Compliance Particulate Emission Testing

on the

Pathological Waste Incinerator

at the

Humana Hospital-East Ridge

Chattanooga, Tennessee

Test Date: November 12, 1987

Submitted by:

Air Techniques, Inc.
1724 Nekoma Street
Marietta, GA 30067

Bill Timpone

Bill Timpone, B.S.M.E.
Testing Manager

Russell Barton

Russell Barton,
Laboratory Manager

TABLE OF CONTENTS

Appendix

I. Introduction

Air Techniques was retained by Humana East Ridge Hospital to perform compliance emission testing on the pathological waste incinerator exhaust located in Chattanooga, Tennessee. The purpose of the testing was to determine if particulate emissions and opacity comply with standards set forth by the Air Pollution Control Bureau of Chattanooga (Hamilton County), Tennessee. The Air Pollution Bureau also required testing for HCl and Chlorine emissions, although there is currently no emission limits for these pollutants. The primary and secondary chamber temperatures were monitored during the test period. This test series was a repeat of previous tests that were conducted on April 7, 1987 and rejected by the Air Pollution Control Bureau.

Three, one hour test repetitions were performed on November 12, 1987 by Evio deOliveira, Bruce Lawrie, John Soulsby, and Mike Brooks of Air Techniques, Inc., Marietta, Georgia.

Air Techniques would like to extend its appreciation to Mr. Jeff Prine of Humana for his assistance throughout the test program. We would also like to thank Mr. Jim Weyler and Mr. Kenneth Roberts of the Chattanooga Air Pollution Control Bureau for their review of the test procedures and incinerator operations.

II. Summary of Results and Conclusion

The summary of test results is shown in the following table. Additional testing information can be found in the results table in Appendix H. The total particulate emissions for the three runs is 0.139 pounds, which is 50% of the emission limit of 0.277 pounds. This is based on the standard of 0.1 pounds per 100 pounds of waste charged in the incinerator.

The average emission rate for free chlorine was 0.003 pounds per hour and the average emission rate for hydrochloric acid was 0.709 pounds per hour. There are currently no emission standards set for either of these compounds. There is no apparent reason for the very low HCl results in test 2, but they were excluded from the average in case there was some error present that would bias the overall results low. The results from tests one and three were very near those from the previous tests and show no reason to doubt their validity.

There was some confusion on the stack diameter due to an error present in the previous test report. The correct diameter (10 inches) was measured and recorded on the first field data sheet for this retest. Copies of all the field data sheets were provided to Mr. Jim Weyler of the Air Pollution Control Bureau on the day of the test.

The average opacity observed for the three runs was 0.0 percent. The opacity standard for this source is 0.

Table I Summary of Test Results

	Run 1	Run 2	Run 3	Average
Stack Gas Vel. (ft/min)	1465	1295	1268	1343
Volumetric Flow (dscfm)	232	212	218	221
PARTICULATE Emission Rate (lb/hr)	0.06	0.05	0.02	
Total Emissions (pounds)	(Based on 64 minute test)			0.139
Allowable Emissions (pounds)				0.277
HYDROCHLORIC ACID Emission Rate (lb/hr)	1.099	0.004	0.318	0.708
(PPM)	822	3	253	538
FREE CHLORINE Emission Rate (lb/hr)	0.003	0.001	0.005	0.003
(PPM)	1	1	2	1
OPACITY	0.0	0.0	0.0	0.0
Isokinetics	104.9	100.8	104.9	103.5
Process Wt. (lbs)				277.3

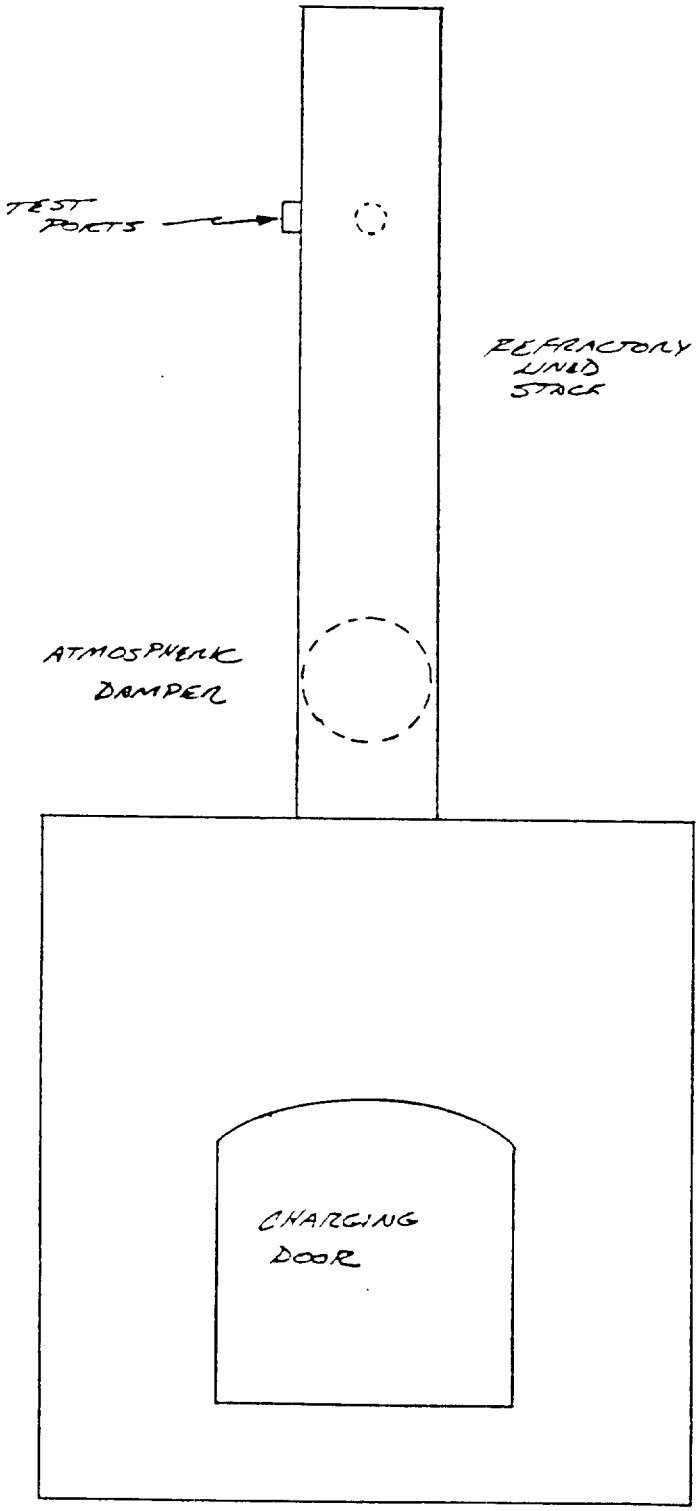
Note: The HCl results from run 2 were excluded from the average.

III. Process Description

The Humana incinerator permit number 0920-50200505-02C is a natural gas fired incinerator which is charged once per day of operation. The day that it was tested a charge of 277.26 lbs of hospital waste was placed into the chamber. The gas consumption for test run 1, 2, and 3 was 300, 230, and 300 cubic feet respectively. The waste was the hospital refuse from the previous day. A sketch of the incinerator is included on the following page.

The untreated exhaust from the incinerator is passed through a refractory lined stack and then released into the atmosphere.

HUMANA HOSPITAL
INCINERATOR



TET

IV. Test Methods

The sampling trains used for execution of the testing were manufactured by GII Enterprises, a division of Andersen Samplers, Atlanta, Georgia. The train meets all specifications as outlined by the U.S. Environmental Protection Agency.

All of the calibrations on the dry gas meter, orifice, thermocouples, digital thermometer, sampling tip, pitot tubes, aneroid barometer, and analytical balance were performed as required by the various test methods. Included in the Appendix G are the results of the calibrations.

The number and location of the sampling points were determined according to Method 1 of the Federal Register. The closest disturbance upstream and downstream from the test site can be found in detail in the test results in Appendix E.

Method 2 was used to determine stack gas velocity and volumetric flow rate. The S - type pitot tube on the three foot probe were calibrated against a standard pitot tube in a wind tunnel. The detailed calibration form can be found in the calibration data section in the Appendix G. After each repetition, a leak check was performed on the pitot-manometer assembly and indicated no leak for 15 seconds.

Dry molecular weight and carbon dioxide gas fraction was determined according to EPA Method 3 during each repetition by orsat analysis of integrated samples. The results of these analyses are reported on the orsat data sheets in the Appendix D.

Method 5, Determination of Particulate Emissions from Stationary Sources, was used to determine particulate concentrations. The sampling train consisted of a calibrated inconel nozzle, probe with inconel liner, glass fiber filter and filter holder, five impingers, 50' umbilical cord, pump, dry gas meter, and orifice. After each test repetition, a leak check was performed and indicated less than the allowable 0.02 CFM. The impinger contents were modified from the standard Method 5 set-up to include sampling for HCl and free chlorine. This was accomplished by placing 100 milliliters (mls) of distilled water in impingers one and two, 100 mls of sodium hydroxide solution in impingers three and four, and 200 grams of silica gel in impinger number five. The complete procedure can be found in Appendix C.

Bill Tompson

V. Sampling Procedures

The test ports and sampling area were located on the exhaust stack, downstream from the incinerator outlet. All pitot and sampling lines, electrical connections, and thermocouples on the probe and filter box were connected to the console by a fifty foot umbilical cord. All thermocouple readings were obtained from an electronic digital thermometer.

Before each test, the probe and filter holder assembly were secured in the filter box. In each of the first two impingers was placed 100 milliliters distilled water. In the third and fourth impingers was placed 100 milliliters of 5% sodium hydroxide solution, and 200 grams of silica gel was put in the fifth impinger. Before each test, an optional leak check was performed to ensure all connections were secure.

Immediately following each test repetition, leak checks were performed on the particulate train, the integrated gas sampling train, and pitot tubes. The particulate train was then disassembled, starting with the filter holder. It was removed and immediately sealed to be sure no particulate matter was lost. A stopper was placed in the end of the probe liner to ensure that no particulate matter was lost from that component. Next, the moisture in impingers one, two, three and four was measured with a graduated cylinder, and each different type of solution was placed into labeled

sample bottles. The silica gel from impinger number five was returned to its container and sealed. The impingers were then reloaded as previously described.

The impinger catches were later sent to an independent lab for analysis. A copy of the analytical procedures can be found in Appendix C.

The probe and nozzle were removed from the test site for clean-up. The nozzle, union, and probe liner were cleaned with acetone, including brushing and rinsing, until all particulate matter was removed. The probe was then returned to the filter box, and a fresh filter and filter holder assembly was installed.

