AP42 Section: 13.2.6

Background Chapter 4

Reference: 4

Title: Written Communication from D. Borda, The Hamilton Foundry & Machine Co., Harrison, OH, to L. Gruber, Southwestern Ohio Air Pollution Control Agency, Cincinnati, OH, November 27, 1990.

SECTION 4
REF. B

APPENDIX X

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER 1431233202/PTI 14-1995

FACILITY NAME Hamilton Foundry

SOURCE DESCRIPTION (OR SCC CODE) BMD Shotblaster

CONTROL EQUIPMENT Fuller Baghouse

DATE(S) OF TEST October 30, 1990

FINAL TEST REPORT RECEIVED ON November 29, 1990

POLLUTANT(S) TESTED Total Suspended Particulate

TEST METHOD USEPA Reference Methods 1-4, 17

TEST FIRM K&B Design - Cincinnati, Ohio

EMISSION RATES*: Inlet 555.6 #/HR
Outlet 0.4 #/HR Total all sources. Outlet 0.6 #/HR BMD only.

ACTUAL (lb(s)/Hr) Efficiency 99.93% ALLOWABLE** Efficiency>99% minimum

OPERATING RATES*:

DURING TEST** 7454 #/HR MAXIMUM** 8500 #/HR

EMISSION FACTOR***

COMMENTS: Allowable limits based on Best Available Technology (BAT).

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSES AND CALCULATIONS ARE:

[X] AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

[ ] AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

January 7, 1991
DATE OF REVIEW

Prepared By: Susan L. Kestler, ETI for
REVIEWED BY
LeRoy R. Gruber, AQE and
Willian L. Ausdenmoore, ETI

* BASED ON - RUN AVERAGE
** SPECIFY APPLICATION UNITS
*** SPECIFY IN UNITS OF MASS/INPUT

SLK/LRG/WLA/sal

OBSERVER'S REPORT

PARTICULATE TESTING

Conducted On:	October 30, 1990
Source:	Hamilton Foundry
Premise Number:	1431233202/PTI 14-1995
Test Firm:	K&B Design, Inc. Cincinnati, Ohio
Prepared By:	Susan L. Kestler, ET1 for William L. Ausdenmoore, ET1 and LeRoy R. Gruber, AQE
Date Prepared:	January 7, 1991

SOUTHWESTERN OHIO AIR POLLUTION CONTROL AGENCY
(S.W.O.A.P.C.A)

Hamilton Foundry
P.N. 1431233202/PTI 14-1995

Testing for particulate emissions (all size fractions) was conducted on October 30, 1990 at Hamilton Foundry in Harrison, Ohio. The facility's fuller baghouse was tested to prove compliance. A new BMD pellet blasting cleaning device (7100 #/HR) was added to the baghouse that also controls emissions from several blasting machines, a sand cast vibrator belt and other plant processes. The foundry has no controls on the melting furnaces. Testing was done to determine if the baghouse could achieve 99% control efficiency when the new blaster and the other processes were running. That would satisfy Best Available Technology (BAT) requirements (OAC Rule 3745-31-05) for the new cleaner. An outlet emission rate of less than .6 #/HR is also specified.

The test series was performed by K&B Design under the direction of Craig Jones. The test was witnessed ny William L. Ausdenmoore and LeRoy R. Gruber of SWOAPCA. USEPA Reference Methods 1-4, 17 (in-stack filtration method) was used due to a vertical inlet traverse. Three sixty minute runs were done at both the inlet and the outlet of the baghouse. The inlet samples were taken in the main truck line. An ID fan pulls the dust laden air from the building, through the baghouse, and exhausts the clean air stream to the atmosphere. Outlet samples were taken on the discharge side of the fan. An excessive amount of fugitive emissions were observed inside of the plant, especially in the melting furnace area. Dust exiting from the silo located on the front of the building averaged 20-30% opacity. Better control of that source is recommended for investigation.

Results from the test averaged 555.6 #/HR at the inlet and 0.4 #/HR at the outlet. That represents a 99.93% control efficiency. Stack gas flow was 41,151 dscfm at 98 degrees F and 2.9% moisture (inlet). Fyrite analysis resulted in 21.0% O2 and an undetectable amount of CO2 on the inlet. The outlet averaged a stack gas flow of 50,125 dscfm at 97 degrees F and 2.6% moisture.

