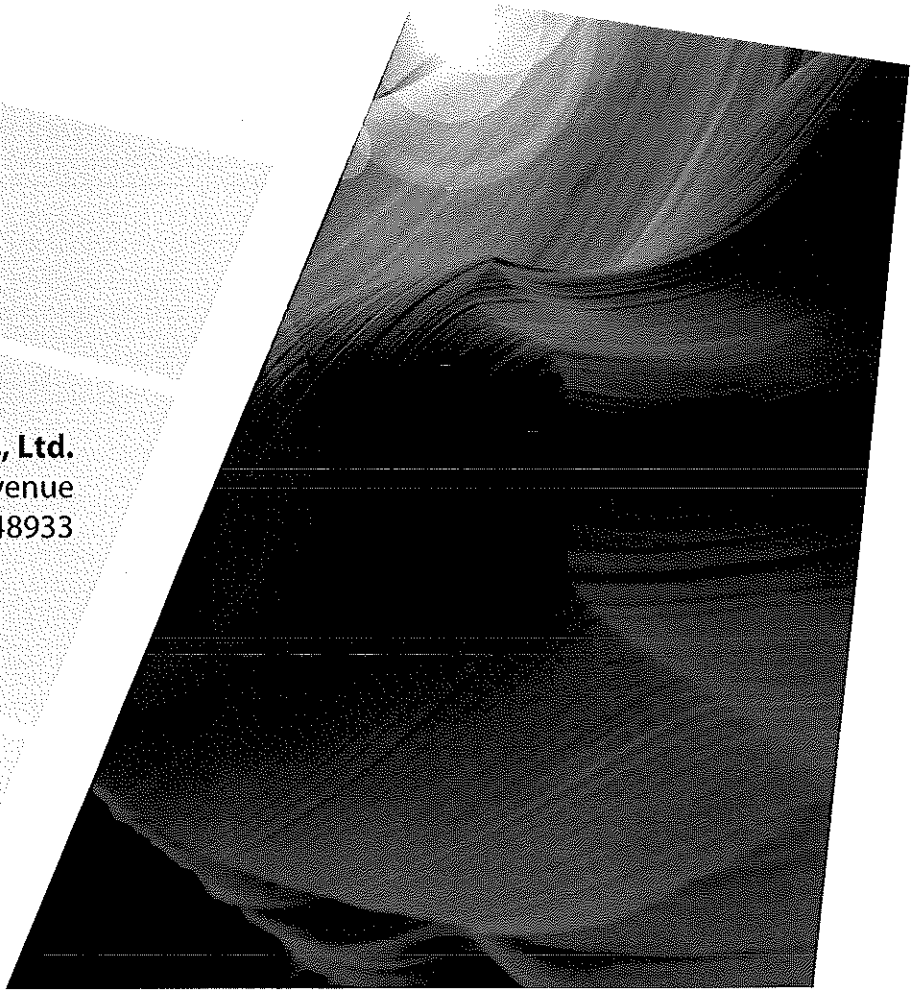
Report

Emissions Test
Federal-Mogul Corporation
Test Date: January 13-20, 2014

Federal-Mogul Corporation
510 E. Grove Street
Greenville, Michigan 48838

NTH Project No. 73-130459-01
March 4, 2014



NTH Consultants, Ltd.
608 S. Washington Avenue
Lansing, MI 48933

1.0 INTRODUCTION

NTH Consultants, Ltd (NTH) has been retained by Federal-Mogul Corporation (Federal-Mogul) to perform emissions testing at the exhaust of a Torrit cartridge collector associated with EU-BABBITTLINE in Permit to Install (PTI) No. 176-07, the powder manufacturing equipment (foundry baghouse) identified in PTI No. 360-82, and the sintering lines (North and South baghouses) identified in PTI No. 362-82. The facility is located in Greenville, Michigan.

1.1 Purpose of Test

The purpose of this emissions program is to evaluate current emissions at EU-BABBITLINE, the foundry baghouse, and the North and South sintering lines. Emissions testing at these processes has been requested by Michigan Department of Environmental Quality (MDEQ).