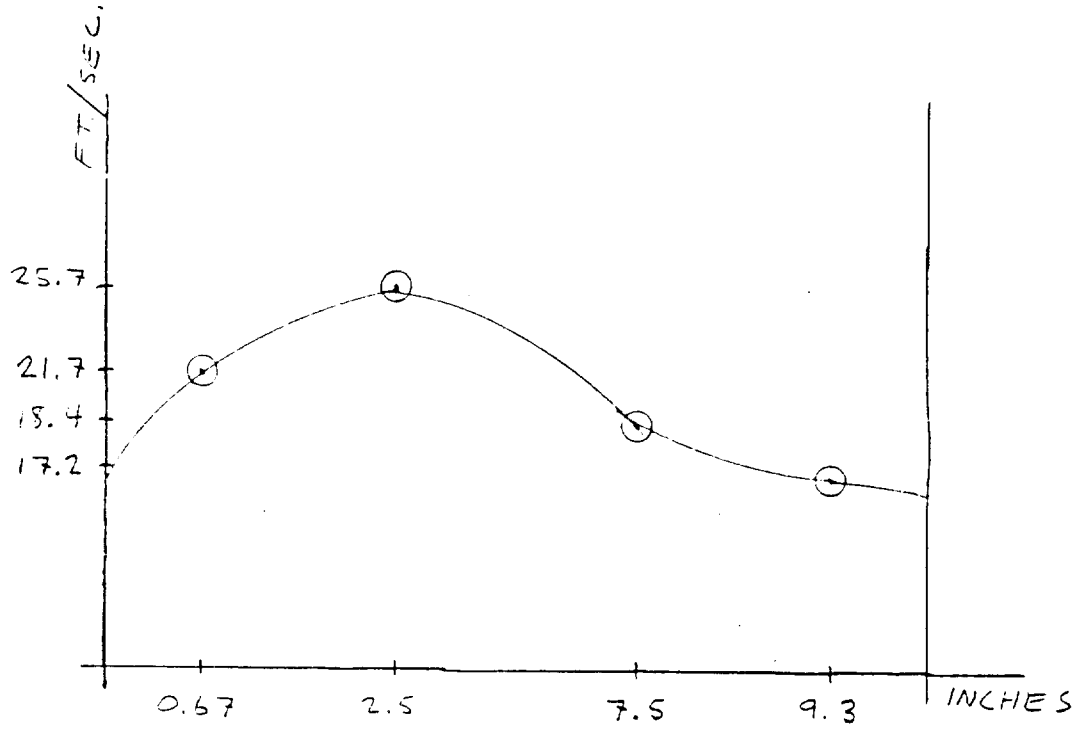
Bill Tompson

APPENDIX A

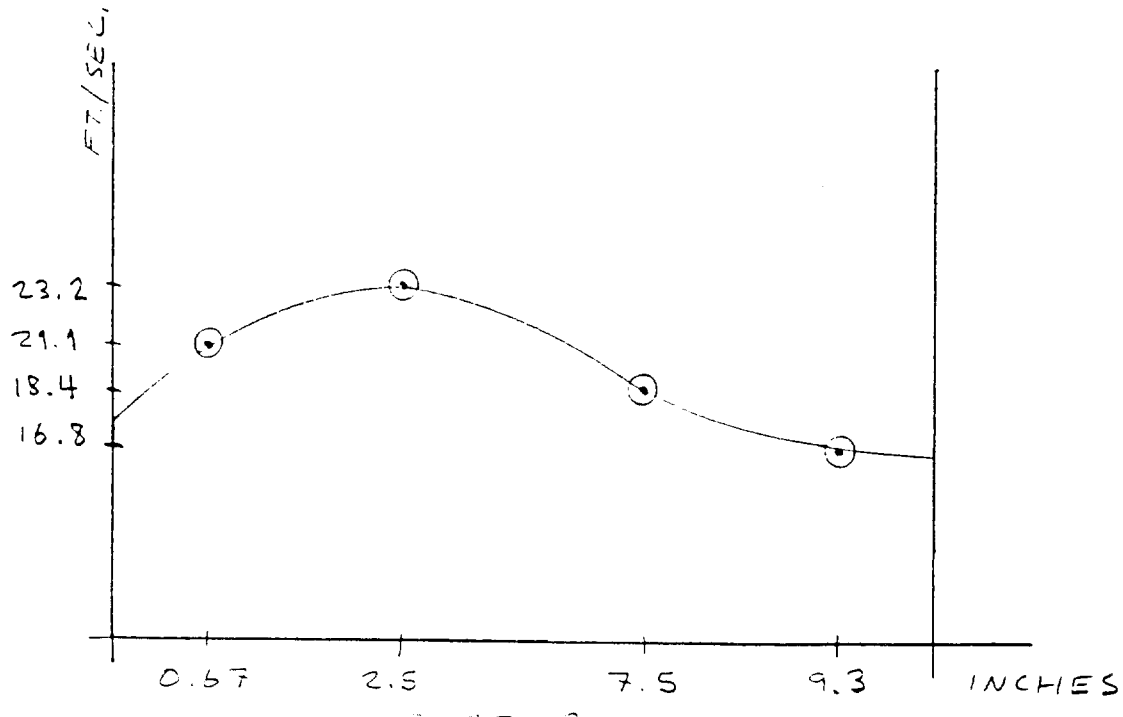
VELOCITY PROFILE DIAGRAM

AIR TECHNIQUES

VELOCITY PROFILE
TEST # 1



PORT A

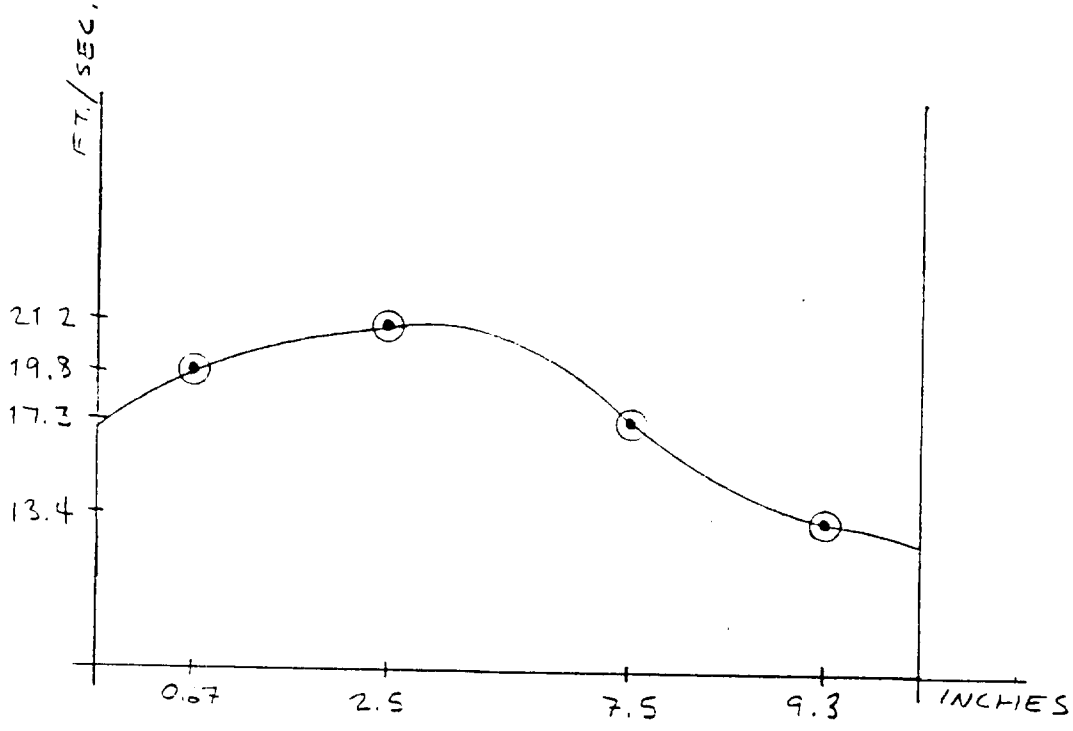


PORT B

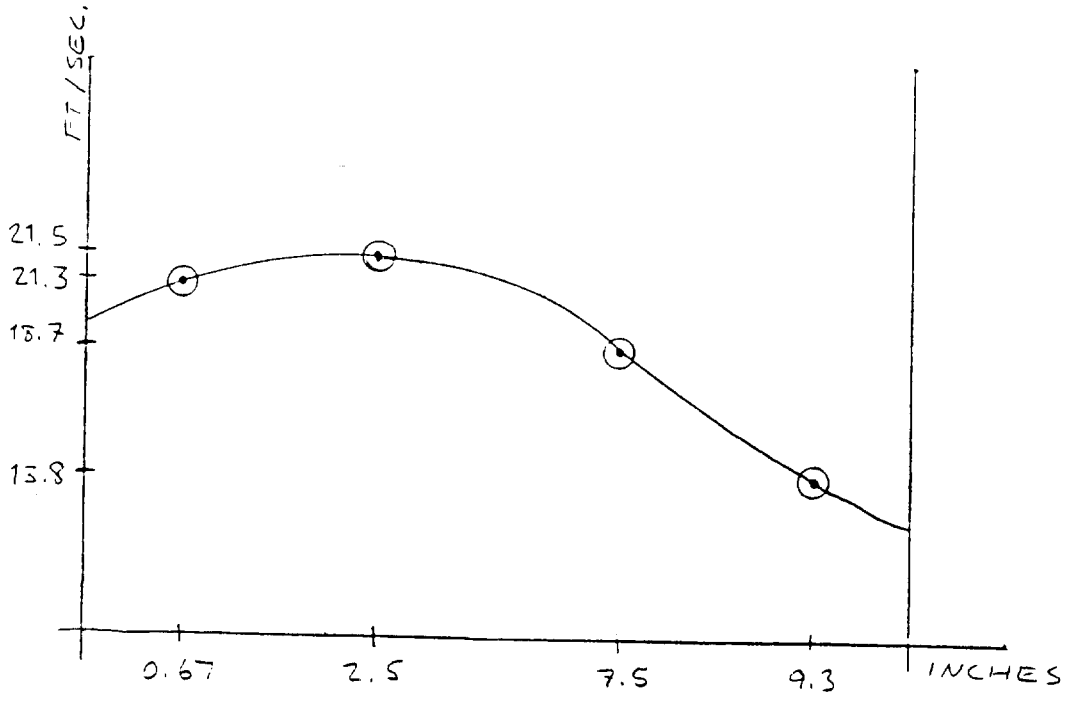
Project: HUMANA Work Order: By: AB Date: Sheet:

AIR TECHNIQUES

VELOCITY PROFILE
TEST # 2



PORT A

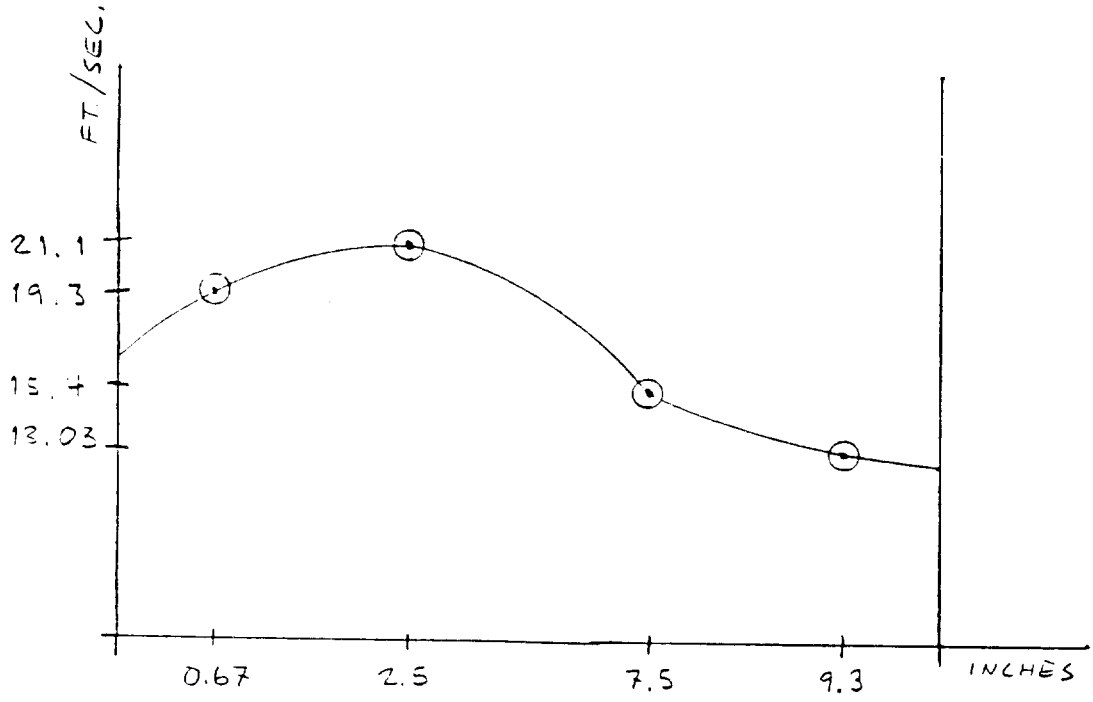


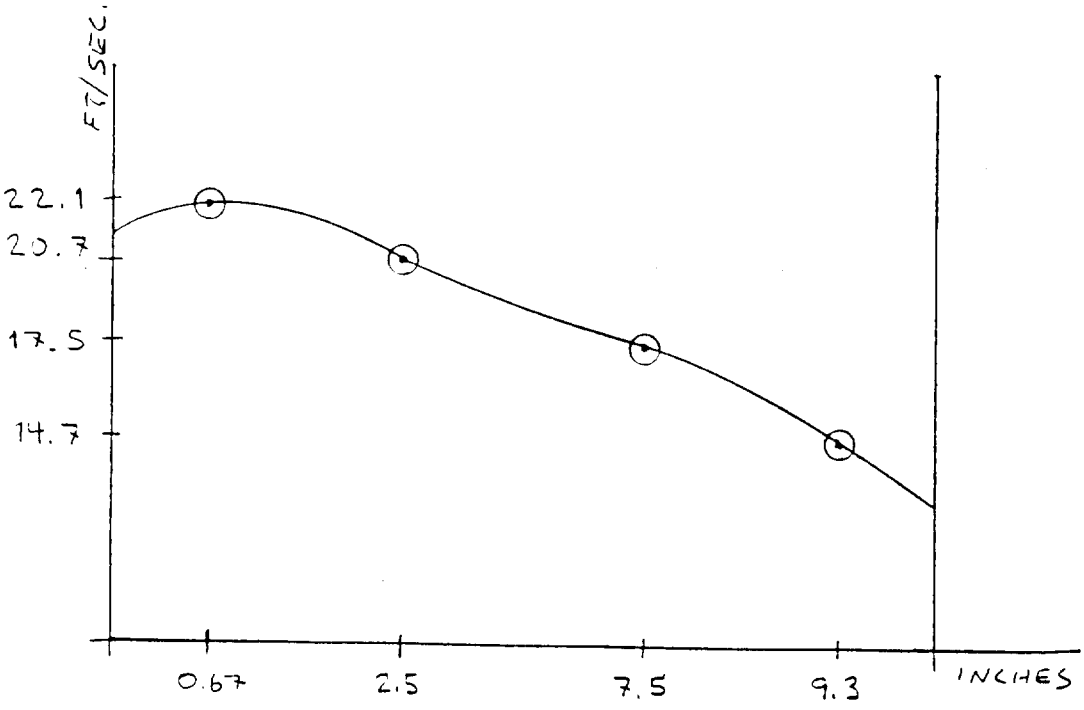
PORT B

Project: HUMANA Work Order: By: AB Date: Sheet:

AIR TECHNIQUES

VELOCITY PROFILE
TEST #3





Project HUMANA Work Order: By AB Date: Sheet:

APPENDIX B

TEST CALCULATION & NOMENCLATURE

AIR TECHNIQUES INC. 1724 Nekoma Street, NE • Marietta, Georgia 30067 • 404/977-7090

TEST CALCULATIONS

I. Determination of Moisture in Stack Gases

a. Volume of Water Vapor Collected (Cubic Feet):

$$Vwstd = 0.04707 * (Vlc)$$

b. Dry Gas Volume Through Meter (Cubic Feet):

$$Vmstd = 17.64 * Vm * Y * [(Pbar + (H/13.6)) / Tm]$$

c. Moisture Content (Percent):

$$Bws = Vwstd / [Vwstd + Vmstd] * 100$$

d. Wet Molecular Weight: (Ms)

$$Ms = [Md * (1-Bws)] + [18.0 * Bws]$$

II. Actual Stack Gas Volume Sampled (Cubic Feet):

$$Vma = [Vmstd * Ts * Pstd] / [(1-Bws) * Tstd * Ps]$$

III. Determination of Stack Gas Velocity & Volumetric Flow Rate

a. Stack Gas Velocity (Feet per Second):

$$Vs = Kp * Cp * (SQR\ \ P) * [SQR (Ts / (Ps * Ms)]$$

b. Stack Volumetric Flow Rate (Cubic Feet per Minute):

1. Dry Standard Conditions (Qs)

$$Qs = 60 * (1-Bws) * Vs * As * (Tstd/Ts) * (Ps/Pstd)$$

2. Actual Conditions (Qa)

$$Qa = Vs * As * 60$$

IV. Determination of Particulate Concentration (Grainloading)

a. Dry Standard Conditions: (cs)

$$cs = 0.01543 * (Mn / Vma)$$

b. Actual Conditions: (csl)

$$csl = 0.01543 * (Mn / Vmstd)$$

V. Emission Rate (Pounds per Hour)

$$E = 60 * Qs * cs / 7000$$

VI. Determination of Acceptability of Sampling Results: (I)

$$I = \frac{Ts * ((0.00267 * Vlc) + ((Vm*Y/Tm)*(Pbar+(^{2}H/13.6))))}{0.599 * \theta * Vs * Ps * An}$$

