United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EMB Report 78-ISC-2
April 1979

Air

EPA

Industrial Surface Coating: Cord Coating

Emission Test Report The Gates Rubber Company Denver, Colorado

VOLATILE ORGANIC CARBON EMISSION TESTING

AT

GATES RUBBER COMPANY
DENVER, COLORADO

JULY, 1979

TO

Environmental Protection Agency
Research Triangle Park, NC 27711

TRW
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INTRODUCTION

From 12 June to 20 June, 1978 a two person test crew from the Environmental Engineering Division at TRW, Inc. performed volatile organic carbon (VOC) emission tests at Gates Rubber Company in Denver, Colorado. The total gaseous non-methane organic (TGNMO) sampling method was utilized at the following six locations:

1. Cord Coater Incinerator inlet
2. Cord Coater Incinerator outlet
3. Banbury exhaust hood
4. Baghouse Outlet of the banbury exhaust system
5. Banbury Mill exhaust hood
6. Sheet Mill.

The purpose of the tests was to obtain for the Environmental Protection Agency volatile organic carbon emissions data from these processes in the rubber industry.

Table 1 summarizes the results of the volatile organic carbon tests. Results are reported as total gaseous non-methane organics as carbon. The average total gaseous non-methane organic concentration from the incinerator inlet was 1637 parts per million (ppm) while the incinerator outlet was 1311 parts per million (ppm). The results obtained at the incinerator are inconsistent with the results that would be expected. No explanation for the erratic results is available. Due to the nature of the results, a retest of this incinerator should be conducted. The banbury fume exhaust hood had an average concentration of 194 ppm reported as TGNMO. Test results for the banbury mill fume exhaust hood averaged 239 ppm. The baghouse outlet emitted an average concentration of 946 ppm. The sheet mill average concentration of VOC reported as TGNMO was 631 ppm.

DATE	TEST LOCATION	SAMPLING TIME (MINUTES)	TOTAL GASEOUS NON-METHANE ORGANICS		VOLUMETRIC FLOW RATE	
			(ppm C_1)	AVERAGE (ppm C_1)	DSCF/hr	DSCM/hr
6-13	Incinerator Inlet	60	136			
		60	3390			
		60	2220			
		60	801	1637		
6-13	Incinerator Outlet	60	1580			
		60	1490			
		60	2100			
		60	75	1311		
6-15	Banbury	60	158		99.4	2.82
		60	224			
		60	190			
		40	205	194		
6-15	Banbury Baghouse Outlet	60	1130		218.9	6.20
		70	148			
		50	2180			
		40	326	946		
6-16	Banbury Mill	50	154		195.1	5.52
		75.5	269			
		79.75	295	239		
6-19	Sheet Mill	60	145		87.7	2.48
		70	148			
		70	1600	631		

TABLE 1. SUMMARY OF TEST RESULTS

II. PROCESS DESCRIPTION

(to be prepared as an addendum to this report by the Chemical and Petroleum Branch, Environmental Protection Agency (EPA)).

III. DISCUSSION OF RESULTS

Table 2 is a tabulation of the analytical results obtained for all test runs. In all cases, the methane and volatile non-methane organics (non-methane organics not captured in the trap but carried over to the evacuated tank) concentrations were less than the sensitivity of the analytical method (10 and 20 ppm for methane and non-methane organics, respectively). Consequently, the organics captured in the condensate trap fraction of the sampling train constitute the total gaseous non-methane organic emissions.

Sampling at the incinerator inlet and outlet were conducted simultaneously. Nonetheless, the results obtained are so erratic that it is not useful to calculate an incinerator efficiency either on a per run or on an average basis. No explanation for the erratic results is available. During the day of testing, some problems were encountered with the cord oven operation (shut-off due to electrical problems). However, this would not seem to have any effect on the test results since the process was operating normally during the actual testing.

Continuous samples were taken at all test locations except for the banbury mill (in some cases at other locations the sampling trains were stopped and restarted during process breaks--see test logs in appendix). Sampling of the banbury mill was conducted only when material was being processed which was approximately a three to five minute period every ten minutes. Material was not continuously being worked on the mill because the banbury takes longer than the mill to completely process a batch. During the first test run a three (3) minute sampling period was conducted for each process batch. The sampling began when the banbury skip entered the mill hood. At the end of the three minute period, the train was shut off and the probe tip was moved to a new traverse point in the duct; sampling resumed with the processing of the next batch. However, during this run it became apparent that the period of time during

which material was on the mill varied considerably. Therefore, for the next two runs the sampling trains were not abitrarily stopped at the end of a three minute period but instead were left operating until the mill was completely clear of material. During each of the three test runs, twenty batches were sampled.