1.2 Test Date Requirement

This test program was performed January 13-20, 2014.

1.3 Project Contact Information

The names and affiliations for personnel associated with the test program are presented below.

Location	Address	Contact
Test Facility	Federal-Mogul corporation 510 E. Grove Street Greenville, Michigan 48838	Ms. Shanda Jennings (616) 754-1240 Shanda.jennings@federalmogul.com
Testing Company Representative	NTH Consultants, Ltd. 1430 Monroe Avenue NW, Suite 180 Grand Rapids, Michigan 49505	Ms. Lori Myott (517) 702-2957 lmyott@nthconsultants.com
State Agency Representative	MDEQ - Air Quality Division Constitution Hall, 2nd Floor South 525 W. Allegan Lansing, Michigan 48909	Mr. Tom Gasloli (517) 335-4861 gaslolit@michigan.gov

Messers. Chris Occhipinti, Kyle Daneff and Tyler Hanna of NTH conducted the testing. Ms. Shanda Jennings of Federal-Mogul provided assistance and coordinated plant operating conditions. Mr. Tom Gasloli and Mr. Eric Grinstern of the MDEQ observed the testing.

1.4 Summary of Results

A summary of results is presented in Table 1-1. Detailed results can be found appended to this report.

Table 1-1
EU-BABBITTLINE
Summary of Test Results and Permit Limits

Pollutant	Average Tested Emission Rate	Permit Limit	Units
Lead	5.8E-4	N/A	Lb/hr

Table 1-2
Foundry Line
Summary of Test Results and Permit Limits

Pollutant	Average Tested Emission Rate	Permit Limit	Units
PM	8.9E-4	1.0E-2	lbs/1000 lbs
Lead	1.5E-2	N/A	lb/hr

Table 1-3
Sintering Line
Summary of Test Results and Permit Limits

Pollutant	Average Tested Emission Rate	Permit Limit	Units
PM	3.9E-4	1.0E-2	lbs/1000 lbs
Lead	1.3E-3	N/A	lb/hr

2.0 PROCESS DESCRIPTION

The Babbitt operation (EU-BABBITTLINE) consists of casting, milling, skiving and wire brushing of alloy on steel strip. Coiled steel strips are unwound and enter an induction heat box. From the heat box, the steel strip enters a furnace along with a mixture of hydrogen and nitrogen gases. As the steel strip leaves the furnace, depending on the desired product, gaseous HCl is introduced to the strip for bonding purposes of the Babbitt alloy to the strip. The steel strip then enters a pot of molten tin or Babbitt, depending on the end product, and re-introduced to gaseous HCl (for bonding purposes of Babbitt only). After this process, the steel strip is applied with molten Babbitt, and then cooled with water. After the steel strip is cooled, it is then wire brushed, skived, milled, and wound into a coil. Emissions from EU-BABBITTLINE are controlled by a ductwork and hood system and a lime-injected Torrit cartridge collector.

The powder manufacturing process consists of melting copper, lead and tin together, and spraying water on the molten metal where it is blown into small particles (atomizes). The small particles are then sent to a dryer where the drying process takes about four (4) hours. The dried material (powder) is then dropped to a hopper and moved to a classifier where fine powder is separated from coarse powder. The coarse powder is sent back through the process, while the finer powder is sent to a blender and blended for about an hour. Once the powder is blended, a sample is sent to the lab to be checked. After passing the check, the powder is sent to the strip line for use. Emissions from this process are controlled by the foundry baghouse.

The sintering lines consist of seven (7) different lines were various powder alloys are applied to steel strips. Coiled steel strips are unwound and applied with powder alloy and placed in a furnace along with a mixture of hydrogen and nitrogen gases. From the furnace the steel is then milled to job specific thickness. The steel strip then enters another furnace with hydrogen and nitrogen gases, and is then cooled by either direct contact with water, or set aside in a cooling section of the sintering line. The final steel product is then wound and wrapped into a coil. Emissions from the sintering process are controlled by the North and South baghouses.