NOMENCLATURE

As	Cross-sectional area of stack, square feet
An	Cross-sectional area of nozzle, square feet
ACF	Actual cubic feet of gas at stack conditions
ACFM	Actual cubic feet of gas per minute at stack conditions
Bws	Proportion by volume of water vapor in gas stream
cs	Particulate concentration in stack gas, gr/dscf
csl	Particulate concentration in stack gas, gr/ACF
Ca	Acetone blank residue concentration, mg/g
Cp	Pitot tube coefficient
delta H	Pressure drop across orifice meter, inches water
dp	Nozzle diameter, inches
delta P	Velocity head of stack gas, inches water
dscf	Cubic feet of dry gas corrected to standard conditions
E	Particulate emission rate, pounds/hour
F	F-factor, 9780 dscf/MMBTU's of heat input
Kp	Constant (85.49)
Ma	Mass of residue of acetone after evaporation, mg
Maw	Mass of residue of acetone blank, mg
Mf	Particulate matter collected on filter, mg
Mn	Total particulate matter collected, mg
I	Percent of isokinetic sampling
Pa	Density of acetone, mg/ml
Pbar	Barometric pressure, inches mercury
Pm	Barometric pressure of dry gas meter, in. mercury

Ps	Absolute stack gas pressure, inches mercury
Pstd	Barometric pressure, standard conditions, 29.92 "Hg
Qa	Volumetric flow rate, actual conditions, ACF/min
Qs	Volumetric flow rate, dry standard conditions, dscf/min
Tm	Absolute average dry gas meter temperature, degree R
Ts	Absolute average stack gas temperature, degree R
Tstd	Absolute temperature at standard conditions, 528 R
θ	Total sampling time, minutes
Va	Volume of acetone blank, ml
Vaw	Volume of acetone used in wash, ml
Vf	Final volume of impinger contents, ml
Vi	Initial volume of impinger contents, ml
Vlc	Total volume collected in impingers and silica gel, ml
Vm	Volume of gas sampled through gas meter, cubic feet
Vma	Stack gas volume sampled, ACF
Vmstd	Volume of gas sampled through gas meter, cubic feet
Vs	Average stack gas velocity, feet/sec
Vwstd	Volume of water vapor in gas sampled, standard cubic feet
Wa	Weight of residue in acetone wash, mg
Wf	Final weight of filter or probe wash beaker, g
Wi	Initial weight of filter or probe wash beaker, g
Y	Dry gas meter calibration factor

AIR TECHNIQUES

SAMPLE CALCULATIONS

TEST 1

$$C_{HCl} = \frac{838 f_1 m_3}{V_T}$$ EQUATION 5.54

$$C_{HCl} = \frac{31,230}{37.997} = 822 \text{ PPM}$$

$$M_{HCl} = (5.76 \times 10^{-6}) C_{HCl} Q$$ EQUATION 5.55

$$M_{HCl} = (5.76 \times 10^{-6})(822)(232) = 1.099 \text{ LB/HR}$$

$$C_{Cl} = \frac{419 (f_1 m_1 + f_2 m_2)}{V_T}$$ EQUATION 5.52

$$C_{Cl} = \frac{43.5}{37.997} = 1 \text{ PPM}$$

$$M_{Cl} = (11.2 \times 10^{-6}) C_{Cl} Q$$ EQUATION 5.53

$$M_{Cl} = (11.2 \times 10^{-6})(1)(232) = 0.003 \text{ LB/HR}$$

Project Work Order: By: Date: Sheet:

APPENDIX C

SAMPLE PREPARATION, RECOVERY & ANALYSIS

Sample Preparation, Recovery, and Analysis

For each repetition, the following procedures were followed:

Container No. 1

A pre-numbered desiccated glass fiber filter was weighed to a constant weight and transferred by tweezers to this container. Before the test, the filter was placed in the filter holder. After the test, the filter was returned to the container, making sure no particulate matter was lost. If any filter fibers remained on the gasket, they were carefully removed with a knife blade and added to container number 2.

Container No. 2

The nozzle, liner, union, cyclone bypass, and front half of the filter holder were washed with acetone, brushed, and washed again until no visible particulate remained. The brush was then rinsed with the acetone to remove any particulates. All of these washes were collected in this container.

Container No. 3

200.0 grams of silica gel were weighed and sealed in this container. Immediately before the test, the silica gel was transferred to impinger number five. After the test, the silica gel was returned to the container and sealed.

The following laboratory analyses were performed on each sample:

Container No.1

The filter was desiccated for a minimum of 24 hours and weighed to a constant weight. The weight was recorded to the nearest 0.1 mg.

Container No. 2

The contents of this container were transferred to a tared beaker. The container was rinsed with acetone to be sure all the particulate was removed to the beaker. The volume of the beaker was recorded. After all of the acetone in the beaker had evaporated, the beaker was desiccated and reweighed to a constant weight.

NOTE: A sample of the acetone was removed from the wash bottle and transferred to a sample bottle. Laboratory analysis was performed similar to that of container No. 2 above to determine any residue in the acetone.

Container No. 3

The silica gel was weighed to the nearest 0.5 gram.

Bill Tompson

5.4.10 CHLORINE AND CHLORINE COMPOUNDS

The following method has been used to a limited extent for analysis of hydrochloric acid, free chlorine, and total chlorides in emissions from chlorination fluxing of molten aluminum alloys. DON'T TEST FOR CHLORIDES

5.4.10.1 METHOD SUMMARY

Hydrochloric acid is collected by impingers containing water at ambient temperature. These are followed by impingers containing caustic, cooled in an ice bath, for collection of free chlorine. If only free chlorine is to be determined, collection may be made with potassium iodide solution, analyzing for free liberated iodine by standard iodometric methods. Only traces of free chlorine and hydrochloric acid, respectively, are collected by the distilled water and caustic.

The hydrochloric acid and free chlorine are determined by alkalimetric and iodometric titrations, respectively. Total chlorine is determined as chloride by the Volhard method; other halides, except fluorides, will be included in the analysis. The latter determination is made for checking purposes, as well as for other chlorides that may be present in the sample.

Metal chlorides, if present in more than trace amounts, are removed by a paper thimble preceding the distilled water impingers. The thimble collection is extracted and analyzed by usual chemical procedures for metal and chloride ions. An APCD method uses 8-hydroxyquinoline reagent for analysis of milligram quantities of aluminum and magnesium.

5.4.10.2 SAMPLING

The absorption train consists of: *(a)* two impingers, each containing 100 ml of distilled water (the contents are later referred to as *solution A*), followed by *(b)* two impingers, each containing 100 ml of 5% sodium hydroxide solution (the contents are later referred to as *solution B*), followed in turn by a ~~dry~~ S. GEL impinger fitted with a thermometer on the inside stem. The first two impingers are held in a water bath at ambient temperature, and the remaining three are placed in an ice bath. A dry gas meter and vacuum pump follow the impingers. Details of assembly, sampling, and recording data are the same as described for other constituents, e.g., ammonia, organic acids, and sulfur dioxide; sampling rates should not exceed 0.5 cfm.

The total volume of each of solutions A and B are measured; the condensate volume, if not negligible, is recorded for later calculation of sampled gas volume. The impingers and tubing for each solution are rinsed with water ~~and each made up to an exact volume~~.

5.4.10.3 ANALYTICAL PROCEDURE

To analyze for free chlorine, a few milligrams of solid potassium iodide are added to an aliquot of solution A; if no iodine color develops, the solution is then titrated for determination of free hydrochloric acid as described below. If iodine is liberated, the solution is first titrated to the starch end point with standard 0.1 N sodium thiosulfate solution.

An aliquot of solution B is acidified with sulfuric acid, about one gram of solid potassium iodide added, and the liberated iodine titrated with standard 0.1 N sodium thiosulfate to the starch end point. The quantity of sodium thiosulfate used for each of the above titrations is recorded and expressed as milliequivalents.

For hydrochloric acid, the solution A aliquot from above is titrated with standard 0.1 N sodium hydroxide solution to the methyl

red end point. The quantity of standard base used is recorded and expressed as milliequivalents.

In the analysis for total free and combined chlorine, separate aliquots of solution A (made alkaline) and solution B are used. Sufficient 30% hydrogen peroxide is added to each solution to reduce all free chlorine to chloride ion. The total chloride ion content of each is determined by the standard Volhard titration procedure, and expressed as milliequivalents of chloride ion.

5.4.10.4 Calculations

Calculations of the volume of stack gas sampled are made in the same manner as described for other constituents collected by sampling trains, e.g., ammonia, organic acids, sulfur dioxide. Usually little or no condensate is collected so only Equation 4.9 may be needed.

The concentration and emission rate of free chlorine (as Cl_2) in the sampled gas are calculated using the following relations:

$$c_{Cl} = 419 \frac{(f_1 m_1 + f_2 m_2)}{V_T} \quad , \qquad (5.52)$$

and

$$N_{Cl} = 11.2 \times 10^{-6} \, c_{Cl} Q \quad , \qquad (5.53)$$

where,

c_{Cl} = concentration of free chlorine, parts per million by volume

m_1, m_2 = milliequivalents of standard sodium thiosulfate used for titration of iodine liberated by aliquots of solutions A and B, respectively

f_1, f_2 = *aliquot factors* for solutions A and B, respectively

V_T = volume of stack gas sampled, standard cubic feet

N_{Cl} = emission rate of free chlorine, pounds per hour

Q = stack gas flow rate, standard cubic feet per minute

The concentration and emission rate of hydrochloric acid (as HCl) in the sampled gas are calculated with the expressions

$$c_{HCl} = 838 \frac{f_1 m_3}{V_T} \quad , \qquad (5.54)$$

and

$$N_{HCl} = 5.76 \times 10^{-6} c_{HCl} Q \quad , \qquad (5.55)$$

where,

c_{HCl} = hydrochloric acid concentration, parts per million by volume

m_3 = milliequivalents of standard sodium hydroxide used for titration of aliquot of solution A

N_{HCl} = emission rate of hydrochloric acid, pounds per hour

f_1, V_T, Q = as defined for Equations 5.52 and 5.53

The milliequivalents of total chloride ion found for solution A should be at least equal to the sum of the milliequivalents of free Cl_2 and HCl found (i.e., $f_1 m_1 + f_1 m_3$). Any greater amount suggests that the difference is due to metal chlorides that may have been collected in the solution.

The milliequivalents of total chloride ion found for solution B should be equal to $f_2 m_2$, the milliequivalents of free Cl_2 found; any slight excess may be attributable to hydrochloric acid that was not absorbed in the distilled water impingers. In this case, the additional acid is added to that calculated from the preceding section.

5.5 STACK GAS WATER VAPOR CONTENT

An average value for water vapor content of the stack gases over the test period is ob-

tained when sampling for particulate matter th any train including wet impingers. In the sence of such sampling, a condensate collection train, such as described in Section 5.5.1 below, can be used for water vapor determination. When, due to fluctuations, a number of water vapor determinations are needed during a test, or when a rapid determination is required (e.g., for sampling rate dalculation), then dry- and wet-bulb thermometry (Sect. 5.5.2) is recommended unless a steam plume is being sampled (Sect. 5.5.3).

5.5.1 CONDENSABLE WATER VAPOR TRAIN

A portion of the stack gas is drawn through two impingers, each containing exactly 100 ml of distilled water, followed by a dry impinger fitted with a thermometer to allow measurement of the exit gas temperature. The impingers are held in an ice bath to maintain the exit gas temperature at 50 F or less. A diagram of the complete train is shown in Figure 5.1. The sampling rate is maintained at any convenient value, normally one cubic foot per minute or less. Necessary data include metered gas volume, metered gas pressure and temperature, exit impinger gas temperature, and volume of condensate collected. These may be entered conveniently on a form similar to Figure 4.9.

For calculating total water vapor content, refer to Sections 4.4.1.8.1 and 4.4.1.8.3 and to Equations 4.7, 4.8, 4.9, 4.11, and 4.12. Figure 4.13 illustrates a convenient form for such calculations.

5.5.2 DRY-WET BULB THERMOMETRY

When the stack gases are below 212 F and flowing at velocities equal to or above 10 feet per second, dry- and wet-bulb mercury thermometers are introduced directly into the gas stream and readings taken at convenient intervals. Conventional psychrometric charts or tables are used to determine relative humidity, dew point, and moisture content (volume per cent) from the thermometer readings.

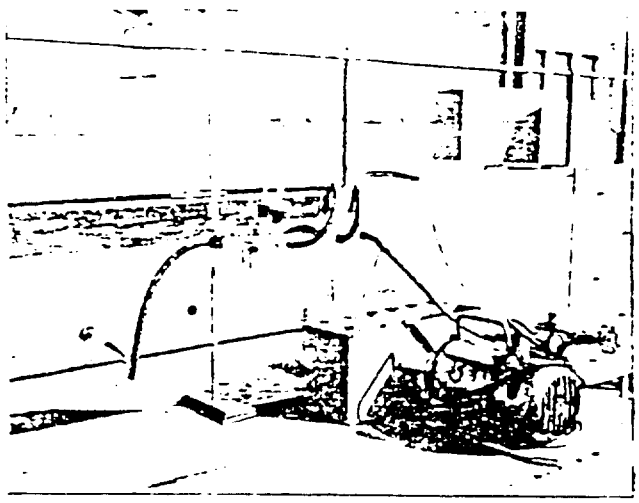


FIGURE 5.11. Apparatus used for the determination of water vapor in stack gas by wet-dry-bulb thermometry.

If the stack gases are above 212 F, they are cooled to below that temperature, but kept well above the dew point, by aspirating a portion of the stack gas through a length of pipe or tubing which serves as a cooler. Two tees are introduced in this line, about one to two inches apart, containing dry- and wet-bulb thermometers, respectively, which are read after equilibrium has been reached. Determination of moisture content is made from the thermometer readings. An aspiration rate is selected to provide the desired amount of cooling. When a pump is used, condensers will be necessary to protect the pump.

Figure 5.11 shows a convenient apparatus for this determination, using a glass holder for the two thermometers.

5.5.3 EVACUATED FLASKS

In unusual cases it may be necessary to determine the water vapor content of emissions

approaching 100 per cent steam. (Actually, the per cent of noncondensable gas, rather than the steam, is of interest in these cases.) Evacuated flasks are used for this purpose.