The banbury exhaust system and the banbury exhaust baghouse outlet stack were sampled simultaneously. In general, the results obtained at the baghouse outlet were higher than the results obtained at the banbury; this requires some explanation. The purpose of the baghouse is to control fugitive carbon black and other dry chemical compound emissions generated at the banbury (refer to Figure 5). The testing at the banbury was being conducted in order to determine VOC emissions, and not particulate emissions, from the banbury. It was believed that all the banbury VOC emissions would be coming from the banbury door area and not from the carbon black feeder; therefore, a test location upstream of the point where the carbon black exhaust stream feeds into the system was chosen (see Figure 5). Hence, two possible explanations for the higher concentrations at the baghouse outlet are:

1. VOC emissions were emitted from the carbon black feeder and these emissions were entering the exhaust system downstream of the test location.

2. Carbon black in the baghouse outlet stream passed the filter of the sampling train and caused a positive interference during analysis.

Upon further investigation subsequent to the testing, plant personnel confirmed[1] that emissions from a defective banbury bearing seal were being fed into the exhaust system downstream of the banbury sampling location.

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[1]Personal conversation between Roy Neulicht (EPA) and Ernest Karger (Gates Rubber), January 19, 1979

Two other points about testing at these locations are worthy of notation. First, the last test run was stopped prematurely because the process operator began feeding scrap material to the banbury. Second, during the third test at the banbury baghouse outlet a loose fitting (connecting the probe to the filter inlet) was found. What effect, if any, this had on the test results is not discernable.

During the three sheet mill tests, no process or sampling problems were encountered. The value reported for condensable hydrocarbon for one test is exceedingly high relative to the other two. No reason is evident for this high value.

Date	Test Location	Sample Sequence	Concentrations (ppm as C1)				
			Carbon Monoxide	Methane	Carbon Dioxide	Volatile ORGANIC	Condensable ORGANIC
6-13	01-A Incinerator Inlet	1	<10	<10	1950	<20	136
		2	103	<10	4690	<20	3390
		3	65	<10	3450	<20	2220
		4	5	<10	1090	<20	801
6-13	01-B Incinerator Outlet	1	11	<10	8170	<20	1580
		2	19	<10	8260	<20	1490
		3	19	<10	9230	<20	2100
		4	19	<10	8610	<20	75
6-15	02 Banbury	1	<10	<10	366	<20	158
		2	<10	<10	385	<20	224
		3	<10	<10	838	<20	190
		4	<10	<10	<10	<20	205
6-15	03 Banbury Baghouse Outlet	1	<10	<10	421	<20	1130
		2	<10	<10	459	<20	148
		3	<10	<10	2520	<20	2180
		4	101	<10	4280	<20	326
6-16	04 Banbury Mill	1	<10	<10	555	<20	154
		2	<10	<10	1420	<20	269
		3	<10	<10	1440	<20	295
6-19	05 Sheet Mill	1	<10	<10	842	<20	145
		2	<10	<10	564	<20	148
		3	<10	<10	840	<20	1600

TABLE 2. ANALYTICAL RESULTS

IV. SAMPLING PROCEDURES

A schematic of the sampling apparatus is provided in Figure 1. The sampling and analytical procedures used during these tests are essentially the same as the Total Combustion Analysis procedures established by The Southern California Air Pollution Control District.[1] One difference in technique is that a heated filter was used in the sampling train during these tests. The sample was drawn from the duct by an one-eighth outside diameter (OD) stainless steel probe through a heated (250°F) glass fiber filter and through a chilled stainless steel condensate trap into a six (6) liter evacuated alumninum gas collection tank. A capillary orifice was installed between the condensate trap and the evacuated tank to provide a constant sample rate (80 cc/min, nominal). The condensate trap was partially submerged in crushed dry ice during the test and was kept packed in dry ice until analysis.