The baghouse pressure drop ran 6.2" to 6.8" water pressure occurred every 80 seconds. New bagging was put in July 1990.

No visible emissions were seen at anytime from the baghouse outlet. The amount of poured and cleaned iron during the test was recorded. It was comparable to average amounts in September and October 1990.

Quality assurance measures utilized for the test included calibrations of dry gas meters, thermometers, pitot tubes, and sample nozzles. Equipment leak checks and proper documentation were in the test report. The emission rate, stack flow and other calculations were checked and found to be correct.

Hamilton Foundry
P.N. 1431233202/PTI 14-1995

In conclusion, the proper testing protocol was followed and the source was operating near worst case conditions. All data is accurate and shows compliance with applicable regulations. Retesting on a five year basis is recommended.

Prepared By: Susan L. Kestler, ET1 for
William L. Ausdenmoore, ET1 and
LeRoy R. Gruber, AQE

WLA/LRG/sal
Rev. 01/08/91

200 Industrial Drive
Harrison, Ohio 45030
Phone 513/367-6900

Established 1875

THE HAMILTON FOUNDRY & MACHINE CO.

November 27, 1990

Mr. Lee Gruber
Southwestern Ohio Air
Pollution Control Agency
1632 Central Parkway
Cincinnati, Ohio 45214

Dear Mr. Gruber:

Please find enclosed two copies of the Hamilton Foundry stack test results and report as requested in the "terms and conditions" under permit to install application number 14-1995 of 6-20-1990.

We trust that the results will fulfill the compliance requirements of that permit.

We want to again thank you and your staff for your patience and support during this analysis.

If additional information is required, please don't hesitate to call.

Very truly yours,

Dennis M. Borda
Production Control &
Industrial Engineer Manager

DMB/wlw

Enclosure (2)

cc: Craig R. Jones
K & B Design, Inc.

Daniel L. Rhoads
Hamilton Foundry

EPA METHOD 5 STACK TEST ANALYSIS

FACILITY NAME: Hamilton Foundry
PREMISE #: 1431233202/PTI 14-1995
SOURCE DESCRIPTION: BMD shot blaster

REVIEWER: SLK 12-7-90
TEST DATE: 10-30-1990
PRINTED: 12-07-1990

INPUT DATA:	RUN #1	RUN #2	RUN #3
METER VOLUME (ACF)	28.031	30.181	31.068
METER CORRECTION	.987	.987	.987
BAROMETRIC PRESSURE (IN HG)	29.65	29.65	29.65
ORIFICE PRESSURE (IN H20)	.78	.75	.79
METER TEMPERATURE (F)	59	79	88
VOLUME WATER (ML H20)	14.1	21.5	19.5
CO2 IN STACK GAS (%)	7	7	7
O2 IN STACK GAS (%)	12	12	12
N2 IN STACK GAS (%)	80.7	80.7	80.7
CO IN STACK GAS (%)	.3	.3	.3
PITOT COEFFICIENT	.84	.84	.84
AVERAGE SQUARE ROOT VELOCITY PRESS	.871	.85	.867
STACK TEMPERATURE (F)	86	93	115
STACK PRESSURE (IN HG)	29.41	29.41	29.41
STACK DIAMETER (IN)	52.5	52.5	52.5
STACK AREA (SQ FT)	15.03301	15.03301	15.03301
PARTICULATE CATCH (MG)	2812.9	3121.6	2874.5
NOZZLE DIAMETER (IN)	.173	.175	.173
NOZZLE AREA (SQ FT)	0.000163	0.000167	0.000163
TEST LENGTH (MIN)	60	60	60

TEST RESULTS:			
METER VOLUME @STP (DSCF)	27.9351	28.9596	29.3240
VOLUME OF WATER VAPOR @STP (CF)	0.663687	1.012005	0.917865
MOLE FRACTION OF WATER IN STACK GAS	0.023207	0.033765	0.030351
DRY MOLECULAR WEIGHT OF STACK GAS	29.6000	29.6000	29.6000
MOLECULAR WEIGHT OF STACK GAS	29.3308	29.2083	29.2479
STACK GAS VELOCITY (FT/SEC)	49.7622	48.9751	50.9041
STACK GAS FLOW (DRY STD CF/HR)	%2500492.0	%2403525.0	%2411100.0
PARTICULATE CONCENTRATION (GR/DSCF)	1.553708	1.663225	1.512534
ISOKINETIC RATIO	102.9267	108.4835	112.0499
MASS RATE OF EMISSION (LB/HR)	555.0048	571.0861	520.9815