A number of clean, dry 2-liter flasks (Fig. 5.2) are evacuated to pressures below one mm Hg absolute. For sampling, the flask is connected to a tee or three-way stopcock which will permit purging of the sampling line with steam before opening the screw clamp. The flask is held in a cold water bath in order to condense the steam and thus maintain a partial vacuum within the flask. The flow of steam will continue for minutes or longer, depending upon the relative volume of noncondensable gas in the emissions. The screw clamp is closed when the flow of gas has ceased and the flask remains cold, or when at least 100 ml of condensate appears to have been collected. It is best to collect as much condensate as possible, unless excessive sampling time is required and several samples are desired at different periods of time. Several samples may be taken.

The sealed flask is cooled, if necessary, the final temperature and pressure within the flask are recorded, and the volume of condensate is carefully measured.

To calculate the water vapor content, the following progression of computations is used:

The *volume of noncondensable gas* sampled is obtained from the relation

$$V_{dg} = 520 \frac{(V_f - l_c)(p_f - p_{H_2O})}{760(T_f)}$$

$$= 0.685 \frac{(V_f - l_c)(p_f - p_{H_2O})}{T_f} \quad , \quad (5.56)$$

where,

V_{dg} = volume of noncondensables, dry basis, standard liters (60 F, 14.7 psia)

V_f = volume of flask, liters

l_c = volume of condensate, liters

p_f = absolute pressure in flask, millimeters of mercury

p_{H_2O} = vapor pressure of water at temperature T_f, millimeters of mercury

T_f = temperature in flask, degrees Rankine

The *volume of steam condensed* in the flask is then given by

$$V_{SC}, \text{ standard liters} = 1320\ l_c \quad ; \quad (5.57)$$

the *volume of water vapor* in the flask is given by

$$V_{WV}, \text{ standard liters} = 520 \frac{(V_f - l_c)(p_{H_2O})}{760(T_f)}$$

$$= 0.685 \frac{(V_f - l_c)\ p_{H_2O}}{T_f} \quad , \quad (5.58)$$

and the *total volume of gas* sampled is then

$$V_{tg}, \text{ standard liters} = V_{dg} + V_{SC} + V_{WV} \quad . \quad (5.59)$$

The *per cent of noncondensable gas* in the sample can be calculated as

$$(N.C.), \text{ volume per cent} = 100 \frac{V_{dg}}{V_{tg}} \quad , \quad (5.60)$$

and the *per cent of water vapor* in the sampled gas is then

$$(W.V.), \text{ volume per cent} = 100 - (N.C.) \quad . \quad (5.61)$$

5.5.4 MATERIAL BALANCE METHOD

As shown by Equation 5.51, the concentration of water vapor produced by the combustion of hydrocarbons can be found from the Orsat

analysis of the flue gases. The water vapor concentration of the stack gases will be about 1% greater due to the moisture contained in the combustion air. An accurate correction can be made when the stack gas flow rate, the combustion air flow rate, and the humidity are known. When sufficient information on the fuel rate and composition is known, calculations of stack gas water vapor content and O_2 concentration can be made by material balances.

Bill Turpin

APPENDIX D

FIELD DATA SHEETS

AIR TECHNIQUES INC.

Field Data Sheet

Run # 1

Plant HUMPHREY EAST RIDGE Source INCINERATOR City CHATTANOOGA State TENN
Date NOV 12 87 Start 11:57 am/pm Stop 1:14 am/pm
Operators deVINCENCA / LOWRIE / BROOKS / / /
Console # 611 #3 EPA Box # 1 Probe # 3 Length 3'
Test Method # 5 Console Km (-) .72 K-factor (-) 1.00
Ambient Conditions: Temp. (°F) 48° Pressure (in. Hg) 29.66 Moisture .13
Stack Conditions: Pressure (in. H2O) -.06 Pressure (in. Hg)

Leak Checks:	Pre-Test	Post-Test
Sample Train: .001	CFM @ 10 in. Hg	.001 CFM @ 10 in. Hg
Pitot Dynamic: ✓	in. Hg for 15 sec.	3.3 OK in. Hg for 15 sec.
Pitot Static: ✓	in. Hg for 15 sec.	2.1 in. Hg for 15 sec.
Method #3 Train: 10	in. Hg for 30 sec.	OK in. Hg for 30 sec.

Fyrite Analysis: %CO2 / / / %O2 / / /
Water Collected (ml.): Tare 400 Gross 526 Net 126
Moisture Collected in Silica Gel (g.): Tare 200 Gross 209 Net 9.0

10" STACK DIAMETER

POINT #	VOLUME	PRESSURE			TEMPERATURE					PUMP VACUUM
			ORIFICE					GAS METER		
θ min	DT. GAS METER	PITOT DEL P	DESIRE	ACTUAL	STACK	FILTER	SILICA GEL	IN	OUT	
-	CUBIC FEET	IN. H20	IN. H20	IN. H20	°F.	°F.	°F.	°F.	°F.	IN. HG
1	451.687	.08	1.3	1.3	1010	244	64	71	75	7.0
—	454.36	.08	1.3	1.3	1036	241	58	72	75	7.0
2	456.95	.09	1.4	1.4	1252	250	58	75	76	7.5
—	459.65	.09	1.5	1.5	1130	265	60	76	76	8.0
3	462.38	.05	.85	.85	1152	252	61	76	76	6.0
—	464.64	.05	1.0	1.0	1028	260	62	78	77	6.5
4	466.93	.06	1.2	1.2	1007	257	61	78	77	7.0
—	469.42	.04	.80	.80	995	248	52	78	76	5.0
	STOP - CHANGE PORTS									
1	471.54	.07	1.4	1.4	1036	237	46	74	74	7.5
—	474.20	.07	1.4	1.4	1139	234	42	75	75	3.0
2	476.86	.08	1.6	1.6	1145	235	41	76	75	8.5
—	479.61	.08	1.6	1.6	1161	241	42	77	74	9.0
3	82.38	.05	1.0	1.0	1150	252	42	77	74	7.0
—	84.70	.05	1.0	1.0	983	260	45	78	74	7.0
4	487.00	.05	1.0	1.0	965	266	44	80	77	7.0
—	489.29	.04	.80	.80	963	263	48	79	75	6.0
END	491.47									

AIR TECHNIQUES, INC.

Field Data Sheet

Run # 2

Plant Hamm & Eastridge Source Incinerator City Chattanooga State Tenn
Date 11/12/87 Start 13:30 am/pm Stop 14:42 am/pm
Operators DeOliveira / Lawrie / Brooks / / /
Console # 611 #1 EPA Box # 2 Probe # #3 Length 3'
Test Method # 5T Console Km (-) .63 K-factor (-) 29
Ambient Conditions: Temp. (°F) 70 Pressure (in. Hg) 29.58 Moisture .15
Stack Conditions: Pressure (in. H2O) -.06 Pressure (in. Hg)

Leak Checks:	Pre-Test	Post-Test
Sample Train: .012	CFM @ 10 in. Hg	0.000 CFM @ 4 in. Hg
Pitot Dynamic: ✓	in. Hg for 15 sec.	✓ in. Hg for 15 sec.
Pitot Static: ✓	in. Hg for 15 sec.	✓ in. Hg for 15 sec.
Method #3 Train: 10	in. Hg for 30 sec.	10 in. Hg for 30 sec.

Fyrite Analysis: %CO2 / / / %O2 / / /
Water Collected (ml.): Tare 400 Gross 479 Net 79
Moisture Collected in Silica Gel (g.): Tare 200 Gross 2095 Net 9.5

POINT #	VOLUME	PRESSURE			TEMPERATURE					PUMP VACUUM
	GAS METER	PITOT DEL P	ORIFICE DESIRE	ORIFICE ACTUAL	STACK	FILTER	SILICA GEL	GAS METER IN	GAS METER OUT	
-	CUBIC FEET	IN. H20	IN. H20	IN. H20	°F.	°F.	°F.	°F.	°F.	IN. HG
1	005.728	.06	1.5	1.5	1118	255	61	83	74	2.5
-	008.25	.06	1.5	1.5	1119	267	63	89	76	2.5
2	010.62	.07	1.6	1.6	1095	258	62	91	74	3.0
-	013.18	.06	1.4	1.4	1096	261	65	96	76	2.5
3	015.60	.04	.42	.42	1015	269	61	95	77	1.5
-	017.60	.05	1.1	1.1	1083	267	59	93	79	2.5
4	019.80	.03	.69	.69	1025	263	57	95	77	1.0
-	021.52	.03	.69	.69	1010	264	56	94	79	1.0
1	023.23	.07	1.6	1.6	1105	265	51	87	81	3.0
-	025.74	.07	1.6	1.6	1076	264	50	99	80	3.0
2	028.24	.07	1.4	1.4	1124	264	48	103	81	3.0
-	030.81	.07	1.6	1.6	1076	263	50	105	82	3.0
3	033.44	.05	1.1	1.1	1193	261	50	106	84	2.5
-	035.61	.04	.92	.92	1106	261	50	104	84	2.0
4	037.61	.03	.69	.69	1095	262	51	94	85	2.0
-	039.35	.03	.69	.69	965	258	50	91	85	1.5
End	041.048									

AIR TECHNIQUES INC.

Field Data Sheet

Run # 3

Plant HUMANA EAST RIDGE Source INCINERATOR City CHATTANOOGA State TENN
Date 5/12/87 Start 14:57 am/pm Stop 16:09 am/pm
Operators de Oliveira / Lawrie / Brooks / /
Console # 3 EPA Box # 1 Probe # 3 Length 3'
Test Method # 5I Console Km (-) .72 K-factor (-) 20
Ambient Conditions: Temp. (°F) 64° Pressure (in. Hg) 29.57 Moisture 12.5
Stack Conditions: Pressure (in. H2O) -.06 Pressure (in. Hg)

Leak Checks:	Pre-Test	Post-Test
Sample Train: .010	CFM @ 10 in. Hg	0.003 CFM @ 5.5 in. Hg
Pitot Dynamic: ✓	in. Hg for 15 sec.	3.7 in. Hg for 15 sec. OK
Pitot Static: ✓	in. Hg for 15 sec.	1.7 in. Hg for 15 sec. OK
Method #3 Train: 10	in. Hg for 30 sec.	10 in. Hg for 30 sec. OK

Fyrite Analysis: %CO2 ___/___/___ %O2 ___/___/___
Water Collected (ml.): Tare 400 Gross 483 Net 83
Moisture Collected in Silica Gel (g.): Tare 200 Gross 208.5 Net 8.5

POINT #	VOLUME	PRESSURE			TEMPERATURE					PUMP VACUUM
	GAS METER	PITOT DEL P	ORIFICE DESIRE	ORIFICE ACTUAL	STACK	FILTER	SILICA GEL	GAS METER IN	GAS METER OUT	
-	CUBIC FEET	IN. H20	IN. H20	IN. H20	°F.	°F.	°F.	°F.	°F.	IN. HG
1	492.093	.06	1.2	1.2	1069	269	47	70	69	6.0
"	494.62	.06	1.2	1.2	1106	273	45	71	69	6.0
"	497.05	.06	1.2	1.2	1087	271	45	74	70	6.0
-	499.49	.07	1.4	1.4	1136	247	46	75	70	6.5
3	502.28	.04	.80	.80	1014	246	47	78	71	5.0
-	504.34	.04	.80	.80	1048	254	47	79	71	5.0
4	506.42	.03	.60	.60	973	261	48	82	73	3.5
-	508.20	.03	.60	.60	970	263	46	82	72	4.0
	STOP - CHANGE PORTS									
1	509.95	.07	1.4	1.4	1044	262	55	77	74	7.0
-	512.59	.08	1.6	1.6	1073	254	55	77	74	2.5
2	515.42	.07	1.4	1.4	1050	261	52	79	74	8.0
-	518.22	.07	1.4	1.4	1114	269	48	79	76	8.0
3	521.00	0.05	1.0	1.0	1049	272	48	82	76	6.0
-	523.39	0.05	1.0	1.0	976	270	48	82	75	6.0
4	525.77	0.04	0.8	0.8	927	260	47	83	76	5.0
-	527.86	0.03	0.6	0.6	920	255	47	84	76	4.0
END	529.650									

COMPANY Haliana/East Ridge
LOCATION Tn-Annex Tn
TYPE FACILITY Incinerator
CONTROL DEVICE
T NUMBER 1
DATE 11-12-87

HEIGHT OF DISCHARGE PT. Appx. 30 ft.
POINT OF EMISSIONS Stack
HOURS OF OBSERVATION 1
OBSERVER John Bailey
CERTIFICATION DATE 10-21-87
OBSERVER AFFILIATION Air Techniques

CLOCK TIME: INITIAL 12:00pm FINAL 1:11pm

OBSERVER LOCATION

DISTANCE TO DISCHARGE Appx. 120 ft.
DIRECTION FROM DISCHARGE E. SE
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground Level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION N/NW WIND SPEED Calm C-5 AMBIENT TEMPERATURE 50°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear

MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	C	C	C	C			
	1	C	C	C	C			
	2	C	C	C	C			
	3	C	C	C	C			
	4	C	C	C	C			
	5	C	C	C	C			
	6	C	C	C	C			
	7	C	C	C	C			
	8	C	C	C	C			
	9	C	C	C	C			
	10	C	C	C	C			
	11	C	C	C	C			
	12	C	C	C	C			
	13	C	C	C	C			
	14	C	C	C	C			
	15	C	C	C	C			
	16	C	C	C	C			
	17	C	C	C	C			
	18	C	C	C	C			
	19	C	C	C	C			
	20	C	C	C	C			
	21	C	C	C	C			
	22	C	C	C	C			
	23	C	C	C	C			
	24	C	C	C	C			
	25	C	C	C	C			
	26	C	C	C	C			
	27	C	C	C	C			
	28	C	C	C	C			
	29	C	C	C	C			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

COMPANY Humana / East Pipe — HEIGHT OF DISCHARGE PT. Approx 30 ft.
LOCATION Chattanooga TN — POINT OF EMISSIONS Stack
TYPE FACILITY [illegible] — HOURS OF OBSERVATION 1
CONTROL DEVICE — OBSERVER [illegible]
T NUMBER 1 — CERTIFICATION DATE 10-21-81
DATE 11-12-81 — OBSERVER AFFILIATION Air Techniques