The analytical work was performed by Truesdail Laboratories, Inc. The laboratory report is included in the appendix. Total gaseous non-methane organics (TGNMO) were determined by combining the analytical results obtained from independent analyses of the condensate trap and the evacuated tank sample fractions. The organic contents of the condensate trap were oxidized to carbon dioxide (CO_2) which was quantitatively collected and then measured by a non-dispersive infrared (NDIR) analyzer. A fraction of the sample collected in the evacuated tank was injected into a gas chromatograph in order to achieve separation of the non-methane organics from carbon monoxide, carbon dioxide, and methane. Once separated, the four fractions were oxidized to carbon dioxide and separately measured with the NDIR. The volume of sample collected was

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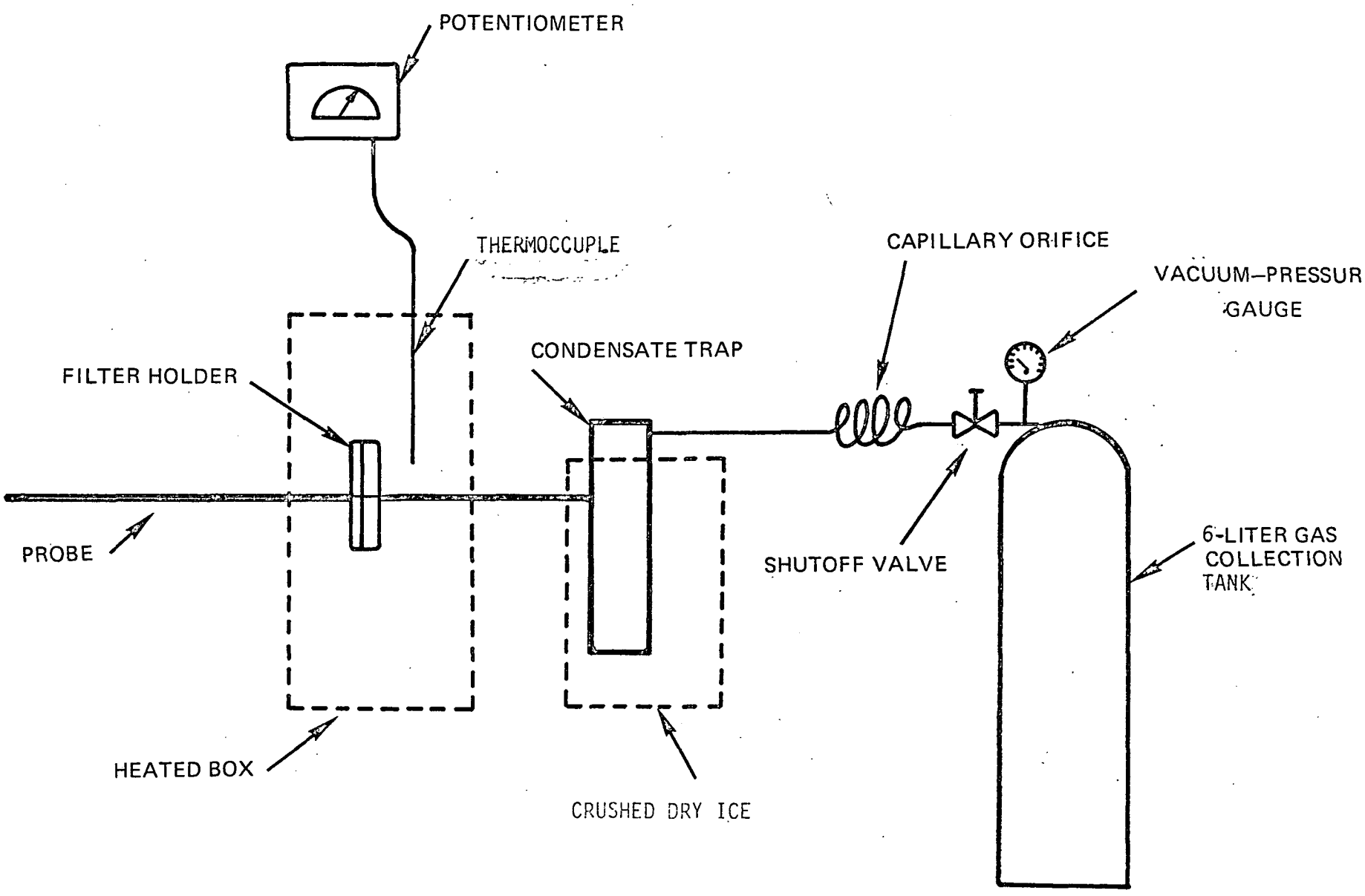
[1] "Total Combustion Analysis: A Test Method for Measuring Organic Carbon; "Salo, Albert E., Oaks, William L., MacPhee, Robert D., Air Pollution Control District - County of Los Angeles; August, 1974.