3.0 REFERENCE METHODS AND PROCEDURES

Triplicate 120-minute test runs were conducted for PM and Lead at each location. The following United States Environmental Protection Agency (U.S. EPA) reference Test Methods were utilized for emissions testing.

- **Method 1:** Sampling and Velocity Traverses for Stationary Sources
- **Method 2:** Determination of Stack Gas Velocity and Volumetric Flow Rate (Type "S" Pitot Tube)
- **Method 3:** Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources
- **Method 4:** Determination of Moisture Content in Stack Gases
- **Method 5:** Determination of Particulate Matter Emissions from Stationary Sources
- **Method 29:** Determination of Metals Emissions (lead) from Stationary Sources

3.1 Traverse Points

The number of traverse points for exhaust gas velocity and cyclonic air flow was determined in accordance with U.S. EPA Method 1. The EU-Babbitt exhaust duct measured 40 inches at the test location. The Foundry exhaust duct measured 28 inches at the test location. The Sintering exhaust duct measured 33 inches at the test location. A total of 12 measurement points were selected at each location utilizing two ports which resulted in 24 traverse points per test port. Diagrams depicting the sampling points and port locations are presented in Figures 1, 2, and 3.

3.2 Velocity and Temperature

The exhaust stack gas velocity and temperature measurements were conducted in accordance with U.S. EPA Method 2. The exhaust stack pressure differential (delta P) was measured at each traverse point using a calibrated S-type Pitot tube connected to an appropriately sized inclined water column manometer. Temperatures were recorded in conjunction with delta P determinations using a calibrated Type "K" thermocouple attached directly to the pitot tube.

3.3 Molecular Weight

The exhaust gas composition was determined using U.S. EPA Reference Method 3A. The oxygen and carbon dioxide concentrations were used to determine exhaust gas composition and molecular weight.

3.4 Moisture

The exhaust gas moisture content was determined in accordance with U.S. EPA Reference Method 4. The sample was passed through a series of four impingers, with the first two containing deionized water, the third empty, and the fourth containing silica gel. The impingers were immersed in an ice bath to ensure condensation of the flue gas stream moisture. The amount of water collected was measured gravimetrically to determine moisture content.

3.5 Filterable Particulate Matter

Filterable particulate matter (PM) concentrations were determined following the guidelines of U.S. EPA Method 5. The sample apparatus consisted of a glass nozzle, a heated glass lined probe, a heated 83 mm glass fiber filter, four chilled impingers, and a metering console. The PM sample was collected in the nozzle, probe, and filter. At the conclusion of each test run, the filter was removed from the filter holder, visually inspected and placed into a petri dish. The front half of the filter holder was rinsed with acetone into a separate sample bottle. Acetone blanks were collected during the PM testing.

At the laboratory, Method 5 analytical procedures were used to analyze the samples for PM. The acetone rinses were evaporated and desiccated to dryness and the residue weighed to determine the amount of PM collected. The filters were also desiccated to remove uncombined water and then weighed. A diagram of the PM sampling apparatus is presented in Figure 4.

3.6 Metals (Lead)

Lead concentrations were determined in accordance with U.S. EPA Method 29 in conjunction with Method 5. The sampling train consisted of a glass nozzle, a heated glass lined probe, a heated 83 mm quartz fiber filter, four (4) chilled impingers, and a metering console. Since testing for mercury was not necessary, only four (4) impingers were used. The samples were collected in the nozzle, probe, filter and impinger contents. The four (4) impingers were placed in an insulated ice water bath for the purpose of removing any uncondensed moisture.

The contents of the impingers consisted of a modified impinger containing 100 ml of 5 percent Nitric Acid / 10 percent Hydrogen Peroxide (5% HNO_3/10% H_2O_2) solution; a Greenburg-Smith impinger containing 100

ml 5% HNO_3/10% H_2O_2 solution; a modified impinger dry; and a modified impinger containing approximately 200 to 300 grams of pre-dried indicating silica gel. All glassware used in the sample apparatus was cleaned prior to testing according to Method 29 specifications.