CLOCK TIME: INITIAL 12:00 pm — FINAL 1:1 pm

OBSERVER LOCATION

DISTANCE TO DISCHARGE Approx 50 ft
DIRECTION FROM DISCHARGE SE
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION Out of N/NW — WIND SPEED 5 MPH C-5 — AMBIENT TEMPERATURE 50°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear
MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	C	C	C	C			
	1	C	C	C	C			
	2	C	C	C	C			
	3	C	C	C	C			
	4	C	C	C	C			
	5	C	C	C	C			
	6	C	C	C	C			
	7	C	C	C	C			
	8	C	C	C	C			
	9	C	C	C	C			
	10	C	C	C	C			
	11	C	C	C	C			
	12	C	C	C	C			
	13	C	C	C	C			
	14	C	C	C	C			
	15	C	C	C	C			
	16	C	C	C	C			
	17	C	C	C	C			
	18	C	C	C	C			
	19	C	C	C	C			
	20	C	C	C	C			
	21	C	C	C	C			
	22	C	C	C	C			
	23	C	C	C	C			
	24	C	C	C	C			
	25	C	C	C	C			
	26	C	C	C	C			
	27	C	C	C	C			
	28	C	C	C	C			
	29	C	C	C	C			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

COMPANY Humana East Ridge
LOCATION [illegible] TN
TYPE FACILITY [illegible]
CONTROL DEVICE None
TEST NUMBER 2
DATE 11-12-87

HEIGHT OF DISCHARGE PT. 30 ft.
POINT OF EMISSIONS Stack
HOURS OF OBSERVATION 1
OBSERVER John Soulsby
CERTIFICATION DATE
OBSERVER AFFILIATION Air Technigues

CLOCK TIME: INITIAL 1:35 FINAL 2:42

OBSERVER LOCATION

DISTANCE TO DISCHARGE 50 ft
DIRECTION FROM DISCHARGE SE
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground Level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION Out of N/NW WIND SPEED 0-5 AMBIENT TEMPERATURE 70°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear

MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
	9	0	0	0	0			
	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
	29	0	0	0	0			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

COMPANY Yuma East Ridge
LOCATION Yuma—Arizona
TYPE FACILITY [illegible]
CONTROL DEVICE
TEST NUMBER 2
DATE 11-12-87

HEIGHT OF DISCHARGE PT. 30 ft.
POINT OF EMISSIONS Stack
HOURS OF OBSERVATION 1
OBSERVER John Seeley
CERTIFICATION DATE 10-21-87
OBSERVER AFFILIATION Air Techniques

CLOCK TIME: INITIAL 1:35 pm FINAL 2:42 pm

OBSERVER LOCATION

DISTANCE TO DISCHARGE Appx. 50 ft
DIRECTION FROM DISCHARGE E-SE
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground Level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION East of N.W. WIND SPEED 0-5 AMBIENT TEMPERATURE 70°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear
MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
	9	0	0	0	0			
	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
	29	0	0	0	0			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

COMPANY Hominy Free Ridge
LOCATION [illegible]
TYPE FACILITY INCINERATOR
CONTROL DEVICE
TEST NUMBER 3
DATE 11-12-80

HEIGHT OF DISCHARGE PT. 50 ft Appx
POINT OF EMISSIONS STACK
HOURS OF OBSERVATION
OBSERVER Kent Bailey
CERTIFICATION DATE 10-21-80
OBSERVER AFFILIATION Air Techniques

CLOCK TIME: INITIAL 3:00pm FINAL 4:08pm

OBSERVER LOCATION

DISTANCE TO DISCHARGE 40 ft Appx
DIRECTION FROM DISCHARGE SW
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground Level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION Off of NNW WIND SPEED 0-5 mph AMBIENT TEMPERATURE 60°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear

MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	C	C	C	C			
	1	C	C	C	C			
	2	C	C	C	C			
	3	C	C	C	C			
	4	C	C	C	C			
	5	C	C	C	C			
	6	C	C	C	C			
	7	C	C	C	C			
	8	C	C	C	C			
	9	C	C	C	C			
	10	C	C	C	C			
	11	C	C	C	C			
	12	C	C	C	C			
	13	C	C	C	C			
	14	C	C	C	C			
	15	C	C	C	C			
	16	C	C	C	C			
	17	C	C	C	C			
	18	C	C	C	C			
	19	C	C	C	C			
	20	C	C	C	C			
	21	C	C	C	C			
	22	C	C	C	C			
	23	C	C	C	C			
	24	C	C	C	C			
	25	C	C	C	C			
	26	C	C	C	C			
	27	C	C	C	C			
	28	C	C	C	C			
	29	C	C	C	C			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

COMPANY Humana East Ridge
LOCATION Chattanooga Tn.
TYPE FACILITY Incinerator
CONTROL DEVICE
TEST NUMBER 3
DATE 11-12-80

HEIGHT OF DISCHARGE PT. 30 ft.
POINT OF EMISSIONS Stack
HOURS OF OBSERVATION 1
OBSERVER Jack Spivey
CERTIFICATION DATE 10-21-80
OBSERVER AFFILIATION Air Techniques

CLOCK TIME: INITIAL 3:00 pm FINAL 4:08

OBSERVER LOCATION

DISTANCE TO DISCHARGE Approx 60 ft.
DIRECTION FROM DISCHARGE SW
HEIGHT OF OBSERVATION POINT RELATIVE TO DISCHARGE POINT Ground Level

PLUME DESCRIPTION

COLOR None
DISTANCE VISIBLE —

WEATHER CONDITIONS

WIND DIRECTION Out of N/NW WIND SPEED 0-5 AMBIENT TEMPERATURE 64°
OTHER

SKY CONDITIONS: (Clear, Overcast, % Clouds, etc. Clear

MINUTES OF NON-COMPLIANCE

HR.	MIN.	SECONDS 0	15	30	45	STEAM PLUME (Check if applicable) ATTACHED	DETACHED	COMMENTS
	0	0	0	0	0			
	1	0	0	0	0			
	2	0	0	0	0			
	3	0	0	0	0			
	4	0	0	0	0			
	5	0	0	0	0			
	6	0	0	0	0			
	7	0	0	0	0			
	8	0	0	0	0			
	9	0	0	0	0			
	10	0	0	0	0			
	11	0	0	0	0			
	12	0	0	0	0			
	13	0	0	0	0			
	14	0	0	0	0			
	15	0	0	0	0			
	16	0	0	0	0			
	17	0	0	0	0			
	18	0	0	0	0			
	19	0	0	0	0			
	20	0	0	0	0			
	21	0	0	0	0			
	22	0	0	0	0			
	23	0	0	0	0			
	24	0	0	0	0			
	25	0	0	0	0			
	26	0	0	0	0			
	27	0	0	0	0			
	28	0	0	0	0			
	29	0	0	0	0			

Burner or Bark Boiler yes ☐ no ☐
if yes: Physical Condition
Feed Method & Rate

APPENDIX E

SAMPLING LOCATION

AIR TECHNIQUES INC. 1724 Nekoma Street, NE • Marietta, Georgia 30067 • 404/977-7090

PRELIMINARY SAMPLE TRAVERSE DATA

PLANT Humana Hospital CITY Chattanooga DATE 12 NOV 87

SAMPLING LOCATION INCINERATOR EXHAUST

OPERATOR(S) deOliveira, Brooks, Laurie STACK HEIGHT FT. 30'+

STACK DIMENSIONS IN. 10 circ EQ.DIA.IN. 10 PORT.EXT.IN. 5.5

UPSTREAM DISTURBANCE L/D 8+ DOWNSTREAM DISTURBANCE L/D 2+ REQUIRED NO. POINTS

WET BULB: DRY BULB: Ps in. Hg.

STATIC PRESS.IN H_2O: BAROMETRIC PRESS.:

AMBIENT TEMP: DUCT AREA (ft^2):

Cp: .78 % CO_2: % O_2: % N_2 + CO:

TRAVERSE POINT NUMBER	DIAMETER FRACTION FOR TRAVERSE POINTS ON DIAMETER				DISTANCE FROM STACK WALL IN.	DISTANCE WITH PORT EXTENSION IN.	ADDITIONAL DATA
	6 PTS.	8 PTS.	10 PTS.	12 PTS.			
1 .067	0.044	0.032	0.026	0.021	.67	6.17	
2 .250	0.146	0.105	0.082	0.067	.250	8.0	
3 .750	0.296	0.194	0.146	0.118	7.5	13.0	
4 .933	0.704	0.323	0.226	0.177	9.33	14.83	
5	0.854	0.677	0.342	0.250			
6	0.956	0.806	0.658	0.356			
7		0.895	0.774	0.644			
8		0.968	0.854	0.750			
9			0.918	0.823			
10			0.974	0.882			
11				0.933			
12				0.979			

APPENDIX F

REGULATIONS

Chattanooga — Hamilton County
Air Pollution Control Bureau
3511 Rossville Boulevard • Chattanooga, Tennessee 37407 • (615) 867-4321

December 9, 1987

Mr. Bill Timpone
Air Techniques, Inc.
1724 Nekoma Street, N.E.
Marietta, Georgia 30067

Reference: Humana Hospital-East Ridge
stack test

Dear Mr. Timpone:

In regard to our telephone conversation of December 7, 1987, enclosed are copies of the following:

1) Chain of Custody Form

2) Run #1 Sample Analysis

Additionally, for your information, the East Ridge Municipal Code allowable particulate emission rate for a pathological incinerator is 0.1 pounds per 100 pounds charge; there are no current applicable regulations upon which to base allowable emission rates for HCl and Cl_2.

If I can be of further assistance, please contact me at 867-4321.

Sincerely,

James J. Weyler
Associate Engineer

JJW/pl

Enclosures

EMISSIONS PRE-TEST AGREEMENT

Mdl 7518

Preamble

0920-50200502-02

An source sampling test of the Simonds Model ~~75 & 1B~~ 7516 Incinerator at Humana Hospital-East Ridge will be conducted to demonstrate compliance with all applicable provisions of the East Ridge Municipal Code and will be conducted by Air Techniques, Inc. The test will be conducted for particulate matter, chlorine, hydrochloric acid, primary chamber temperature, secondary chamber temperature and visible emissions. Additionally, secondary chamber residence time shall be provided in the final report. The test shall be observed by representatives of the Chattanooga-Hamilton County Air Pollution Control Bureau (Bureau) and shall be conducted under maximum representative operating conditions. Failure to meet the test conditions specified herein or include all necessary information in the final report shall constitute sufficient basis for the Bureau's rejection of the test results and/or the final report.

Minimum Test Requirements

A. Process Requirements

1. Normal incineration rate (permitted incineration rate): 65 lbs/hr.
2. Incineration parameters:
   - A. Raw material requirements: Pathological waste, as defined by the East Ridge Municipal Code
   - B. 1. For incinerator installation, the charge rate for each run and the method of method of determination shall be: The amount of charged waste shall be weighed to establish a test charge rate
     2. Alternative if charge rate does not meet desired charge rate: Repermit at test charge rate or retest

C. Primary and secondary temperatures shall be recorded at 5 minute intervals throughout the test.

3. What testing methods are to be used: EPA Reference Methods 1-5, 9, and acceptable methods for hydrochloric acid and chlorine. Sampling is to begin within 15 minutes (+ 5 minutes) after initial ignition of the primary burner and each successive run shall begin within 15 minutes (+ 5 minutes) of the previous run. Test results shall be calculated (1) to twelve (12) percent carbon dioxide for products of combustion, and (2) to standard conditions. This limitation shall be met when the incinerator is operating at full load. In measuring emissions from incinerators, the carbon dioxide produced by combustion of any liquid or gaseous fuels shall be excluded from the calculation to a maximum of twelve (12) percent carbon dioxide. Humana Hospital-East Ridge or its representatives will provide certified personnel for EPA Method 9.

B. Compliance Test Requirements:

1. The source sampling test shall be conducted with what equipment: EPA approved equipment
2. Copies of all notes, tables, field documents, tare weights of filters, and calculations shall be exchanged between the representatives of the company and the control agencies prior to test completion.
3. Any and all test reports shall be submitted to the Bureau regardless of the results of the test.
4. For particulate matter tests, unless otherwise noted herein, the Bureau will be provided with the filter and washings from one test run of its choice along with pre-weights and acetone blanks.

The analysis of this will be completed in the Bureau laboratory, and handling of the sample will be protected by a written chain of custody. The Bureau will assume all responsibility for the samples once in its custody, and the results will be given to the test team for inclusion in the final report after the results obtained by the test team are given to the Bureau. The run analyzed by the Bureau will be considered the same as the other two runs and the results averaged as normally required by EPA Reference Method 5. If the Bureau loses, damages, or otherwise alters or destroys the sample, the stack emission rate will be determined on the basis of the two remaining runs, and the Bureau will certify that all three runs were properly completed.

5. Visible Emissions Evaluations shall be conducted and recorded during the entire period of each test run. Such evaluations shall be conducted by certified observers provided by Humana Hospital-East Ridge. The results of such evaluations shall be included in the final report.

C. Test Report

The test report shall consist of the following sections, as a minimum:

1. Introduction
2. Summary of results
   - A. Stack Diameter
   - B. Stack Gas Velocity
   - C. Stack Gas Flow Rate (scfm)
   - D. Emission listed in pounds per hour and grains per standard cubic foot (g/scf), (68F,latm,dry gas)
   - E. Allowable emission rate in pounds per 100 pounds charge
   - G. Percent isokinetic of test
   - H. Incineration rate during test

I. Other pertinent results

3. Conclusions

4. Emission Source Description
   A. APCB permit number
   B. Process description and equipment
   C. Control equipment
   D. Exhaust description

5. Sampling Protocol
   A. Methodology
   B. Analytical Procedures

6. Appendices
   A. Velocity Profile Diagram
   B. Sample Calculations
   C. Description of sampling procedure and laboratory procedure (signed)
   D. Copy of field data sheets (signed by tester)
   E. Schematic diagram of sampling site showing distance to upstream and downstream disturbances
   F. Identification of regulations applicable to source
   G. Calibration data to include the most recent data and results of calibration for all equipment used in the test. (RE: Dry gas meter before and after each test and orifice before each test.)

N. VE certification

FAILURE TO INCLUDE ANY OF THE ABOVE INFORMATION IS ADEQUATE GROUNDS FOR REJECTION OF THE COMPLIANCE TEST.

D. Physical Condition of Testing
   1. The source sampling test will begin at 9:00 a.m. on November 12, 1987.
   2. Representatives of local, state, and federal air pollution agencies shall be permitted to observe the source sampling test and shall be given prompt admittance to the test site during the test.
   3. A company representative shall be assigned to the test site.