(6)

Figure 1

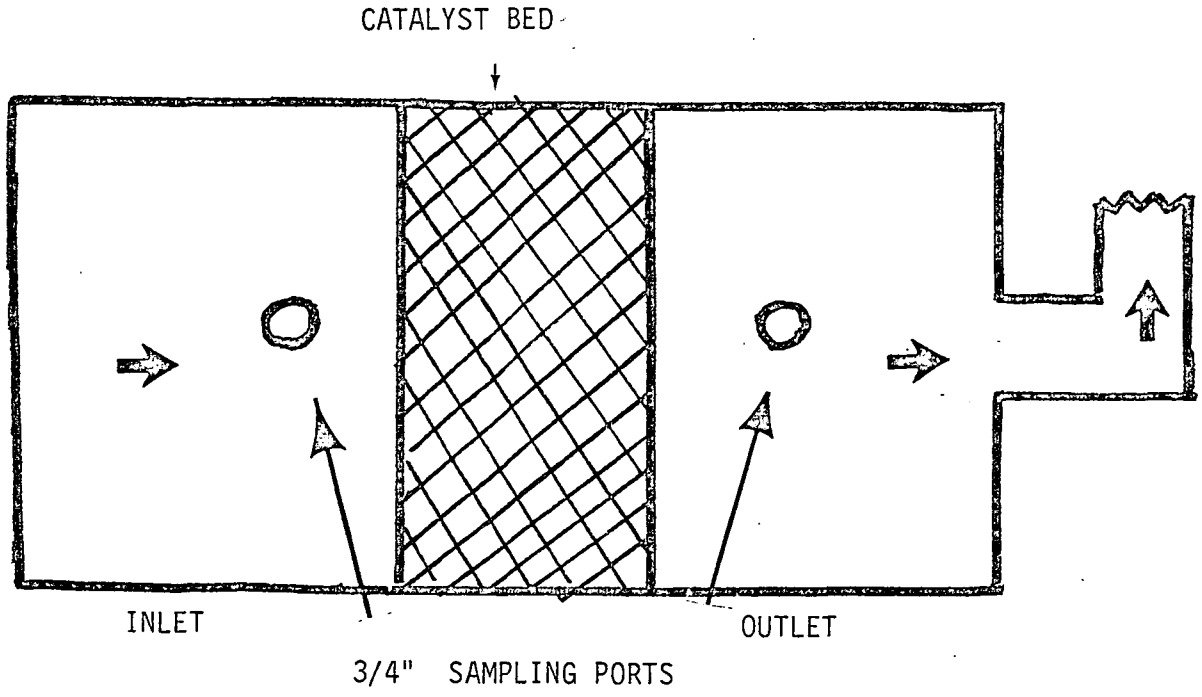
TOTAL GASEOUS NON-METHANE ORGANIC (TGNMO) SAMPLING TRAIN

calculated from vacuum and pressure readings of the evacuated sample tank before and after sampling. The measured CO_2 concentrations and the sample volume collected were used to calculate the total gaseous non-methane organic concentration in the source as parts per million carbon.

Four samples were consecutively taken at each location except for the sheet mill and banbury mill where only three samples were taken. Incinerator inlet and outlet samples were taken from single sampling points; however, each of the process ducts were subdivided into sections and traversed within the duct during sampling. Figures 2 through 6 are schematics of the sampling locations and the traverse points. Velocity measurements were taken before and after each test series at each location (except at the cord coater incinerator) according to standard procedures. Gas flow data were calculated based on these velocity measurements. Due to the large amount of ambient air being drawn into the process exhaust system, ambient conditions (moisture, temperature, and composition) were assumed and a molecular weight of 28.80 was used in the flowrate calculations. At the incinerator only efficiency data were of interest and no volumetric flow rate measurements were taken. Table 3 summarizes the volumetric flow rate data (gas velocity calculation sheets are included in the appendix).

