualified in the specific methods for that project, to be on-site at all times. RCTS representative Thomas Schmelter met these requirements and assumed the on-site lead QI roles for the duration of the CEMS audit.

Table 1-1 presents the test program organization, major lines of communication, and names of responsible individuals.

Table 1-1
Test Program Contact List

Program Role	Contact	Address
EPA Regional Contact	r5ardreporting@epa.gov	USEPA Region 5 77 W. Jackson Blvd. Chicago, IL 60604
EGLE AQD Emissions Measurement Representative	Jeremy Howe Technical Programs Unit Supervisor 231-878-6687 howej1@michigan.gov	EGLE Technical Programs Unit 525 W. Allegan, Constitution Hall, 2nd Floor S Lansing, Michigan 48933-1502
EGLE AQD District Supervisor	Heidi Hollenbach District Supervisor 616-540-1136 hollenbachh@michigan.gov	EGLE Grand Rapids District Office 350 Ottawa Avenue NW, Unit 10 Grand Rapids, Michigan 49503-2316
Responsible Official	Nathan J. Hoffman Executive Director of Fossil Generation 616-738-5436 nathan.hoffman@cmsenergy.com	Consumers Energy J.H. Campbell Generating Complex 17000 Croswell Street West Olive, Michigan 49460
Site Environmental	Joseph J. Firlit Manager Engineering Support 616-836-9900 joseph.firlit@cmsenergy.com	
CEMS Technician	Joe Mason Senior Equipment Technician 616-738-3278 joe.mason@cmsenergy.com	
Corporate Environmental Coordinator	Jason Prentice Principal Environmental Engineer 517-788-1467 jason.prentice@cmsenergy.com	Consumers Energy Company Parnall Office (P22-334) 1945 W. Parnall Road Jackson, Michigan 49201
Test Team Representative	Thomas Schmelter, QSTI Principal Lab Technical Analyst 616-738-3234 thomas.schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460

2.0 SUMMARY AND DISCUSSION

The J.H. Campbell Generating Complex volumetric airflow CEMS relative accuracy (RA) results indicate the CEMS meet the semiannual RA frequency standards in 40 CFR 75, Appendices A and B. Report appendices include RA equations and sample calculations as Appendix A, comprehensive test data as Appendix B, quality assurance data as Appendix C, and AETB certifications as Appendix D.

2.1 WALL ADJUSTMENT FACTOR

In August 2016, USEPA CTM-041, *Determination of Volumetric Gas Flow in Rectangular Ducts or Stacks Taking into Account Velocity Decay near the Stack or Duct Walls*, was performed prior to conducting volumetric flowrate RATAs to evaluate the magnitude of velocity decay near the duct rectangular walls and calculate a site-specific wall effect

adjustment factor (WAF). This measurement yielded a calculated WAF of 0.9740 (dimensionless) which was applied to the Unit 3 duct area and CEMS volumetric flow rate.

CTM-041 rectangular duct criteria allow application of a single operating load WAF to all operating loads and subsequent tests, unless the affected ductwork configuration was changed. The Unit 3 ductwork configuration remains unchanged; thus, the 0.9740 WAF is valid and no additional WAF tests were necessary.

2.2 Volumetric Flowrate

Two ultrasonic volumetric airflow monitors, identified as components F01 and F02, are installed in an X-pattern within the duct. The monitors operate in tandem as the primary flow monitoring system, with volumetric flowrate and continuous emission rates calculated and reported based on the average of both. The monitors also act as individual redundant backups to the primary system and are assigned to data acquisition and handling system (DAHS) channels BK1 and BK2, respectively.

Flow RATA runs were completed at the High load level. The RATA results presented in Table 2-1 met the 40 CFR Part 75, Appendix A §3.3.4(a) and Appendix B §2.3.1.1(a) ≤10.0% criterion semiannual test frequency.