STACK TEST COMMENTS:

Baghouse Inlet

EPA METHOD 5 STACK TEST ANALYSIS

SLK 12-7-90

FACILITY NAME: Hamilton Foundry
PREMISE #: 1431233202/ PTI 14-1995
SOURCE DESCRIPTION: BMD shot blaster

REVIEWER: SLK
TEST DATE: 10-30-1990
PRINTED: 12-07-1990

INPUT DATA:	RUN #1	RUN #2	RUN #3
METER VOLUME (ACF)	67.491	64.158	64.752
METER CORRECTION	.976	.976	.976
BAROMETRIC PRESSURE (IN HG)	29.65	29.65	29.65
ORIFICE PRESSURE (IN H20)	4.6	4.02	3.87
METER TEMPERATURE (F)	66	83	90
VOLUME WATER (ML H20)	22.1	46.8	35
CO2 IN STACK GAS (%)	7	7	7
O2 IN STACK GAS (%)	12	12	12
N2 IN STACK GAS (%)	80.7	80.7	80.7
CO IN STACK GAS (%)	.3	.3	.3
PITOT COEFFICIENT	.84	.84	.84
AVERAGE SQUARE ROOT VELOCITY PRESS	1.031	.959	.967
STACK TEMPERATURE (F)	89	99	102
STACK PRESSURE (IN HG)	29.61	29.61	29.61
STACK DIAMETER (IN)	54	54	54
STACK AREA (SQ FT)	15.90431	15.90431	15.90431
PARTICULATE CATCH (MG)	3.2	6.6	1.2
NOZZLE DIAMETER (IN)	.251	.252	.251
NOZZLE AREA (SQ FT)	0.000344	0.000346	0.000344
TEST LENGTH (MIN)	60	60	60

TEST RESULTS:

METER VOLUME @STP (DSCF)	66.2460	60.9161	60.6753
VOLUME OF WATER VAPOR @STP (CF)	1.040247	2.202876	1.647450
MOLE FRACTION OF WATER IN STACK GAS	0.015460	0.034900	0.026434
DRY MOLECULAR WEIGHT OF STACK GAS	29.6000	29.6000	29.6000
MOLECULAR WEIGHT OF STACK GAS	29.4207	29.1952	29.2934
STACK GAS VELOCITY (FT/SEC)	58.7752	55.3789	55.8966
STACK GAS FLOW (DRY STD CF/HR)	%3153430.0	%2860441.0	%2896961.0
PARTICULATE CONCENTRATION (GR/DSCF)	0.000745	0.001672	0.000305
CONCENTRATION (GR/DSCF @ 12% CO2)	0.001278	0.002866	0.000523
ISOKINETIC RATIO	97.2729	97.8279	96.9808
PERCENT EXCESS AIR (%)	125.3332	125.3332	125.3332
MASS RATE OF EMISSION (LB/HR)	0.3358	0.6831	0.1263

STACK TEST COMMENTS:

Baghouse Outlet

Table of Contents

1.0 EXECUTIVE SUMMARY

K&B Design, Inc. was retained by Hamilton Foundry to determine the particulate removal efficiency of the Fuller baghouse which controls emissions from the BMD shot blast, the spin blast, and the sand shakeout. Three samples were collected from the inlet and the outlet of the baghouse using USEPA Reference Methods for stationary source sampling.

The results of the tests are summarized below:

TEST #	REMOVAL EFFICIENCY (%)
1	99.94
2	99.88
3	99.98
Average	99.93

2.0 *INTRODUCTION*

K&B Design, Inc. was retained by Hamilton Foundry to determine the removal efficiency of particulate matter of the Fuller baghouse. Three, 60 minute samples were taken at the inlet and outlet of the baghouse using USEPA Reference Methods 1-4 and 17. The tests were conducted on October 31, 1990. Measurements were also made of the stack gas temperature, moisture content, velocity and volumetric flow rate, oxygen and carbon dioxide content.

Mr. Lee Gruber and Mr. Bill Augsberger of the Southwestern Ohio Air Pollution Control Agency (SWOAPCA) were on-site to observe the test procedures and the process conditions. Mr. Dennis Borda of Hamilton Foundry coordinated the sampling activities with the plant production activities. Mr. Craig Jones was the Project Manager for K&B Design. Messrs. Larry Hagen, Tom Bayer, Ron Wittich, and Chris Hazelwood of K&B Design assisted with the field tests.