Immediately following each test run, the probe, nozzle, and front-half of the filter holder were rinsed with 100 ml of 0.1N HNO_3 and placed into a labeled sample container. The filter was then recovered and placed into a labeled glass petri dish. The contents of impingers 1-2 were then weighed and recovered into a third labeled sample container. Impingers 1 - 2, filter support, back half of the filter housing, and all connecting glassware were rinsed with 100 ml of 0.1N HNO_3 and added to the impinger contents container. Impingers 3 and 4 were weighed to calculate moisture gain. The weight gain from each impinger was recorded to calculate the total moisture (expressed as %) associated with each test run. Field quality assurance/quality control procedures included one field blank for the filter, 0.1N HNO_3 solution, 5% HNO_3/10% H_2O_2 solution, acetone, and deionized water. An illustration of the sampling train is shown in Figure 4, located at the end of this report.

4.0 QUALITY ASSURANCE

Each promulgated U.S. EPA reference method described above is accompanied by a statement indicating that to obtain reliable results, persons using these methods should have a thorough knowledge of the techniques associated with each. To that end, NTH attempts to minimize any factors in the field that could increase error by implementing our quality assurance program into every testing activity segment.

The pitot tubes and thermocouples used to measure the exhaust gas during this test program were calibrated according to the procedures outlined in the *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source-Specific Methods,* Method 2, *Type S Pitot Tube Inspection,* and Calibration Procedure 2E *Temperature Sensor.*

5.0 SUMMARY OF RESULTS

Plant operations appeared normal throughout the testing event with no problems encountered with the test equipment during the test program with the exception of a low filter box temperature for the first run at the Babbitt Line. However, due to the low stack temperature, the MDEQ allowed the test to proceed. Results are appended in Tables 1-3 and Appendix B. Operating data was collected by Federal-Mogul and can be found in Appendix C.

TABLES

TABLE 1

Federal Mogul

Summary of Particulate Matter and Lead Emissions

Babbitt Line

U.S. EPA Methods 5 and 29

1/13/14 - 1/20/14

Run No.	1	2	3	Average
Date	January 13, 2014	January 20, 2014	January 20, 2014	
Run Time	1045-1300	855-1100	1205-1415	
Sample Duration (Minutes)	120	120	120	
Sample Volume (dscf)	64.1	83.0	81.0	76.1
Volumetric Flow Rates				
Actual Cubic Feet Minute	26,234	31,060	29,828	29,040
Standard Cubic Feet Minute	22,961	27,968	26,819	25,916
Dry Standard Cubic Feet Minute	22,776	27,826	26,700	25,767
Fixed Gases				
Oxygen, % by volume, dry	20.9	20.9	20.9	20.9
Carbon dioxide, % by volume, dry	0.00	0.00	0.00	0.0
Moisture, % by volume	0.8	0.5	0.4	0.6
Emission Rate:				
Lead:				
Lead emissions (lb/hr)	3.8E-04	7.9E-04	5.6E-04	5.8E-04

dscf: dry standard cubic feet
gr/dscf: grains per dry standard cubic feet of sample volume collected
lb/hr: pounds per hour
lb/ton of Lead: pounds per ton of Lead

TABLE 2

Federal Mogul

Summary of Particulate Matter and Lead Emissions

Foundry

U.S. EPA Method 5 and 29

1/15/14 - 1/17/14

Run No.	1	2	3	Average
Date	January 15, 2014	January 16, 2014	January 17, 2014	
Run Time	1107-1514	940-1145	825-1030	
Sample Duration (Minutes)	120	120	120	
Sample Volume (dscf)	55.6	56.7	58.7	57.0
Process Conditions				
Tons of Lead per hour	100.0	100.0	100.0	100.0
Volumetric Flow Rates				
Actual Cubic Feet Minute	29,489	32,012	32,657	31,386
Standard Cubic Feet Minute	26,702	29,176	29,901	28,593
Dry Standard Cubic Feet Minute	26,607	29,005	29,758	28,457
Fixed Gases				
Oxygen, % by volume, dry	20.9	20.9	20.9	20.9
Carbon dioxide, % by volume, dry	0.00	0.00	0.00	0.0
Moisture, % by volume	0.4	0.6	0.5	0.5
Emission Rate:	**1**	**2**	**3**	**Average**
Particulate Matter:				
lb PM / 1000lb exhaust gas, wet	1.8E-03	7.8E-04	1.5E-04	8.9E-04
Lead:				
lb/hr	1.6E-02	9.8E-03	1.8E-02	1.5E-02