Table 2-1
Summary of Volumetric Airflow RATA Results

CEMS Make/ Model	CEMS Duct Location & Serial Number	RATA Criteria	Required RATA Performance	Actual RATA Performance		
				Primary (F01 & F02)	F01 Monitor	F02 Monitor
Teledyne Monitor Labs Model 150	Unit 3 F01 Monitor SN 1500470	High-Load	≤10% of mean RM	9.98%	9.68%	9.74%
	F02 Monitor SN 1500471	Bias	|d| ≤ |CC| = Pass	1.077	1.095	1.075

|d| average absolute difference between the RM and CEMS
|CC| confidence coefficient

3.0 SOURCE AND MONITOR DESCRIPTION

The J.H. Campbell Generating Complex operates under State of Michigan Registration Number (SRN) B2835 in accordance with air permit MI-ROP-B2835-2020b, within which EUBOILER3 is identified as a designated emission unit. The permit incorporates various applicable federal regulations, including requirements for monitoring gas flow, sulfur dioxide (SO_2), carbon dioxide (CO_2), and oxides of nitrogen (NO_x) emissions using CEMS installed, maintained, and operated in accordance with 40 CFR Part 75 provisions.

EUBOILER3 is a pulverized coal-fired 8,240 MMBtu per hour dry bottom, wall-fired boiler with fuel oil startup capability. High pressure steam from the boiler turns a turbine connected to a generator to produce electricity. The boiler is fired with pulverized coal and is rated to produce an electricity output of approximately 910 MW gross.

Unit 3 emissions are minimized or controlled using low-NO_x burners (LNB), over-fire air (OFA), and selective catalytic reduction (SCR) for NO_x, activated carbon injection (ACI) for mercury (Hg), spray dry absorbers (SDAs) for acid gases [e.g., sulfur oxides (SO_x),

hydrogen chloride (HCl)], and a low pressure/high volume pulse jet fabric filter (PJFF) baghouse system for particulate matter control.

Thermo Environmental dilution-extractive CO_2, SO_2, NO_x, and Teledyne ultrasonic air flow CEMS are installed in the common exhaust duct, upstream of the discharge stack, to measure exhaust gas concentrations and velocity on a wet basis. Mercury (Hg) and particulate matter (PM) CEMS are also installed in this proximity. The CEMS are designed to interface with a data acquisition handling system (DAHS) manufactured by ESC Spectrum (ESC). The DAHS records various data including exhaust gas flow rates, concentrations, mass emissions, and unit operating parameters.

Figure 1, *J.H. Campbell Unit 3 Test Port Location*, and Figure 2, *J.H. Campbell Unit 3 Duct Cross Section and Flow Traverse Point Detail*, illustrate the in-duct RM test port locations. Although not presented via diagram, the upstream flow disturbance relative to the RM test ports consists of a silencer/change in duct size, while the downstream disturbance consists of a 90-degree duct bend/change in duct size entering the base of the exhaust stack.

In preparation for the testing, a Unit 3 Operating Load Analysis (OLA) was obtained encompassing the September 20, 2023, through October 22, 2024, period. As stated in 40 CFR Part 75, Appendix B, §2.3.1.3(c)(3), a single-load flow RATA may be performed in lieu of the 2-load RATA if the results of a historical load data analysis show that in the time period extending from the ending date of the last annual flow RATA (September 20, 2023), and no more than 21 days prior to this test event, the unit has operated at a single load level for ≥85.0 percent of the time. The OLA, presented in Appendix C, shows that High load was the operating level for 87.1% of the time since the previous RATA; therefore, a single-load flow RATA was performed at High load.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Specific test procedures detailed in 40 CFR Part 60, Appendix A, Reference Methods 1, 2, CTM-041, 3, and 4 were followed in conjunction with 40 CFR Part 75 Appendices A and B to conduct 12 runs and to calculate CEMS RA. Flue gas velocity and temperature were measured for a minimum of 5 minutes during each flow RATA test run. The following sections provide the sampling and analytical procedures.

4.1 Traverse Points (USEPA Method 1)

The number and location of traverse points used for determining exhaust gas velocity and flow RA were determined in accordance with USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources*. The exhaust duct area was calculated, and the cross-section divided into equal areas based on the location of existing airflow disturbances.

The equivalent diameter of the duct is 28.54 feet, and the flow test ports are located approximately 107.5 feet (3.8 duct diameters) downstream and 23.1 feet (0.8 duct diameters) upstream of a flow disturbance.