3.0 DESCRIPTION OF OPERATIONS

Particulate emissions from the BMD shot blast, the spin blast, and the sand shakeout are ducted to the Fuller baghouse. The emission control system consists of several pickup points that converge into a common trunkline upstream of the baghouse. The inlet samples were taken in the main truck line. An ID fan pulls the dust laden air from the building, through the baghouse, and exhausts the clean air stream to the atmosphere. The outlet samples were taken on the discharge side of the fan.

4.0 *SAMPLING AND ANALYTICAL PROCEDURES*

The sampling and analytical procedures used in these emission tests conform to the most recent revisions of USEPA Reference Methods for stationary source sampling. The following procedures were employed:

- **Measurement Sites**
  Location of measurement sites and the number of traverse points that were sampled was determined as specified in USEPA Reference Method 1, "Sample and Velocity Traverses for Stationary Sources."Drawings of the sampling sites are included in Figure 4.1 and Figure 4.2.

- **Velocity and Temperature**
  Stack gas velocity and temperature were determined using USEPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Standard Pitot Tube)." The velocity pressure was measured with an 'S' type pitot tube and manometer.

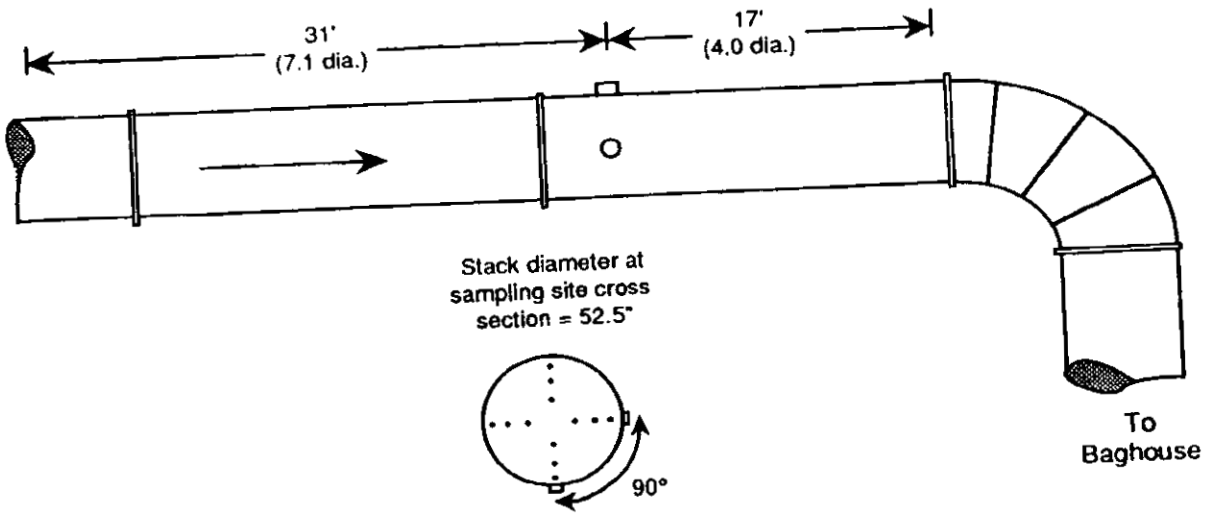
- **Dry Molecular Weight**
  The dry molecular weight was determined using USEPA Reference Method 3, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight." Several grab samples of the stack gas were collected during each test and analyzed with Fyrite combustion gas analyzers for oxygen and carbon dioxide.

- **Stack Gas Moisture**
  Stack gas moisture content was determined using USEPA Reference Method 4, "Determination of Moisture Content in Stack Gases."

- **Particulate**
  Particulate emissions were determined using USEPA Reference Method 17, "Determination of Particulate Emissions From Stationary Sources (In-Stack Filtration Method)."

  In the laboratory, the filter was desiccated to dryness for 24 hours and then weighed on an analytical balance to a constant weight. (A constant weight is a difference of no more than 0.5 mg. or 1 percent of the the total weight less tare weight between two consecutive analysis with no less than six hours of desiccation between analysis). A blank filter was analyzed in the same manner. The acetone from the probe rinse was transferred to a tared glass beaker and evaporated to dryness. The resulting residue was then desiccated for 24 hours and weighed to a constant weight. An acetone blank was analyzed in the same manner for sample weight correction.