lb/hr: pounds per hour

TABLE 3

Federal Mogul

Summary of Particulate Matter and Lead Emissions

Sintering Line

U.S. EPA Methods 5 and 29

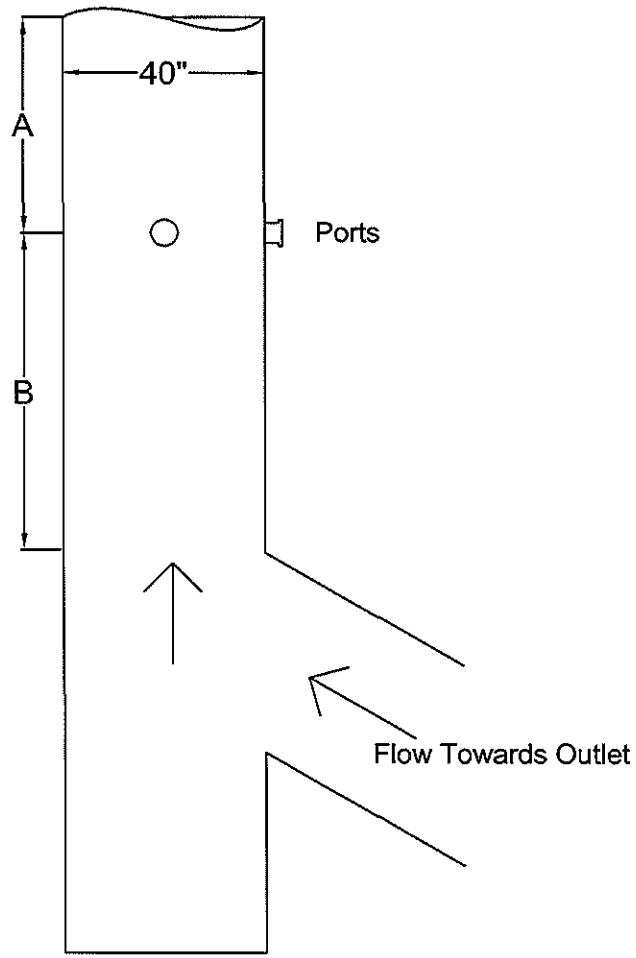
1/14/14 - 1/15/14

Run No.	1	2	3	Average
Date	January 14, 2014	January 15, 2014	January 15, 2014	
Run Time	1210-1415	1010-1215	1320-1520	
Sample Duration (Minutes)	120	120	120	
Sample Volume (dscf)	153.6	160.5	158.1	157.4
Process Conditions				
Tons of Lead per hour	0.0	0.0	0.0	#DIV/0!
Volumetric Flow Rates				
Actual Cubic Feet Minute	15,045	15,442	15,163	15,217
Standard Cubic Feet Minute	13,611	13,963	13,726	13,767
Dry Standard Cubic Feet Minute	13,539	13,947	13,679	13,722
Fixed Gases				
Oxygen, % by volume, dry	20.9	20.9	20.9	20.9
Carbon dioxide, % by volume, dry	0.00	0.00	0.00	0.0
Moisture, % by volume	0.5	0.1	0.3	0.3
Emission Rate:	1	2	3	Average
Particulate Matter:				
lb PM / 1000lb exhaust gas, wet	4.0E-04	6.3E-04	1.5E-04	3.9E-04
Lead:				
lb/hr	1.2E-03	6.5E-04	2.2E-03	1.3E-03