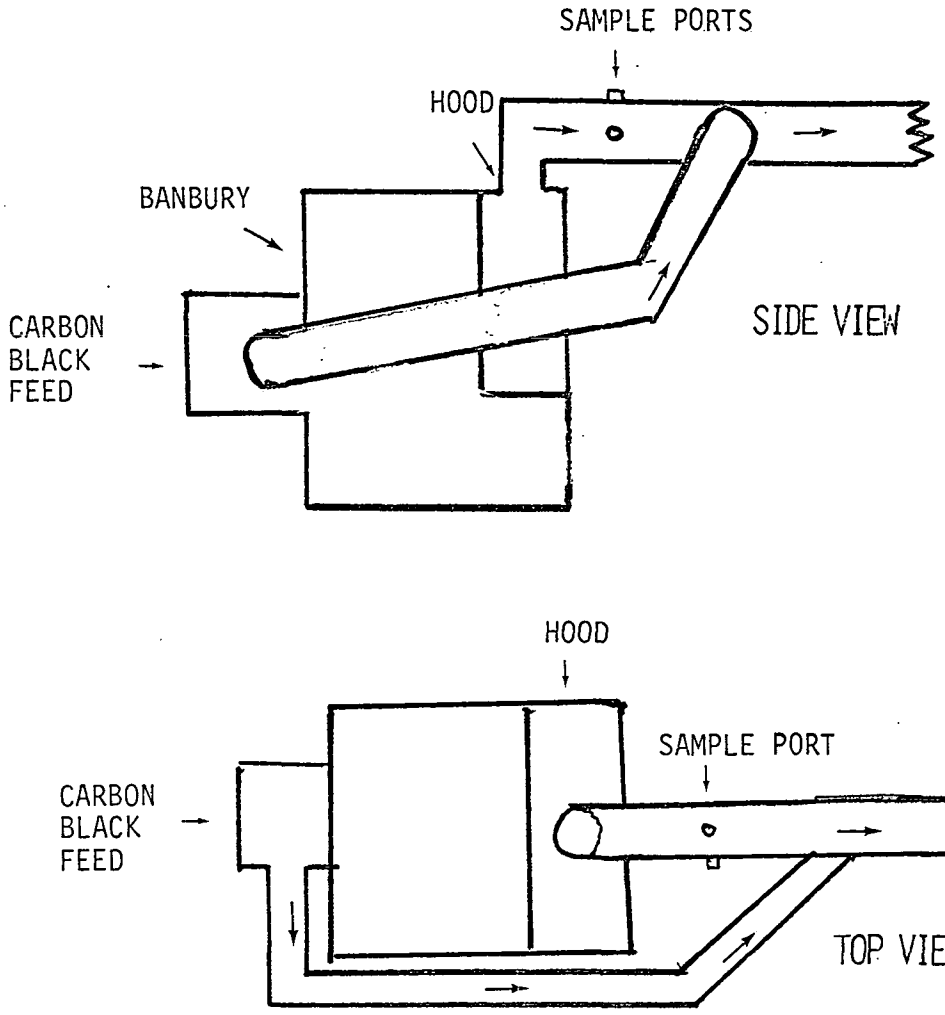
NOTE:

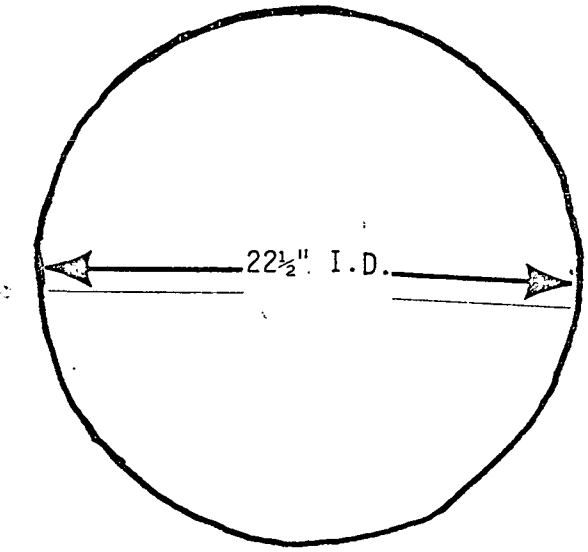
- No Velocity Measurements Were Taken at This Location.