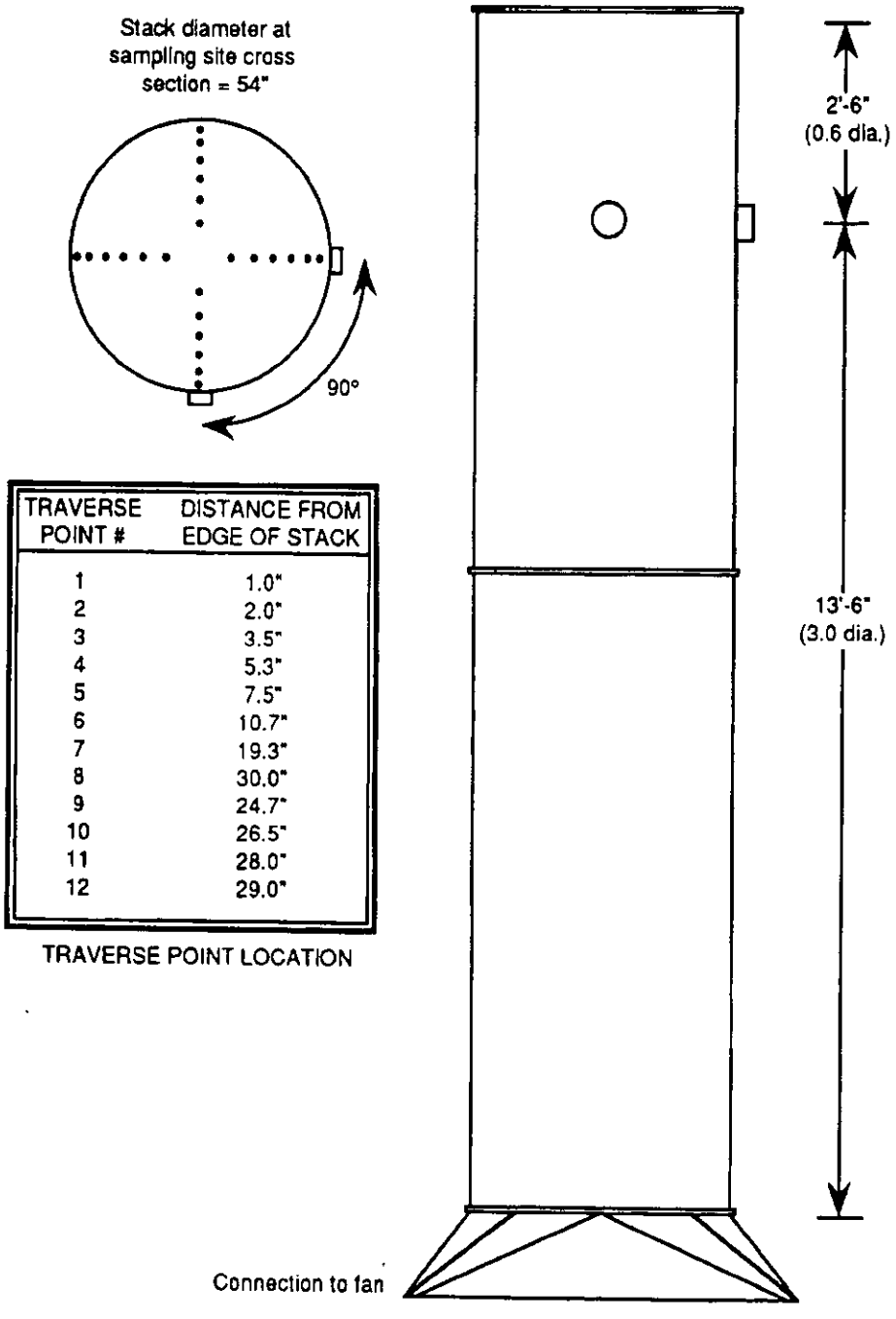
  (Due to extremely large amount of loose particulate in the inlet samples, the filter and loose particulate matter was transferred to a foil weighing dish in the laboratory. Several weighings were attempted in order to arrive at a constant weight. The material appears to be hydroscopic since the samples began to pick up moisture immediately after removal from the desiccator. Since a constant weight could not be attained, the 2 lowest gross weights were averaged to calculate the sample mass.)