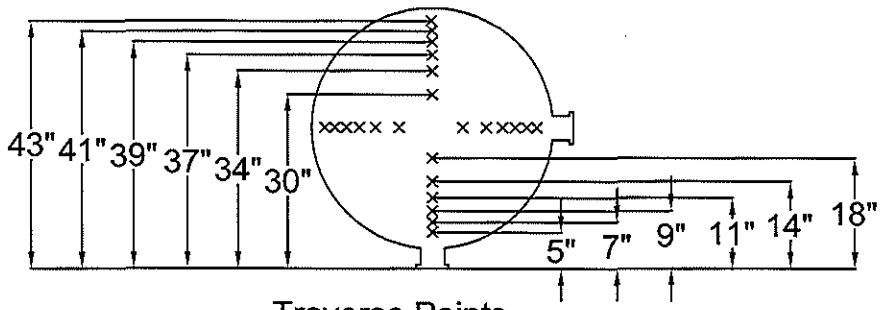
dscf: dry standard cubic feet
gr/dscf : grains per dry standard cubic feet of sample volume collected
lb/hr: pounds per hour
lb/ton of Lead: pounds per ton of Lead

FIGURES

Profile View



Plan View



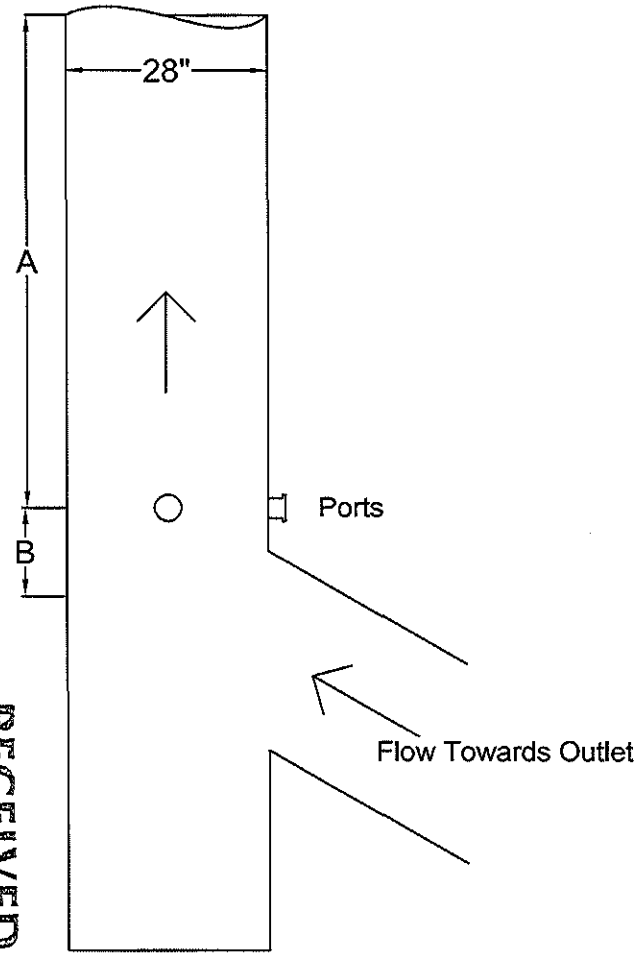
Traverse Points

Notes

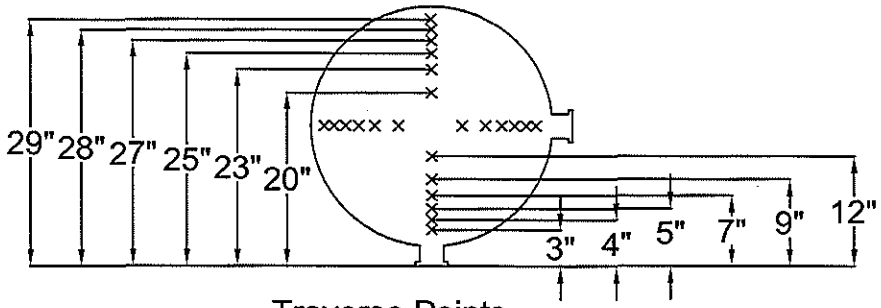
1. Flow and moisture traverse points mirrored for both ports
2. X denotes a traverse point
3. Standard port length 4 inches
4. Traverse point locations shown to the nearest inch