Twenty traverse points (4 traverse points in each of the 5 test ports) were selected and traversed to measure flue gas velocity and temperature to calculate volumetric flowrate. Refer to Figures 1 and 2 for illustrations of the exhaust duct configuration and flow sampling locations.

4.2 Velocity and Volumetric Flow (USEPA Method 2 and CTM-041)

The exhaust gas velocity and temperature measurements were conducted in accordance with USEPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. The pressure differential across the positive and negative openings of an S-type Pitot tube connected to a pressure transducer were used to calculate exhaust gas velocity and volumetric flowrate. Refer to Figure 3 for an illustration of the volumetric flow RM apparatus.

The RM flow data incorporates a wall effect adjustment factor (WAF) of 0.9740 (See Section 2.1), derived using USEPA CTM-041, *Determination of Volumetric Gas Flow in Rectangular Ducts or Stacks Taking into Account Velocity Decay near the Stack or Duct Walls.* CTM-041 results are provided in Appendix B1.

4.3 Diluent/Molecular Weight (USEPA Method 3)

Oxygen (O_2) and CO_2 concentrations were measured using calibrated Fyrite gas analyzers to calculate flue gas composition via USEPA Method 3, *Gas Analysis for the Determination of Dry Molecular Weight*. Triplicate grab samples were captured in absorbing fluid resulting in a proportional fluid rise to the gas concentration absorbed. After reading each sample concentration on the instrument scale, the calculated dry molecular weight is verified to not differ from the triplicate sample mean by more than 0.3 g/g-mole (0.3 lb/lb-mole), with the average result reported to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

4.4 Moisture Content (USEPA Method 4)

Moisture content was determined using USEPA Method 4, *Determination of Moisture in Stack Gases*. Exhaust gas was drawn at a constant rate through a series of impingers immersed in an ice bath to condense moisture (Figure 4), which was subsequently measured gravimetrically to calculate moisture content.

Refer to Appendix A for the RATA calculations used in this report.

5.0 QUALITY ASSURANCE PROCEDURES

The objective of a Quality Assurance (QA) program is to produce data that are complete, representative, and of known precision and accuracy. Within the RATA test program, completeness can be defined as the percentage of the required field measurements and associated documentation achieved. Representativeness, defined as the "when," "how," and "how many" measurements taken, is typically specified within the regulations governing the source to be tested as well as the Test Protocol submitted to the regulatory agency prior to the test event. Precision and accuracy are measures of data quality and exist by design within each of the USEPA reference test methods and procedures incorporated during the RATA.

RCTS addresses these QA goals by operating within a Quality System in compliance with ASTM D 7036-04, Standard Practice for Competence of Air Emissions Testing Bodies; a practice specifying the general competence requirements applicable to all AETB staff engaged in air emission testing at stationary sources, regardless of testing scope. By employing these requirements in conjunction with the precision and accuracy standards in each reference method, RCTS is better able to ensure consistently accurate data quality from an individual and AETB perspective. RCTS' AETB Letter of Accreditation and individual QSTI Certificates are contained in Appendix D.

5.1 Pitot Tube, Thermocouple, and Pressure Equipment

The Pitot tube-thermocouple assembly for measuring exhaust gas volumetric flow was inspected and/or calibrated according to procedures in RCTS' AETB Standard Operating Procedure 3-5 and Appendix O-1, USEPA RM 2, and Approved Alternative Method (ALT-011).

A Pitot tube inspection occurred before the field test to confirm there was no gross damage or excess misalignment of the Pitot openings. A post-test Pitot tube inspection and certification is performed to evaluate if the Pitot face openings are still aligned within acceptable tolerances.

ALT-011 describes the inherent accuracy and precision of a thermocouple within ±1.3°F in the range of -32°F and 2,500°F and states that a system performing accurately at one temperature is expected to behave similarly at other temperatures. Therefore, a single point thermocouple calibration procedure to verify accuracy within ±1.0 percent of the absolute measured temperature, considering the presence of disconnected wire junctions or a potential miscalibrated temperature display, was performed. After the test event, the accuracy of the thermocouple system was checked at ambient temperature, or other temperature, within the range specified by the manufacturer, using a reference thermometer. The temperatures of the thermocouple and reference thermometer(s) shall agree within ±2°F.