4. A lead representative shall be appointed to represent Humana Hospital-East Ridge, the testing and/or consulting firm(s), and the Bureau. The lead representatives shall be:
Jeff Prine - Humana Hospital-East Ridge
~~Bill Timpone~~ - Air Techniques, Inc.
Evio de Oliveira
Jim Weyler - Air Pollution Control Bureau

All field decisions shall be made by and between these respective persons.

This document is not a contractual agreement but constitutes the source test conditions which were negotiated on November 5, 1987 between representatives of the Bureau and Humana Hospital-East Ridge.

This information is set forth in written form to insure that all appropriate parties understand the minimum test conditions. The signature of each representative party signifies that he has read the document and will, to the best of his knowledge and ability, comply with the terms of the pre-test agreement.

(company representative)	11/9/87 (date)
(consultant)	(date)
(test consultant)	(date)
(Bureau)	11/5/87 (date)

Humana Hospital
East Ridge

October 29, 1987

Chattanooga Hamilton County
Air Pollution Control Bureau
3511 Rossville Boulevard
Chattanooga, Tennessee 37407

RE: STACK RETEST FOR INCINERATOR

Dear Mr. Cropp:

This is to inform you that a tentative date has been set for the retesting of the stack and temperature test for our incinerator at Humana Hospital East Ridge. The tentative date will be November 12, 1987. Sorry for the short notice but I have talked with Jim Weyler and he has no problem with the date.

The testing facility, (Air Techniques, Inc., of 1724 Nekoma Street, N.E., Marietta, Georgia 30067) has been contacted as to that tentative date. The testing managers' name is Bill Timpone.

If I can be of any further assistance, please contact me. Thank you.

Sincerely,

Jeff Prine

JP:dr

cc: Jim Weyler
Bill Timpone
Steve McGraw
Pete Petruzzi

Bill

RECEIVED
NOV 2 1987
AIR TECHNIQUES, INC.

APPENDIX G

CALIBRATION

Georgia Department of Natural Resources
205 Butler Street, S.E., Floyd Towers East, Atlanta, Georgia 30334
J. Leonard Ledbetter, Commissioner
Harold F. Reheis, Assistant Director
Environmental Protection Division
(404) 656-4713

July 21, 1987

John Soulsby
Air Techniques
1724 Nekoma Street
Marietta, GA 30067

Dear Mr. Soulsby:

Please be advised that you have successfully completed the field certification training of the Georgia Visible Emissions Evaluation Certification Course conducted at the Atlanta Civic Center parking lot on April 22-23, 1987.

Your plume evaluations were within the specifications of Federal Reference Method "9" which qualified you as a Visible Emissions Evaluator. Your average error on black and white smoke did not exceed 7.5% opacity and you incurred no single error exceeding 15% opacity during your qualifying run.

This letter serves as your official notice of certification which is valid for six months from the date you qualified (April 22, 1987), subject to the following visual restriction: NONE.

If you desire a copy of your original qualified "field test form" or if we may be of any further assistance, feel free to contact our office.

It is our hope that the end result of your participation in this course will help in promoting cleaner and healthier air.

Yours for cleaner air,

Arthur D. Hollis
Environmental Specialist
Air Protection Branch
Planning & Technical Support

ADH:cl

AIR TECHNIQUES. INC.
Meter Calibration Form

Date May 12, 1987 Console GII #1 Pb= 28.98

^H ("H2O)	^cm ("H2O)	V1cm (CF)	V2cm (CF)	V1dgm (CF)	V2dgm (CF)	tcm (oF)	t1 (oF)	t2 (oF)	
0.5	-0.1	0.000	5.210	756.478	762.074	70	116 / 100	99 / 95	1
1.0	-0.1	5.210	13.467	762.074	770.995	70	100 / 118	96 / 96	1
1.5	-0.1	13.467	27.746	770.995	786.479	70	116 / 122	97 / 100	2
2.0	-0.1	27.746	40.649	786.479	800.468	70	120 / 124	100 / 102	1
2.5	-0.1	40.649	51.215	800.468	811.917	70	122 / 125	102 / 103	1
3.0	-0.1	51.215	61.873	811.917	823.434	70	123 / 126	103 / 104	1

^H = Orifice pressure differential, inches of water
^cm = Calibration meter pressure differential, inches of water
V1cm = Initial calibration meter volume, cubic feet
V2cm = Final calibration meter volume, cubic feet
V1dgm = Initial dry gas meter volume, cubic feet
V2dgm = Final dry gas meter volume, cubic feet
tcm = Temperature of calibration meter, degrees F
t1 = Inlet temperature of dry gas meter, degrees F
t2 = Outlet temperature of dry gas meter, degrees F
Tcm = Average temperature of calibration meter, degrees R
Tdgm = Average temperature of dry gas meter, degrees R
Pcm = Absolute pressure in calibration meter, "Hg.
Pdgm = Absolute pressure in dry gas meter, "Hg.

Calculations

1. Pcm = Pb + (^cm/13.6)
2. Pdgm = Pb + (^H/13.6)
3. Meter Correction Factor (MCF)

MCF =((V2cm-V1cm)*(Tdgm)*(Pcm))/((V2dgm-V1dgm)*(Tcm)*(Pdgm))

MCF @ H=0.5 = 0.987 MCF @ H=1.0 = 0.980

MCF @ H=1.5 = 0.986 MCF @ H=2.0 = 0.989

MCF @ H=2.5 = 0.991 MCF @ H=3.0 = 0.994

4. AVERAGE MCF = 0.988 Signed JB Lam

AIR TECHNIQUES, INC.
Meter Calibration Form

Date 12-11-87 Console G11 # 1 Pb= 28.72

^H ("H20)	^cm ("H20)	V1cm (CF)	V2cm (CF)	V1dgm (CF)	V2dgm (CF)	tcm (oF)	t1 (oF)	t2 (oF)
1.5	.10	000.000	005.282	592.670	598.046	62°	75/90	69/72
1.5	.10	005.282	010.481	598.046	603.376	62°	90/93	71/76
1.5	.10	010.481	015.588	603.376	608.642	62°	93/102	75/78

^H = Orifice pressure differential, inches of water
^cm = Calibration meter pressure differential, inches of water
V1cm = Initial calibration meter volume, cubic feet
V2cm = Final calibration meter volume, cubic feet
V1dgm = Initial dry gas meter volume, cubic feet
V2dgm = Final dry gas meter volume, cubic feet
tcm = Temperature of calibration meter, degrees F
t1 = Inlet temperature of dry gas meter, degrees F
t2 = Outlet temperature of dry gas meter, degrees F
Tcm = Average temperature of calibration meter, degrees R
Tdgm = Average temperature of dry gas meter, degrees R
Pcm = Absolute pressure in calibration meter, "Hg.
Pdgm = Absolute pressure in dry gas meter, "Hg.

Calculations

1. Pcm = Pb + (^cm/13.6)

2. Pdgm = Pb + (^H/13.6)

3. Meter Correction Factor (MCF)

MCF =((V2cm-V1cm)*(Tdgm)*(Pcm))/((V2dgm-V1dgm)*(Tcm)*(Pdgm))

MCF @ H= = 1.006

MCF @ H= = 1.010

MCF @ H= = 1.012

4. AVERAGE MCF = 1.009

Person performing calibration [signature]

AIR TECHNIQUES, INC.
Orifice Calibration Form

Date: 12/31/85 Console: G11 #1

ΔH ("H2O)	V1 (CF)	V2 (CF)	θ (Min)	T1 (oR)	T2 (oR)	V2 - V1 (CF)	Qm (CFM)	Km
0.5	712.002	721.928	26.70	547	537	9,50	0,353	0,622
1.0	721,928	732.032	18,98	561	542	9.64	0,500	0.621
1.5	732.032	742.242	15,70	567	548	9,74	0.610	0.616
2.0	742,242	752.503	13.03	570	551	9,77	0,737	0.643
2.5	752.503	768.487	18,38	569	552	15,20	0.814	0.635
3.0	768.487	783318	15,33	569	553	14,10	0.906	0.645

V1 = Dry gas meter at start of each calibration run

V2 = Dry gas meter at end of each calibration run

T1 = Dry gas meter inlet temperature

T2 = Dry gas meter outlet temperature

Pm = Atmospheric pressure (in. Hg.) + (ΔH/13.6)

Mm = 28.97 #/# mole

Tm = T2 average

Calculations

1. Qm = [(V1 - V2) / θ] * [(Avg T2) / (Avg T1+T2)

2. Km = [square root (Pm * Mm / Tm / ΔH)] * Qm

Average orifice meter calibration: 0.630

Calibrated by: Bill Timpone

AIR TECHNIQUES, INC.
DIGITAL THERMOMETER CALIBRATION

Date: 9 SEPT 87 Digital Thermometer: GII #1

Sending MV - degrees F	Reading MV - degrees F	Accuracy
AMBIENT 77°	77°	
100°F	102°	
200°F	202°	
300°F	303°	
400°F	402°	
500°F	501°	
750°F	750°	
1000°F	1000°	
1500°F	1501°	
1950°F	1951°	

NO ADJUSTMENTS WERE NECESSARY ON THE GII DIGITAL THERMOMETER

Used as standard:

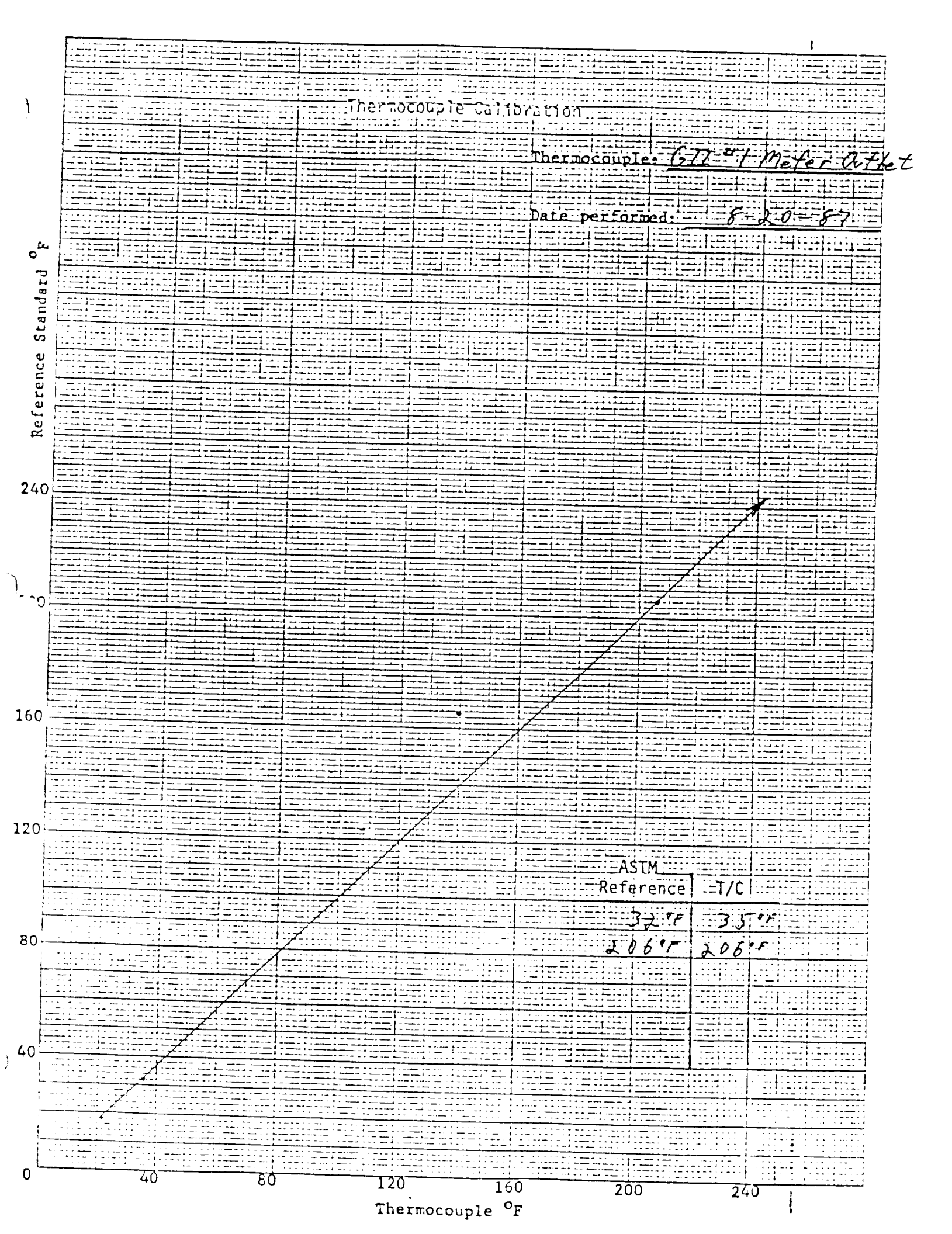
Thermo-Electric Micromite, calibration tracible to NBS standards.