SIDE VIEW

FIGURE 2. CORD COATER OVEN INCINERATOR SCHEMATIC

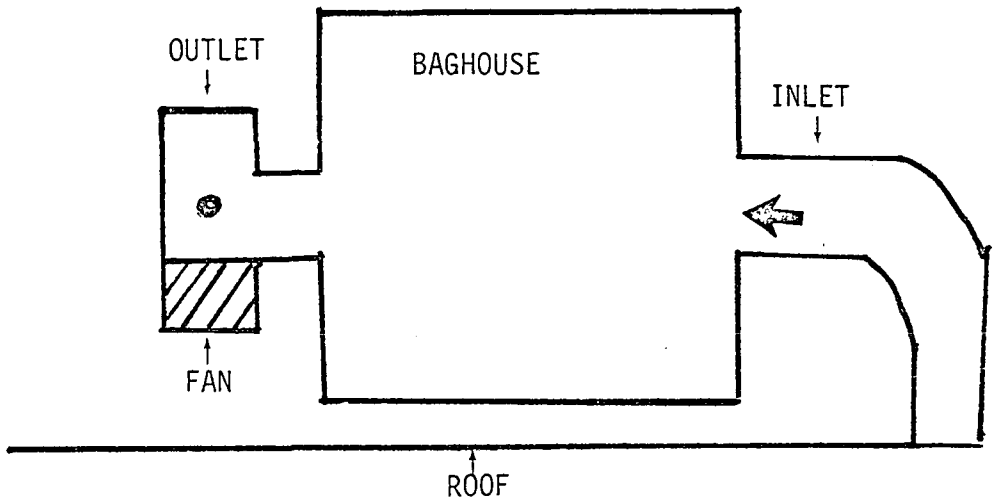




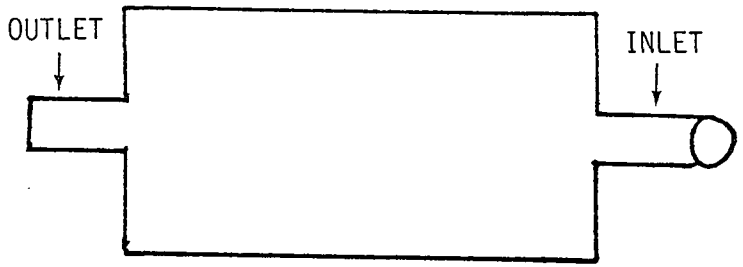
NOTE:

- Sampled 12 points vertical and horizontal for the TGNMO Test.
- Twenty four points vertical and horizontal for post Velocity Test.

