# Report

## *Emissions Test*
## *Federal-Mogul Corporation*
## *Test Date: March 5-6, 2014*

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

**NTH Project No. 73-130459-01**
**April 16, 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 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. Emission testing at this process has been requested by Michigan Department of Environmental Quality (MDEQ).

## 1.2 Test Date Requirement

This test program was performed March 5-6, 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<br>510 E. Grove Street<br>Greenville, Michigan 48838 | Ms. Shanda Jennings<br>(616) 754-1240<br>Shanda.jennings@federalmogul.com |
| Testing Company Representative | NTH Consultants, Ltd.<br>1430 Monroe Avenue NW, Suite 180<br>Grand Rapids, Michigan 49505 | Ms. Lori Myott<br>(517) 702-2957<br>lmyott@nthconsultants.com |
| State Agency Representative | MDEQ - Air Quality Division<br>Constitution Hall, 2nd Floor South<br>525 W. Allegan<br>Lansing, Michigan 48909 | Mr. Tom Gasloli<br>(517) 335-4861<br>gaslolit@michigan.gov |

Mr. Chris Occhipinti, Mr. Tyler Hanna and Ms. Rhiana Dornbos 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

| $PM_{10}$ Emissions | Permit Limit | Units |
|---|---|---|
| 0.6 | 1.3 | lbs/hr |
| 0.003 | 0.01 | gr/dscf |

## 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 is 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.

## 3.0 REFERENCE METHODS AND PROCEDURES

Triplicate 120-minute test runs were conducted for PM 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 3A:** 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 Filterable Particulate Matter Emissions from Stationary Sources
- **Method 202:** Dry Impinger Method for Determining Condensable Particulate Emissions 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. 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 Figure 1.

### 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 Condensable Particulate Matter

The condensable particulate matter concentrations were measured using U.S. EPA Reference Method 202. The exhaust gas was extracted from the sample stream isokinetically through a heated glass lined probe, a glass coil type condenser, a dropout impinger and a modified Greenburg-Smith impinger with an open tube tip, a condensable particulate matter filter holder containing a Teflon$_c$ membrane filter, one impinger containing 100 mL of water and one impinger containing silica gel for moisture collection. All glassware used in the Method 202 sampling train was cleaned prior to testing according to method specifications. During the testing, the condensable particulate matter filter temperatures were monitored and maintained at the method appropriate temperatures through the use of a recirculation pump attached to the condenser, and chilled water surrounded the impinger apparatus. Figure 3 shows the Method 202 apparatus.

## 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. A leak rate below the allowable limit was unable to be obtained so the sample volume was corrected to account for the ambient air. This leak correction methodology was approved onsite by Tom Gasloli of MDEQ. The leak correction caused isokinetic percentage to fall below 90%, this was discussed and approved by Mr. Gasloli. Results are appended in Table 1 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 Emissions**