Calibrated by: [signature]

Thermocouple Calibration

Thermocouple: GT-#1 Meter Outlet

Date performed: 8-20-87

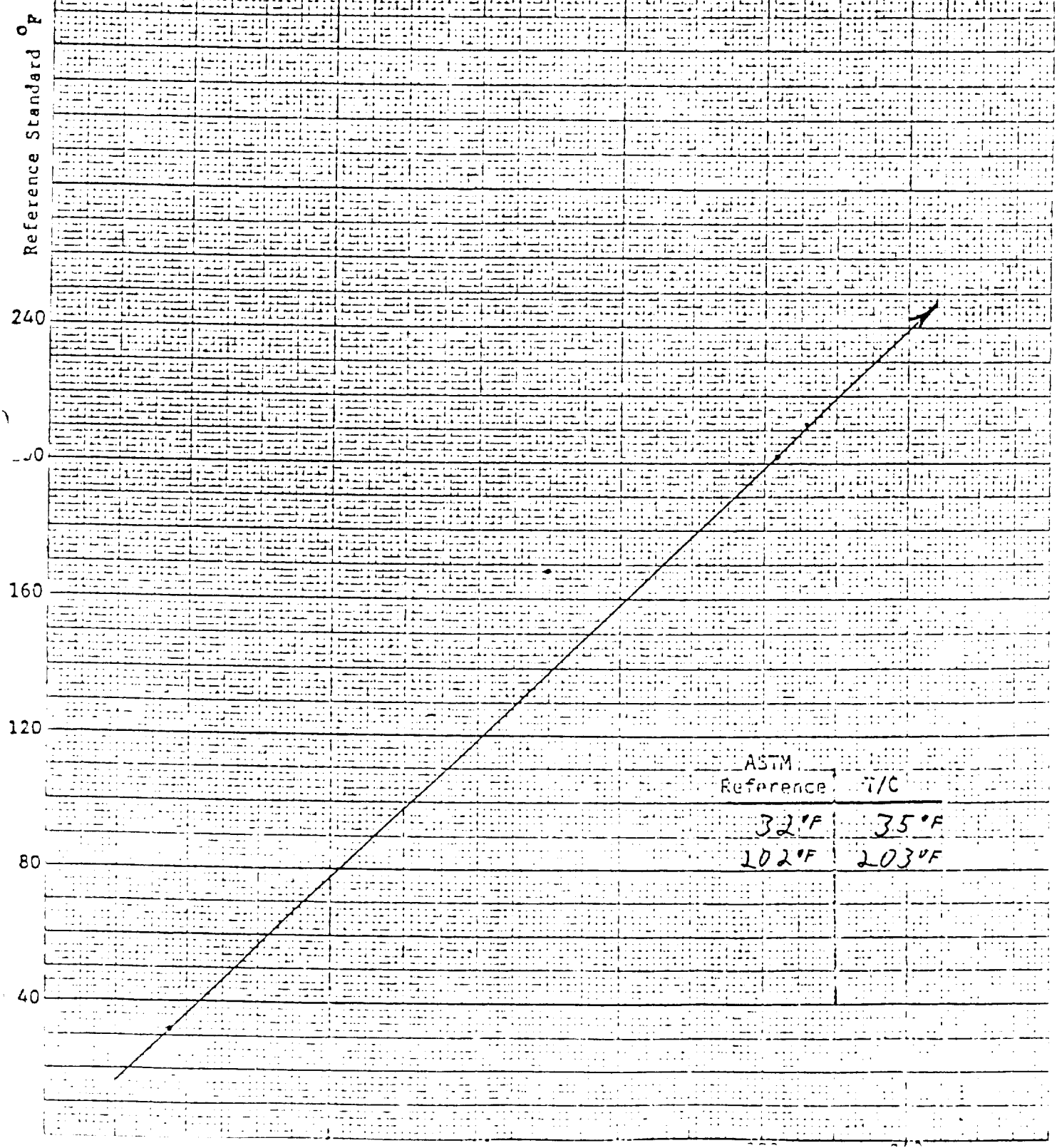


ASTM Reference	T/C
32 °F	35 °F
206 °F	206 °F

Thermocouple Calibration

Thermocouple: GII #1 Meter Inlet

Date performed: 8-20-57



ASTM Reference	T/C
32°F	35°F
102°F	203°F

AIR TECHNIQUES. INC.
Meter Calibration Form

Date 3/11/86 Console G11 NO 3 Pb= 28.89

^H ("H2O)	^cm ("H2O)	V1cm (CF)	V2cm (CF)	V1dgm (CF)	V2dgm (CF)	tcm (oF)	t1 (oF)	t2 (oF)	
0.5	NEG 0.10	651.000	658.000	73.410	80.718	67.5	78 / 75	74 / 74	17:3 / 17.5
1.0	NEG 0.10	658.000	669.000	80.718	92.158	67.5	75 / 84	74 / 76	19:2 / 19.4
1.5	NEG 0.10	669.000	679.000	92.158	102.587	67.5	85 / 96	76 / 81	14:0 / 14.1
2.0	NEG 0.20	679.000	691.000	102.587	115.294	67.5	95 / 94	81 / 83	15: / 15.0
2.5	NEG 0.20	691.000	711.000	115.294	136.662	67.5	94 / 103	84 / 88	21:5 / 21.9
3.0	NEG 0.20	711.000	723.000	136.662	149.565	68	102 / 104	89 / 91	12:1 / 12..

^H = Orifice pressure differential, inches of water
^cm = Calibration meter pressure differential, inches of water
V1cm = Initial calibration meter volume, cubic feet
V2cm = Final calibration meter volume, cubic feet
V1dgm = Initial dry gas meter volume, cubic feet
V2dgm = Final dry gas meter volume, cubic feet
tcm = Temperature of calibration meter, degrees F
t1 = Inlet temperature of dry gas meter, degrees F
t2 = Outlet temperature of dry gas meter, degrees F
Tcm = Average temperature of calibration meter, degrees R
Tdgm = Average temperature of dry gas meter, degrees R
Pcm = Absolute pressure in calibration meter, "Hg.
Pdgm = Absolute pressure in dry gas meter, "Hg.

Calculations

1. Pcm = Pb + (^cm/13.6)
2. Pdgm = Pb + (^H/13.6)
3. Meter Correction Factor (MCF)

MCF =((V2cm-V1cm)*(Tdgm)*(Pcm))/((V2dgm-V1dgm)*(Tcm)*(Pdgm))

MCF @ H=0.5 = 0.970 MCF @ H=1.0 = 0.977

MCF @ H=1.5 = ~~0.977~~ 0.986 MCF @ H=2.0 = 0.976

MCF @ H=2.5 = 0.973 MCF @ H=3.0 = 0.973

4. AVERAGE MCF = 0.976 Signed Bill Timpson

[illegible] TECHNIQUES, INC.
Meter Calibration Form

Date 13 NOV 87 Console GII 3 Pb= 29.22

^H ("H2O)	^cm ("H2O)	V1cm (CF)	V2cm (CF)	V1dgm (CF)	V2dgm (CF)	tcm (oF)	t1 (oF)	t2 (oF)
1.5	.10	000.000	005.214	431.034	436.664	53	63 / 66	50 / 53
1.5	.10	005.214	010.232	436.664	442.107	53	66 / 68	53 / 55
1.5	.10	010.232	016.112	442.107	448.487	53	68 / 71	55 / 57

^H = Orifice pressure differential, inches of water
^cm = Calibration meter pressure differential, inches of water
V1cm = Initial calibration meter volume, cubic feet
V2cm = Final calibration meter volume, cubic feet
V1dgm = Initial dry gas meter volume, cubic feet
V2dgm = Final dry gas meter volume, cubic feet
tcm = Temperature of calibration meter, degrees F
t1 = Inlet temperature of dry gas meter, degrees F
t2 = Outlet temperature of dry gas meter, degrees F
Tcm = Average temperature of calibration meter, degrees R
Tdgm = Average temperature of dry gas meter, degrees R
Pcm = Absolute pressure in calibration meter, "Hg.
Pdgm = Absolute pressure in dry gas meter, "Hg.

Calculations

1. Pcm = Pb + (^cm/13.6)

2. Pdgm = Pb + (^H/13.6)

3. Meter Correction Factor (MCF)

MCF = ((V2cm-V1cm)*(Tdgm/Pcm))/((V2dgm-V1dgm)*(Tcm/Pdgm))

MCF @ H= = 0.931

MCF @ H= = 0.932

MCF @ H= = 0.935

4. AVERAGE MCF = 0.933

Person performing calibration [signature]

AIR TECHNIQUES, INC.
Orifice Calibration Form

Date: 3/11/86 Console: 611 # 3

ΔH ("H2O)	V1 (CF)	V2 (CF)	θ (Min)	T1 (oR)	T2 (oR)	V2 - V1 (CF)	Qm (CFM)	Km
0.5	73.41 ~~651.000~~	80.718 ~~656.000~~	17.52	537	534	7.090	0.404	0.715
1.0	80.718	92.158	19.40	540	535	11.170	0.573	0.718
1.5	92.158	102.587	14.13	551	539	10.280	0.720	0.734
2.0	102.587	115.294	15.07	555	542	12.400	0.814	0.717
2.5	115.294	136.662	21.98	559	546	20.80	0.935	0.735
3.0	136.662	149.565	12.27	563	550	12.56	1.01	0.723

V1 = Dry gas meter at start of each calibration run

V2 = Dry gas meter at end of each calibration run

T1 = Dry gas meter inlet temperature

T2 = Dry gas meter outlet temperature

Pm = Atmospheric pressure (in. Hg.) + (ΔH/13.6)

Mm = 28.97 #/# mole

Tm = T2 average

Calculations

1. Qm = [(V1 - V2) / θ] * [(Avg T2) / (Avg T1+T2)

2. Km = [square root (Pm * Mm / Tm / ΔH)] * Qm

Average orifice meter calibration: 0.723

Calibrated by: Bill Tinpon

AIR TECHNIQUES, INC.
DIGITAL THERMOMETER CALIBRATION

Date: 9 sept 87 Digital Thermometer: GII #3

Sending MV - degrees F	Reading MV - degrees F	Accuracy
Ambient 78°	78°	
100° F	100°	
200° F	200°	
300° F	301°	
400° F	400°	
500° F	500°	
750° F	749°	
1000° F	999°	
1500° F	1499°	
1950° F	1947°	

No Adjustments were necessary on the GII digital thermometer.

Used as standard:

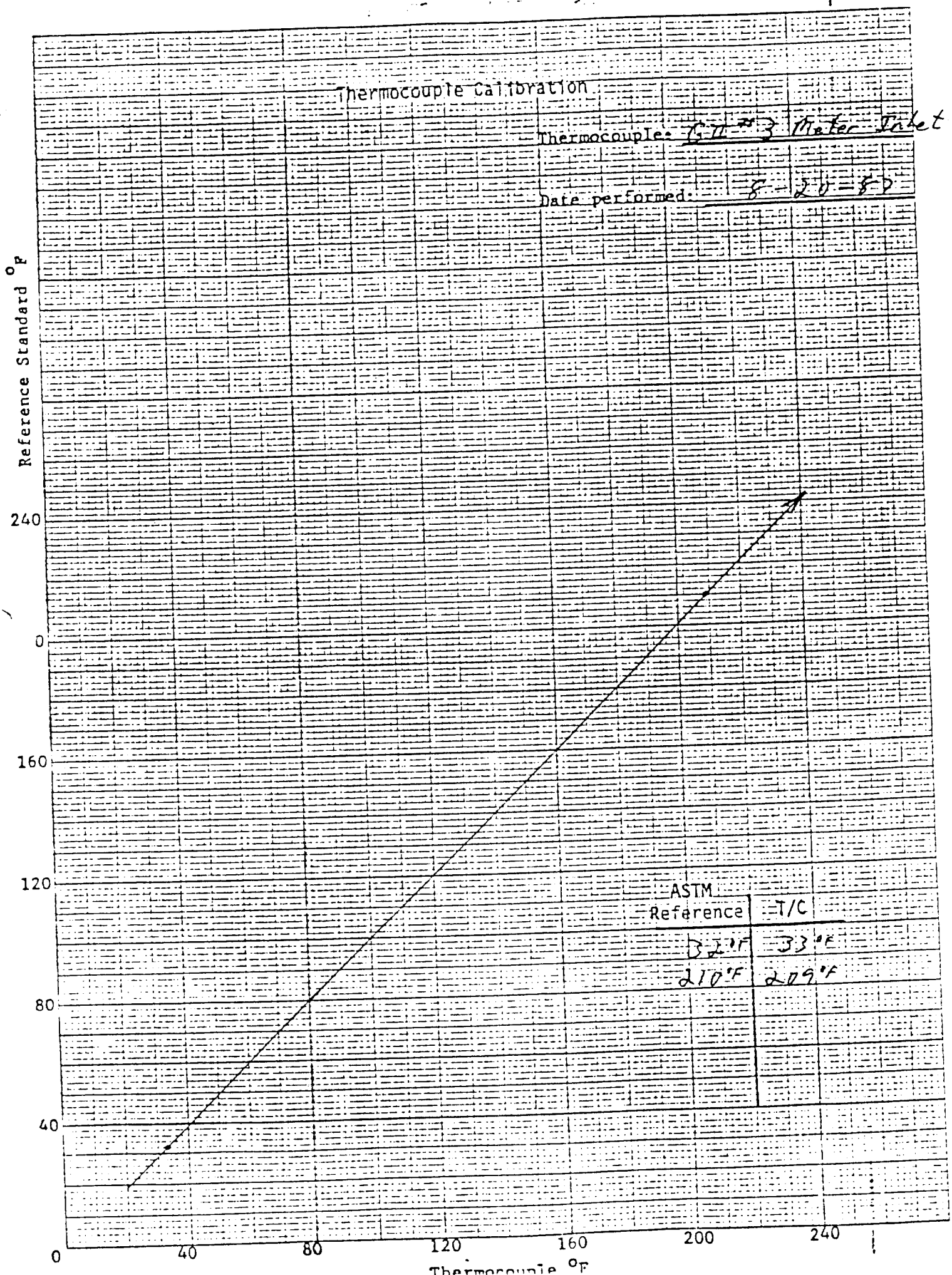
Thermo-Electric Micromite, calibration tracible to NBS standards.