The differential pressure transmitters used with Method 2 were calibrated in accordance with §6.2.1 of the method and RCTS AETB Standard Operating Procedure Appendix J-4. Refer to Appendix C for Pitot tube, thermocouple, differential pressure and barometer calibration or inspection sheets.

5.2 Dry Gas Metering Console

The RM 4 DGM post-test calibration was performed in the field using Alternative Method 5 Post-Test Calibration (ALT-009), which incorporates the optional pretest orifice meter coefficient check principle of Method 5, §9.2.1.1. Instead of determining the pretest DGM calibration check value Yc, ALT-009 calculates a quality assured Yqa after three or more test runs are conducted, with that value required to be within 5 percent of the pre-test DGM calibration factor (Y). Note that field metering system and pump to console leak checks were performed per ALT-009 requirements.

6.0 DISCUSSION OF TEST RESULTS

The CEMS RATA results presented in Appendix B indicate the flow CEMS operating at J.H. Campbell Generating Complex Unit 3 meets the performance specifications in 40 CFR Part 75, Appendix A. These data indicate compliance with the CEMS monitoring and recordkeeping requirements of the facility's air permit MI-ROP-B2835-2020b.

During the test event, no deviations were observed by the QI in attendance and criteria specified in the applicable Reference Methods and the agency-approved Test Protocol were followed.

Quality Assurance data, such as equipment calibrations, are presented in Appendix C. AETB certifications and signature forms are provided in Appendix D.

Hard copy and/or electronic field data were completed in the field and upon return to the office, verified for data precision and accuracy, further ensuring the appropriate AETB and Reference Method quality measures were met.

As noted in Section 1.0, this most recent flow RATA was conducted within a grace period, as the 2024 flow RATA was originally due September 30, 2024, based upon the results of the 2023 flow RATA and the accumulation of subsequent QA operating quarters. As the 2024 grace period flow RATA qualifies for a semiannual retest frequency, the next flow RATA is due within 2 QA operating quarters after the quarter in which the grace period RATA was completed per 40 CFR Part 75, Appendix B, Section 2.3.3(d)(2). Thus, the 2025 flow RATA is due no earlier than June 30, 2025, assuming that each subsequent calendar quarter is also a QA operating quarter. Unit 3 is scheduled to be retired as of May 31, 2025 11:59 PM and thus the October 23, 2024 periodic flow RATA is expected to be the last periodic flow RATA completed at Unit 3.

6.1 Clock Time Synchronization

The electronic timestamps recorded for RM RATA runs are on military time basis and synchronized to the CEMS DAHS, which is in Eastern Standard Time (EST).