**Babbit Line**

**U.S. EPA Methods 5 and 202**

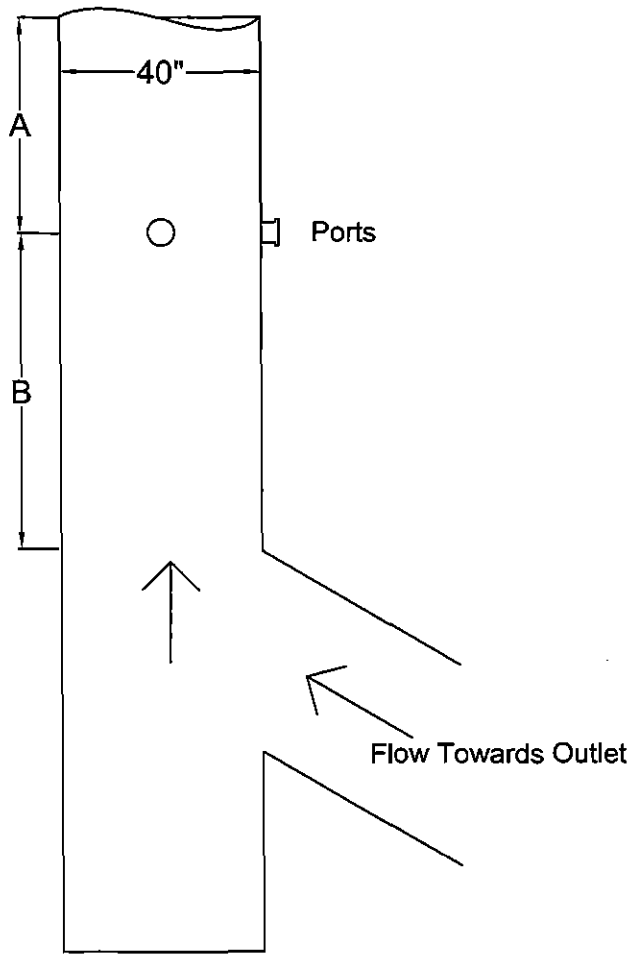
**3/5/14 - 3/6/14**

| Run No. | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| Date | March 5, 2014 | March 5, 2014 | March 6, 2014 | |
| Run Time | 935-1152 | 1249-1500 | 1215-1420 | |
| Sample Duration (Minutes) | 120 | 120 | 120 | |
| Sample Volume (dscf) | 73.9 | 55.1 | 91.5 | 73.5 |
| **Volumetric Flow Rates** | | | | |
| Actual Cubic Feet Minute | 27,926 | 20,664 | 30,925 | 26,505 |
| Standard Cubic Feet Minute | 27,150 | 19,958 | 30,020 | 25,709 |
| Dry Standard Cubic Feet Minute | 26,970 | 19,929 | 29,927 | 25,609 |
| **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 | 0.7 | 0.1 | 0.3 | 0.4 |
| **Emission Rate:** | | | | |
| Filterable Particulate Matter (gr/dscf) | 0.001 | 0.003 | 0.002 | 0.002 |
| Filterable Particulate Matter (lb/hr) | 0.2 | 0.4 | 0.5 | 0.4 |
| Condensable Particulate Matter (gr/dscf) | 0.001 | 0.001 | 0.001 | 0.001 |
| Condensable Particulate Matter (lb/hr) | 0.2 | 0.2 | 0.1 | 0.2 |
| $PM_{10}$ (lb/hr): | 0.5 | 0.7 | 0.6 | 0.6 |
| $PM_{10}$ (gr/dscf): | 0.002 | 0.004 | 0.002 | 0.003 |

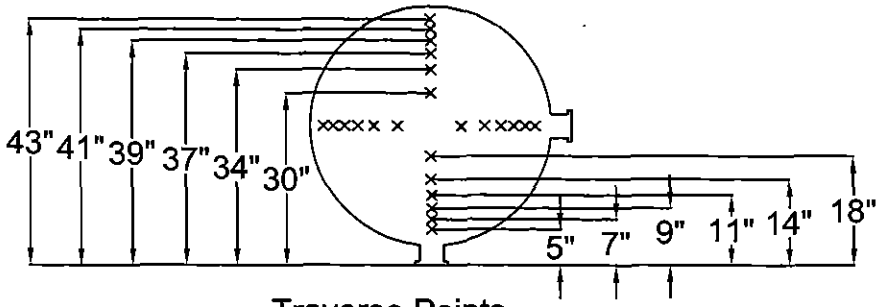
dscf: dry standard cubic feet
gr/dscf: grains per dry standard cubic feet of sample volume collected
lb/hr: pounds per hour