NTH	Drafted by: TH	Job Number: 73-130459	Client: Federal-Mogul.	Babbit Line
	NTH Consultants, Ltd.	Approximate Duct Diameters Upstream (A): 2 Approximate Duct Diameters Downstream (B): 3		Figure 1

Profile View



Plan View



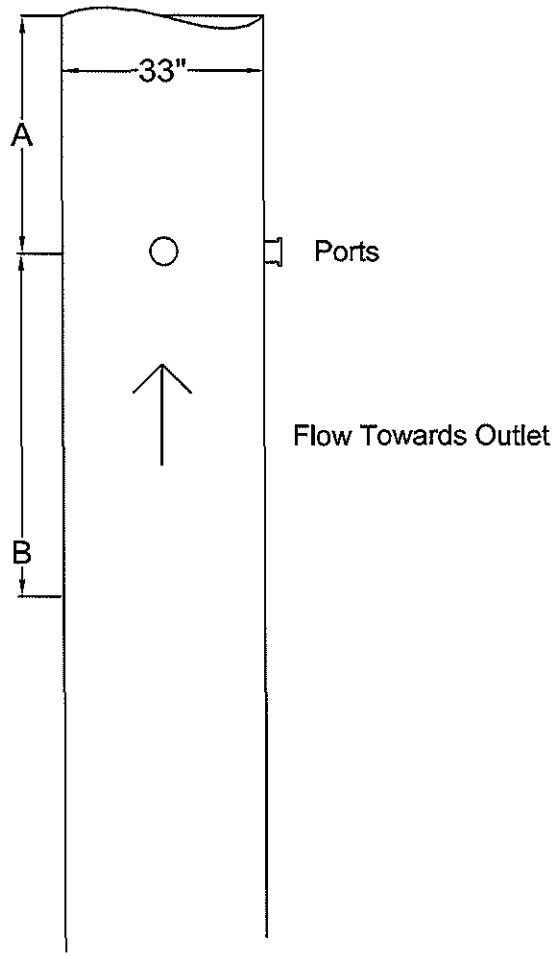
Traverse Points

Notes

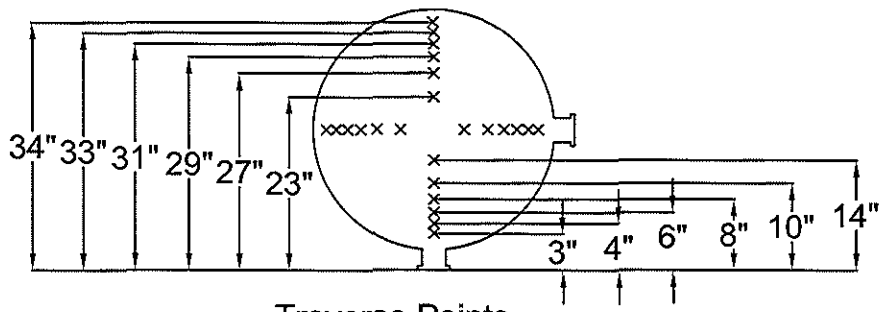
1. Flow and moisture traverse points mirrored for both ports
2. X denotes a traverse point
3. Standard port length 2 inches
4. Traverse point locations shown to the nearest inch

NTH	Drafted by: TH	Job Number: 73-130459	Client: Federal-Mogul.	Foundry Baghouse
	NTH Consultants, Ltd.	Approximate Duct Diameters Upstream (A): 0 Approximate Duct Diameters Downstream (B): 2		Figure 2

Profile View



Plan View



Traverse Points

Notes

1. Flow and moisture traverse points mirrored for both ports
2. X denotes a traverse point
3. Standard port length 2 inches
4. Traverse point locations shown to the nearest inch

NTH	Drafted by: TH	Job Number: 73-130459 | Client: Federal-Mogul.	Sintering Lines
	NTH Consultants, Ltd.	Approximate Duct Diameters Upstream (A): 1 Approximate Duct Diameters Downstream (B): 2	Figure 3

Figure 4
Method 5/29 Sampling Apparatus