TRAVERSE POINT #	DISTANCE FROM EDGE OF STACK
1	2.3"
2	7.7"
3	15.6"
4	37.0"
5	44.8"
6	50.2"

TRAVERSE POINT LOCATION

FIGURE 4.1 INLET SITE DETAIL



TRAVERSE POINT #	DISTANCE FROM EDGE OF STACK
1	1.0"
2	2.0"
3	3.5"
4	5.3"
5	7.5"
6	10.7"
7	19.3"
8	30.0"
9	24.7"
10	26.5"
11	28.0"
12	29.0"

TRAVERSE POINT LOCATION

FIGURE 4.2 OUTLET SAMPLING SITE DETAIL

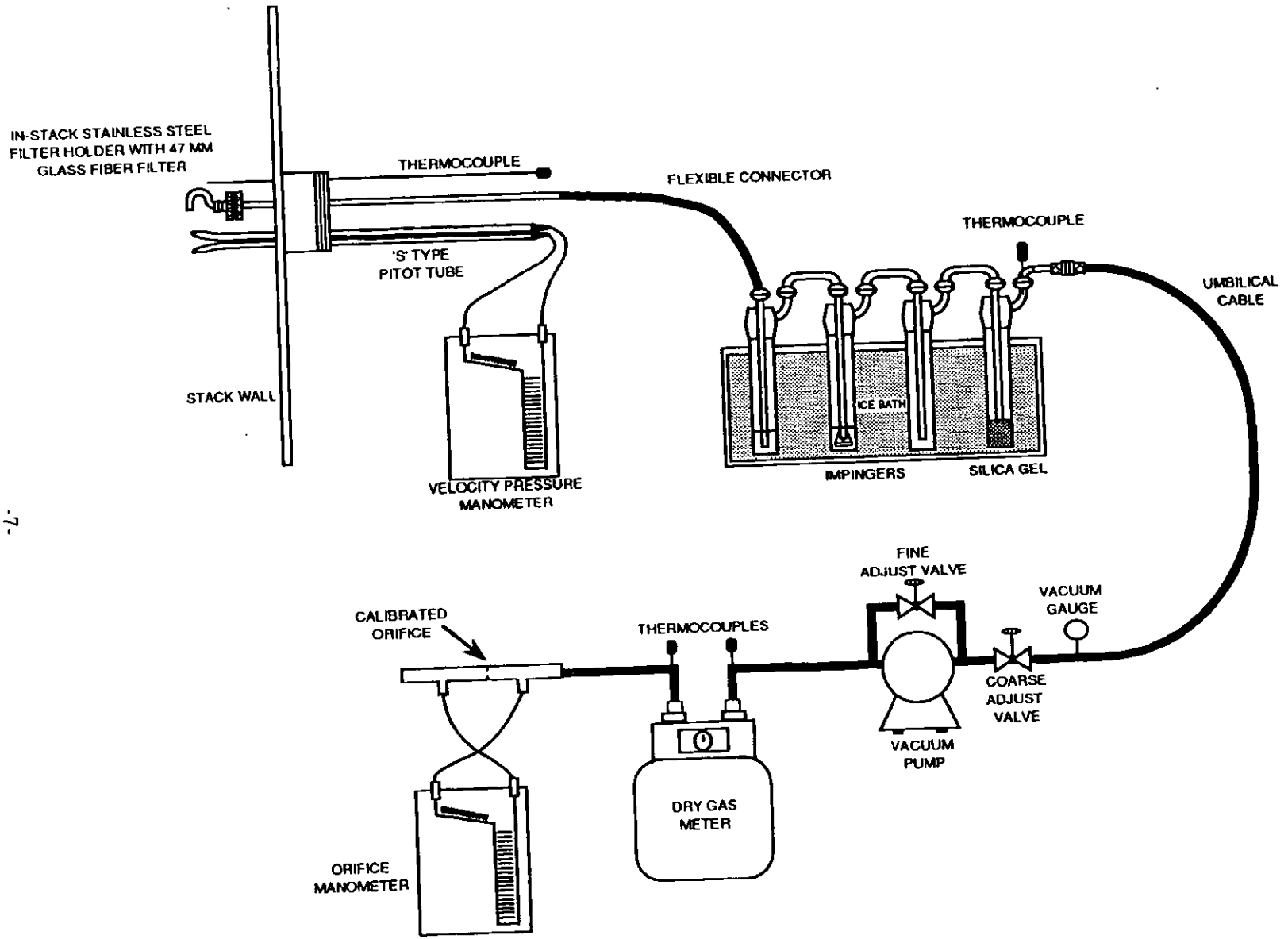


FIGURE 4.3 USEPA REFERENCE METHOD 17 SAMPLING TRAIN

° **Condensible Particulate**
Condensible particulate emissions were determined by recovering the impinger contents, evaporating a 100 ml aliquot of the liquid catch to dryness in a tared beaker, and weighing the remaining residue to a constant weight.