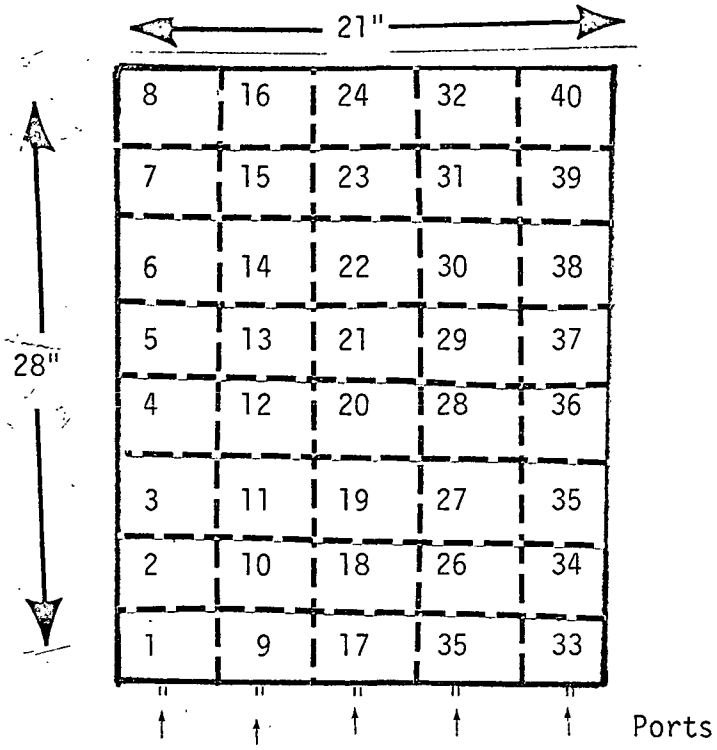
FIGURE 3. BANBURY FUME EXHAUST HOOD SCHEMATIC



SIDE VIEW



TOP VIEW

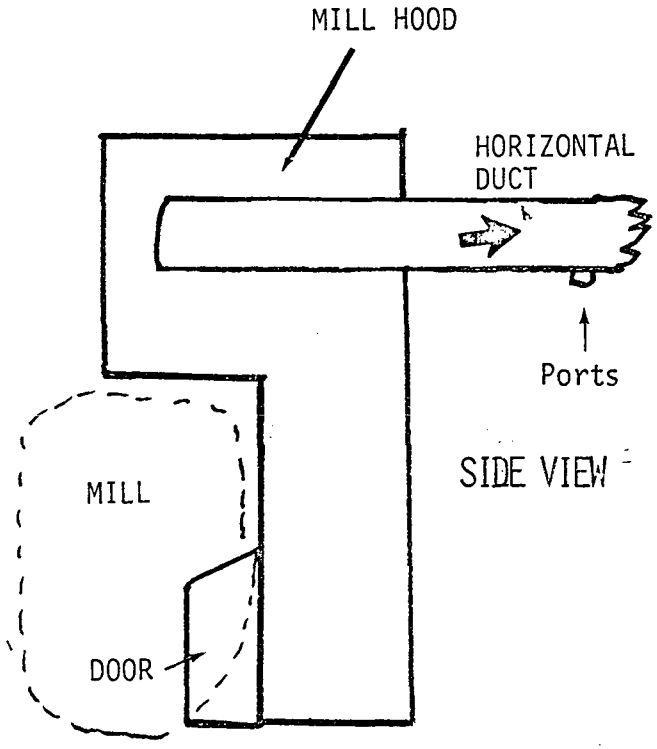


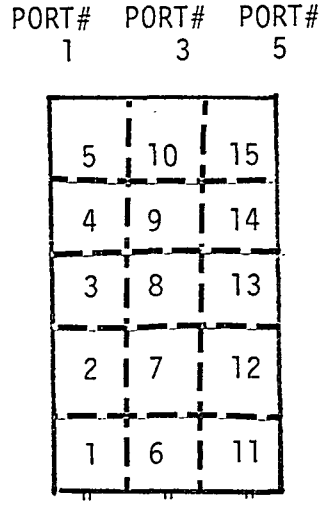
TRAVERSE POINTS

NOTE: Points 1-8, 17-24 and 33-40 were used for initial velocity test and all volatile hydrocarbon tests. Points 1-40 were used for the post-test velocity measuring.

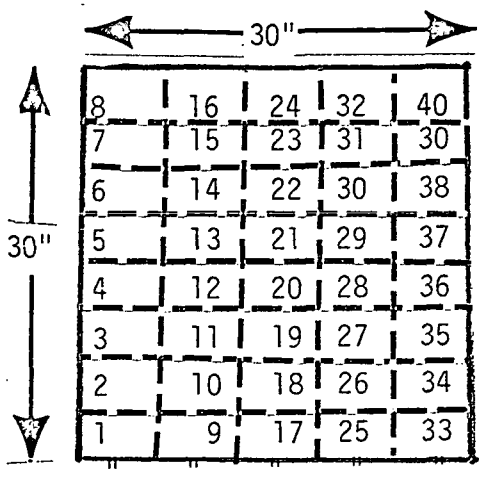
Sampled Gas 40" after fan

FIGURE 4. BAGHOUSE OUTLET





- TRAVERSE POINTS USED FOR TGNMO AND PRELIMINARY VELOCITY TEST.