Figures

Figure 1 – J.H. Campbell Unit 3 Test Port Location

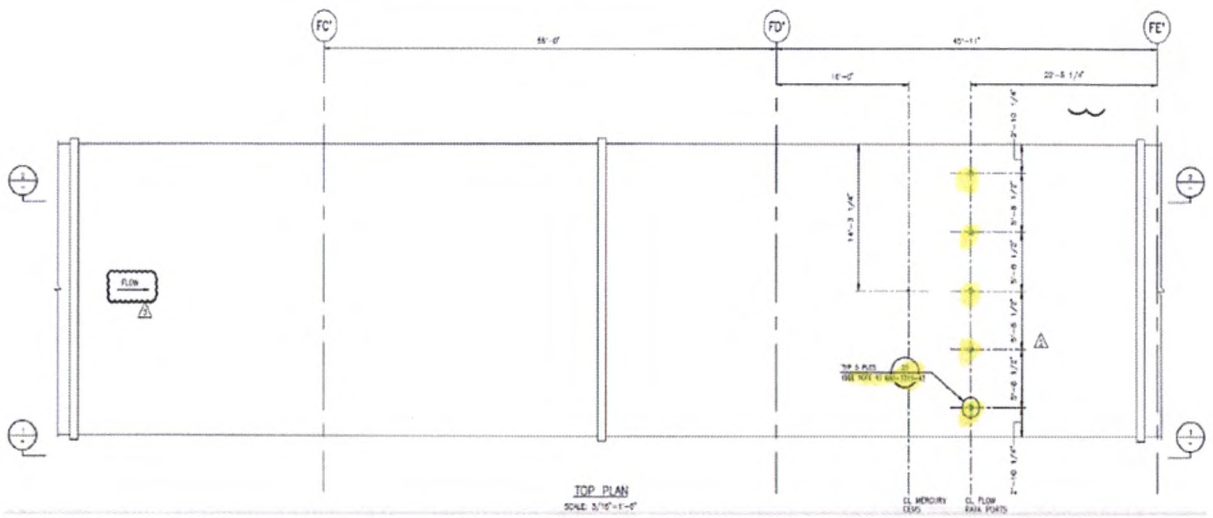
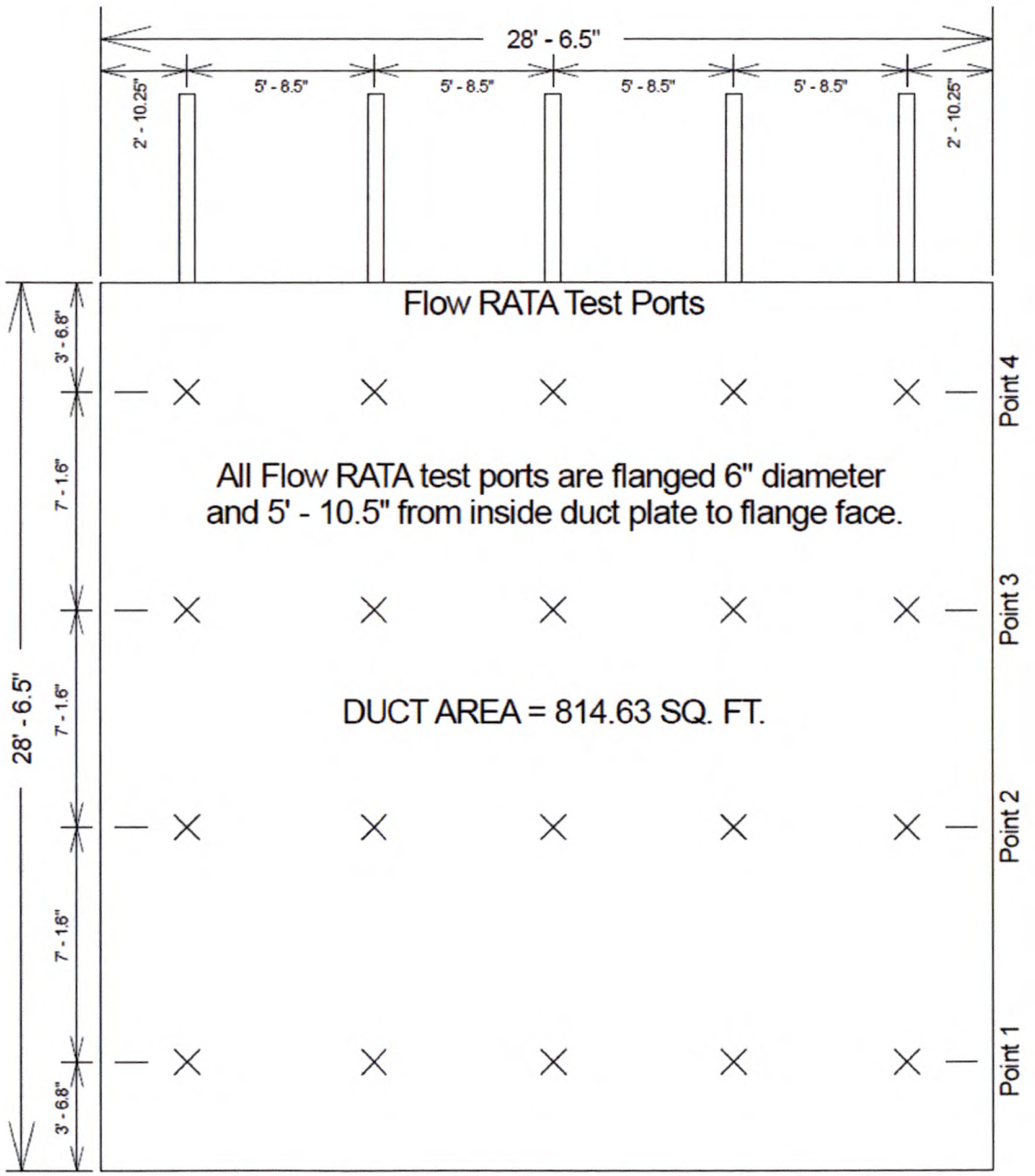