# 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<br>Approximate Duct Diameters Downstream (B): 3 | | Figure 1 |

**Figure 2**
**Method 5 Sampling Apparatus**

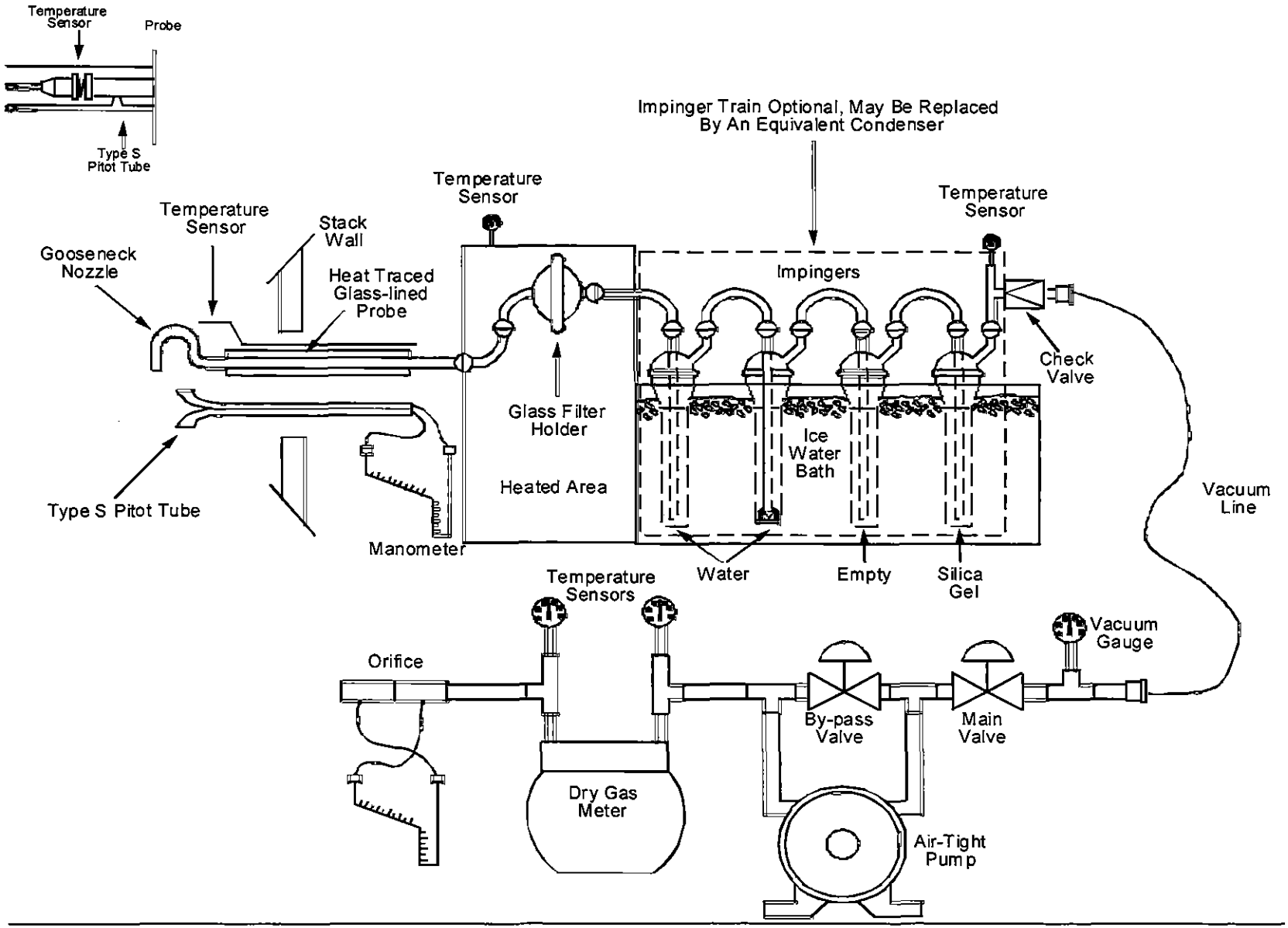


Figure 3: Method 202