(This technique for measuring condensables is typically employed with a Method 5 train where the sample gas passes through a clean, heated glass probe before condensing in the impinger train. This procedure is probably not well suited to a Method 17 sample train since the sample gas passes through several feet of unheated, uncleaned tubing before condensing in the impingers. Because of this, the condensable emission data obtained in this survey is not considered to be meaningful.)

° **Quality Assurance**
Our Quality Assurance procedures includes equipment calibration as per USEPA and manufacturers guidelines, adherence to standard procedures for sample collection and analysis, and attention to the suggested QA procedures included in the Reference Methods. We participate in the USEPA's National Source Audit Program for Methods 3, 5, 6, and 7.

5.0 TEST RESULTS

The stack gas flow rates, temperature, etc. are summarized in Table 5.1. The average flow rate at the inlet site was 45,559 acfm (41,151 dscfm) at 98°F and 2.9% water vapor. The average flow rate at the outlet test site was 54,782 acfm (50,125 dscfm) at 97°F and 2.6% water vapor. We recognize the discrepancy between the measured flow rates at the measurement sites, however cyclonic flow checks indicated the tests sites were free of turbulence and all pitot tube leak checks made during the survey were acceptable. The discrepancy may be attributable to leaks in the baghouse.

Table 5.1 Summary of stack gas conditions

RUN NO.	VELOCITY (fps)[1]	FLOW RATE (acfm)[2]	(dscfm)[3]	TEMP. (°F)	MOISTURE (%)	O2 (%)	CO2 (%)
Inlet							
1	50.4	45,452	42,203	86	2.3	21.0	ND
2	49.6	44,730	40,561	93	3.4	21.0	ND
3	51.5	46,494	40,690	115	3.0	21.0	ND
Ave.	50.5	45,559	41,151	98	2.9	21.0	ND
Outlet							
1	59.5	56,808	53,219	89	1.5	21.0	ND
2	56.1	53,516	48,268	99	3.5	21.0	ND
3	56.6	54,020	48,889	102	2.6	21.0	ND
Ave.	57.4	54,782	50,125	97	2.6	21.0	ND

[1]Feet per second at stack conditions.
[2]Actual cubic feet per minute at stack temperature and pressure.
[3]Dry, standard cubic feet per minute at 68°F and 29.92" Hg.

Particulate emissions are summarized in Table 5.2. The average particulate matter concentration at the inlet was 1.575 gr/dscf (2.25 E-04 lb/dscf). The average particulate emission rate at the inlet site was 555.6 lb/hr. The average particulate matter concentration at the outlet was 0.0009 gr/dscf (1.30 E-07 lb/dscf). The average particulate emission rate at the outlet site was 0.4 lb/hr.

Table 5.2 Summary of particulate emission rates

RUN NO.	CONCENTRATION (gr/dscf)	(lb/dscf)	MASS EMISSION RATE (lb/hr)
Inlet			
1	1.5523	2.22E-04	561.7
2	1.6617	2.37E-04	577.9
3	1.511	2.16E-04	527.2
Average	1.575	2.25E-04	555.6
Outlet			
1	0.0007	1.10E-07	0.3
2	0.0017	2.40E-07	0.7
3	0.0003	4.00E-08	0.1
Average	0.0009	1.30E-07	0.4

The removal efficiency ranged from 99.98% to 99.88% with average of 99.93%. These data are summarized in Table 5.3.

Table 5.3 Summary of particulate removal efficiency

RUN	INLET (lb/hr)	OUTLET (lb/hr)	EFFICIENCY (%)
1	577.9	0.3	99.94
2	577.9	0.7	99.88
3	527.2	0.1	99.98
Average	555.6	0.4	99.93

The Appendices to this report contain a copy of the process data, copies of the field data forms, the laboratory data forms, emissions calculations for each run, condensable emissions data, and the QA/QC data.

APPENDIX A

Process Data