Figure 2 – J.H. Campbell Unit 3 Duct Cross Section and Flow Traverse Point Detail



BCP 1/21/16

Figure 3 – Volumetric Air Flow RATA Sample Apparatus

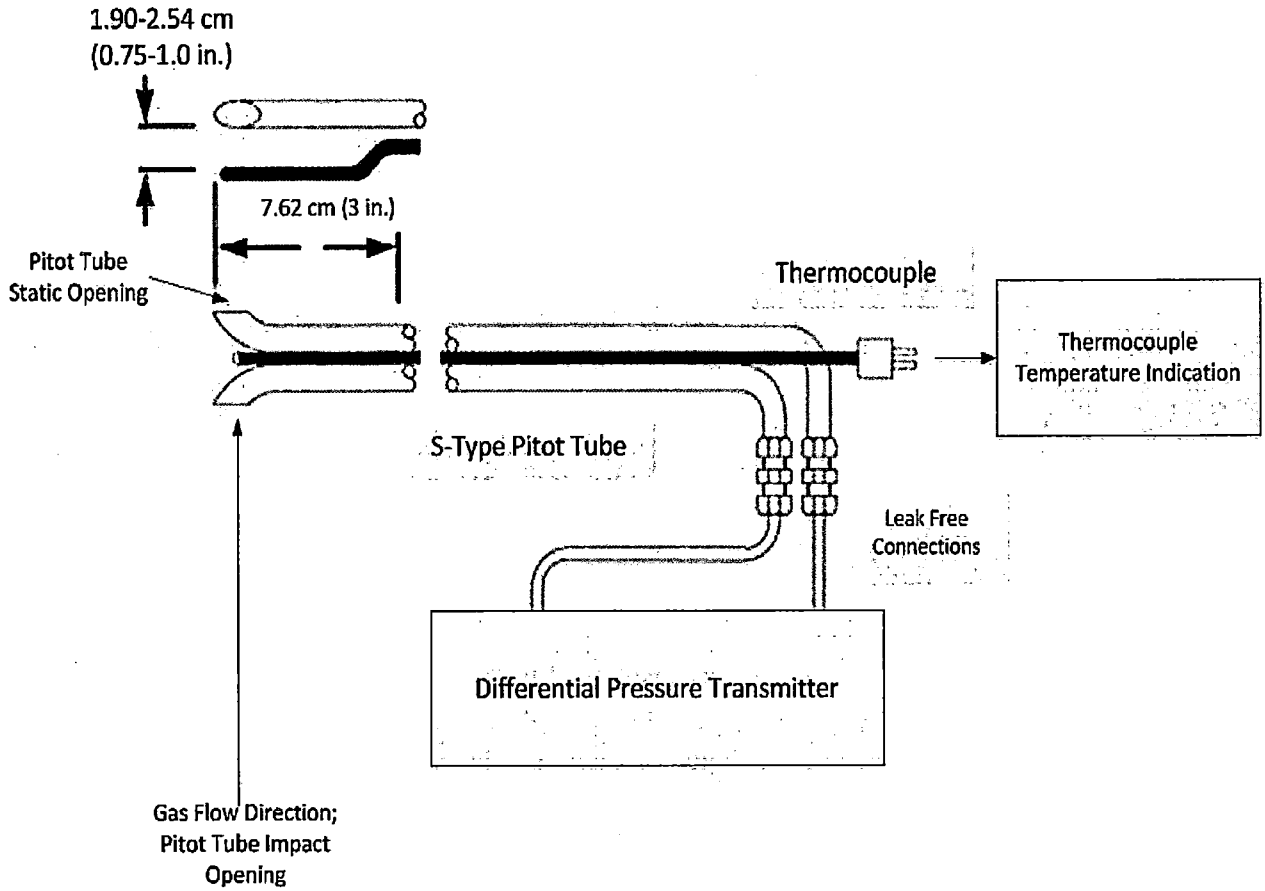


Figure 4 – Method 4 Moisture Sample Apparatus