- TRAVERSE POINTS USED FOR THE POST-TEST VELOCITY

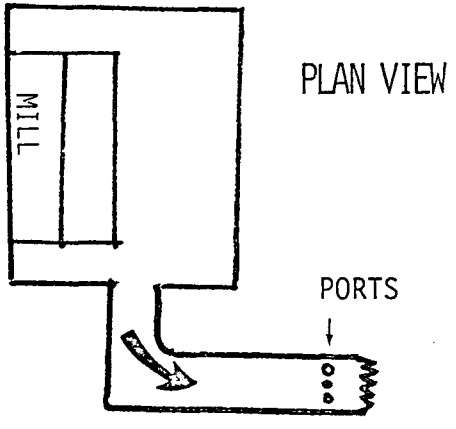


FIGURE 5. BANBURY MILL EXHAUST

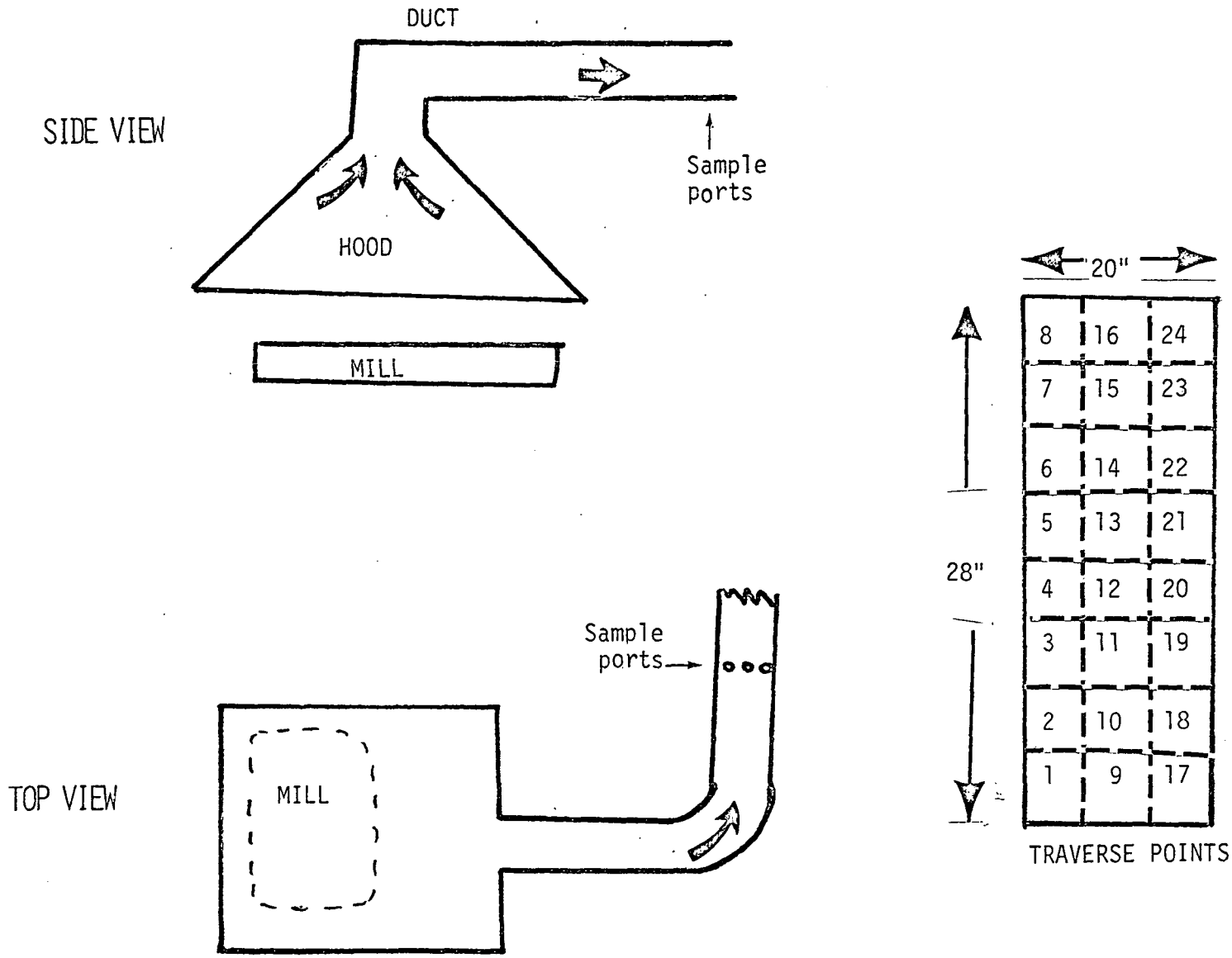


FIGURE 6. SHEET MILL SCHEMATIC

Date	Location	Gas Flow Rate M/Sec.	Ft/Sec.	M^3/Min.	CFM	DSCM/HR	DSCF/HR	AVERAGE DSCM/HR	AVERAGE DSCF/HR
6-14-78	Banbury	12.22	40.1	188.02	6638.9	2.75	97.1		
6-15-78	Banbury	12.92	42.4	198.73	7017.2	2.88	101.7	2.82	99.4
6-16-78	Banbury Mill	11.27	37.0	392.65	13864.6	5.47	193.3		
6-16-78	Banbury Mill	11.03	36.2	384.35	13571.4	5.57	196.8	5.52	195.1
6-14-78	Baghouse Outlet	18.77	61.6	427.58	15097.8	5.61	215.9		
6-15-78	Baghouse Outlet	19.29	63.3	439.01	15501.4	6.28	221.9	6.20	218.9
6-19-78	Sheet Mill	8.33	27.0	178.47	6301.8	2.66	93.8		
6-19-78	Sheet Mill	7.25	23.8	157.31	5554.9	2.31	81.7	2.48	87.7

Note: Molecular weight assumed at 28.80, traverses conducted before and after volatile emission test.

TABLE 3. SUMMARY OF VOLUMETRIC FLOWRATE