Calibrated by: [signature]

Thermocouple Calibration

Thermocouple: GM #3 Meter Inlet

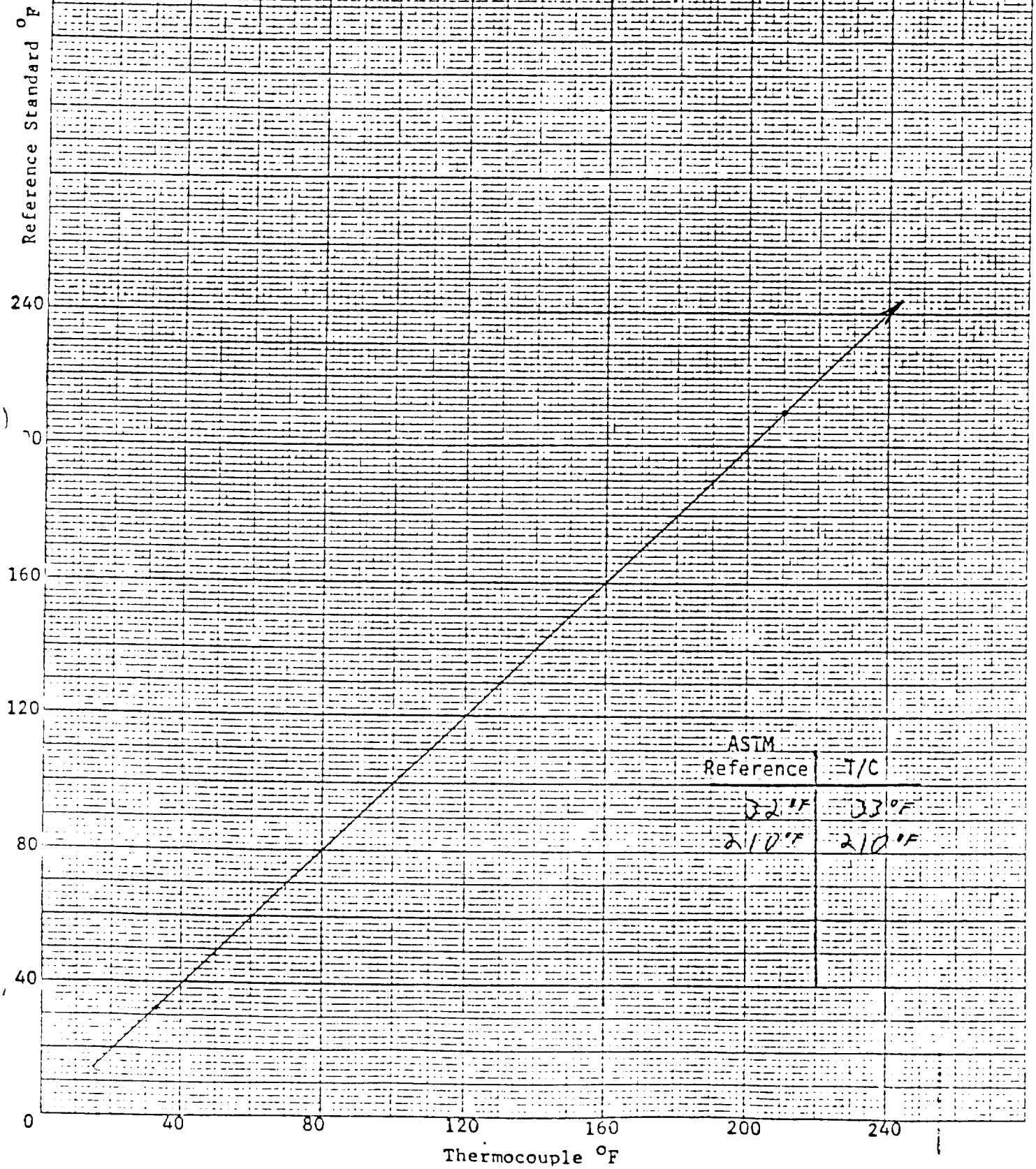
Date performed: 8-20-87

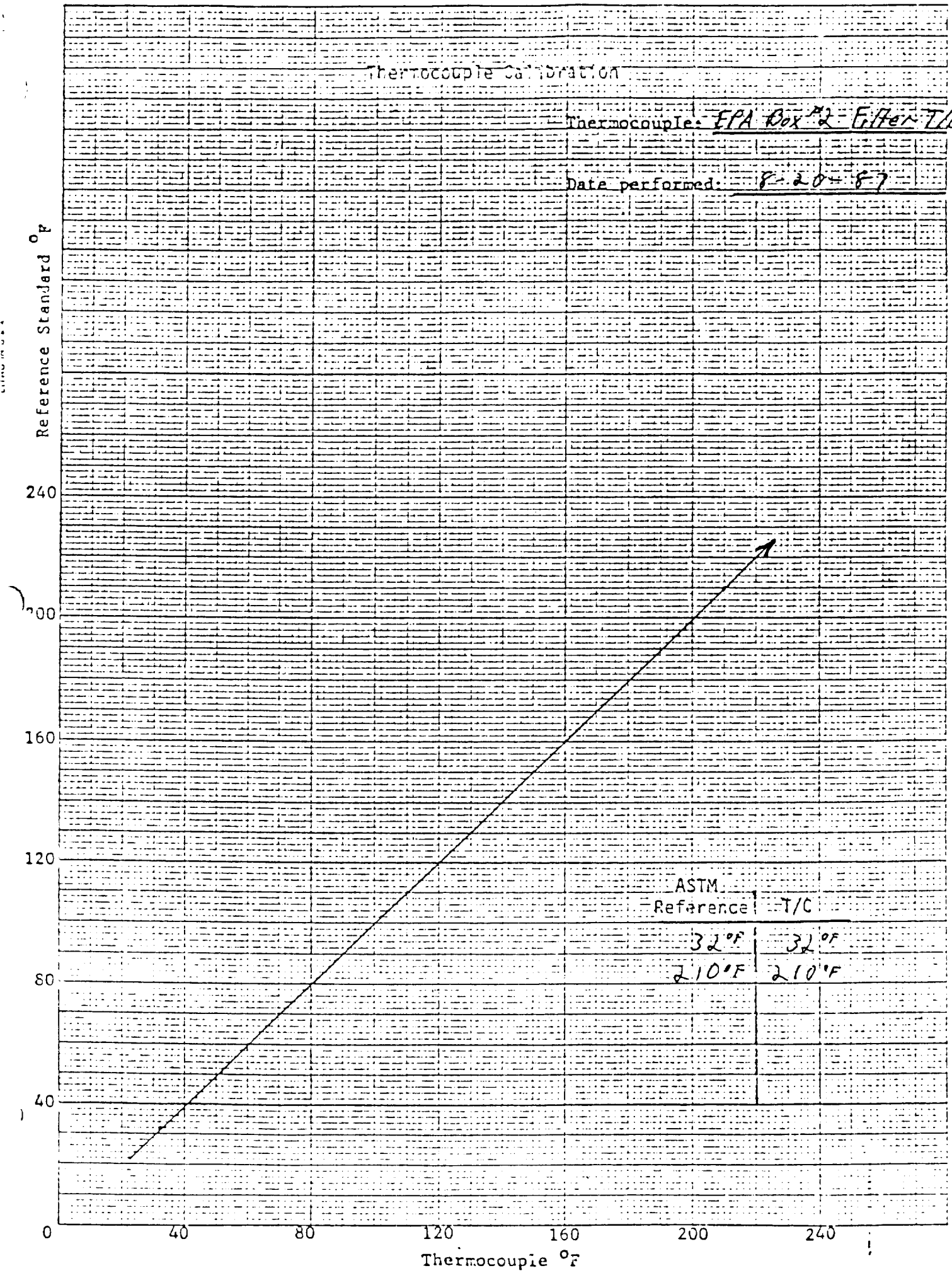


Thermocouple Calibration

Thermocouple: GT #3 Meter Outlet

Date performed: 8-20-87

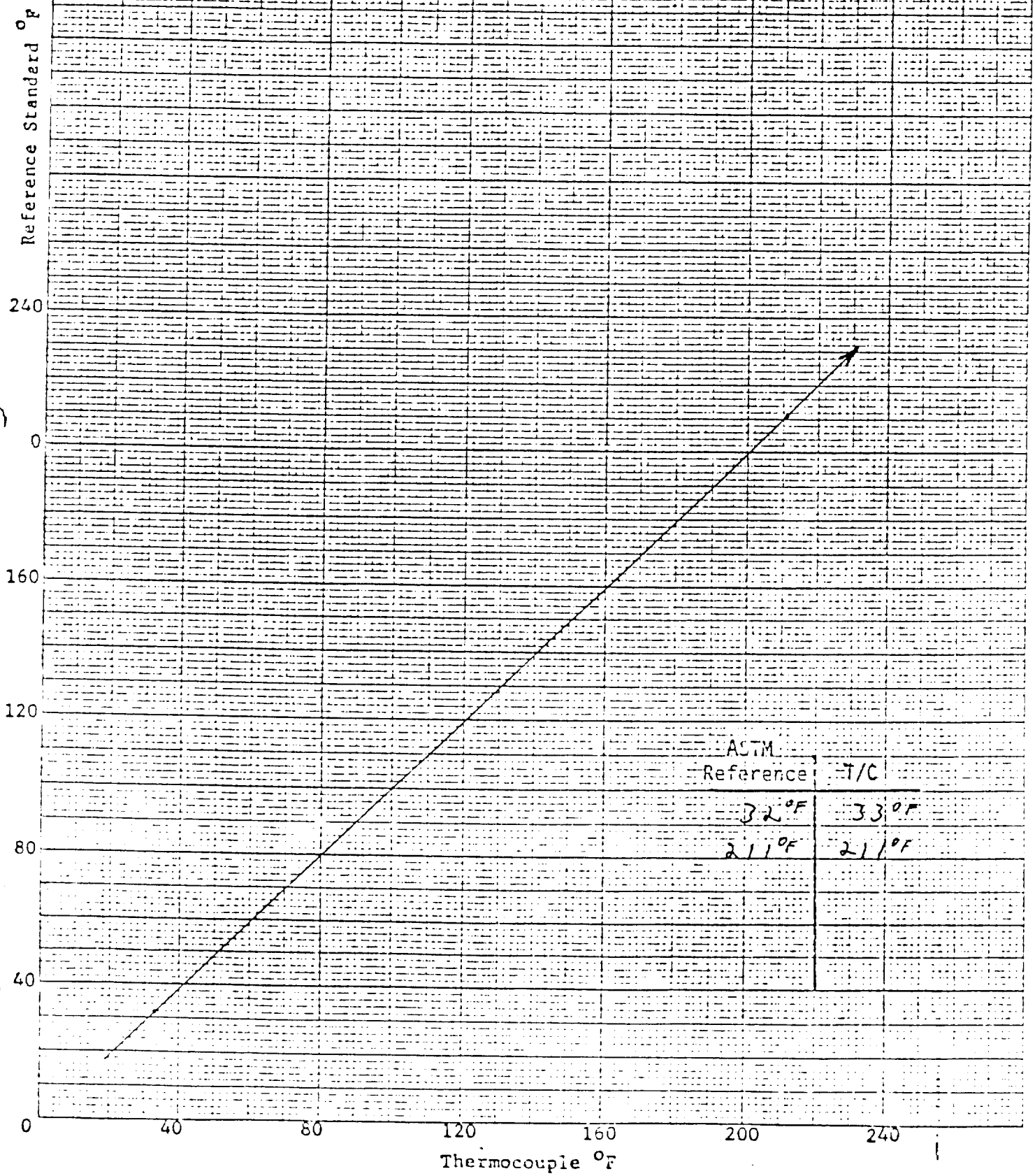



Thermocouple Calibration
Thermocouple: EPA Box #2 - Filter T/C
Date performed: 8-20-87
Reference Standard °F
240
200
160
120
80
40
0
40
80
120
160
200
240
Thermocouple °F
ASTM Reference
T/C
32°F
32°F
210°F
210°F

Thermocouple Calibration

Thermocouple: FPA Box #2 Inp. T/C

Date performed: 8-20-87

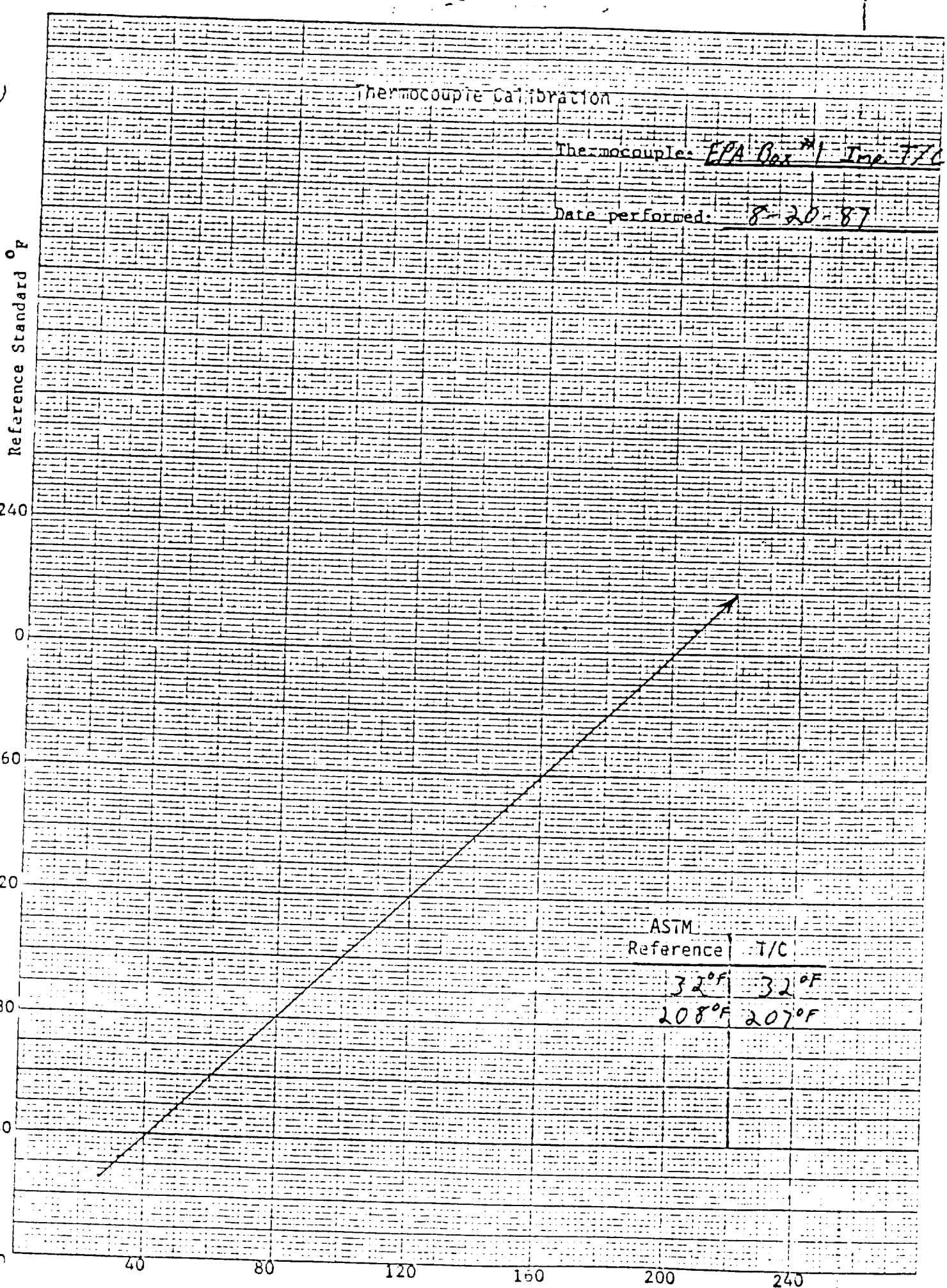


ASTM Reference	T/C
32 °F	33 °F
211 °F	211 °F

Thermocouple Calibration

Thermocouple: EPA Box #1 Imp. T/C

Date performed: 8-20-87

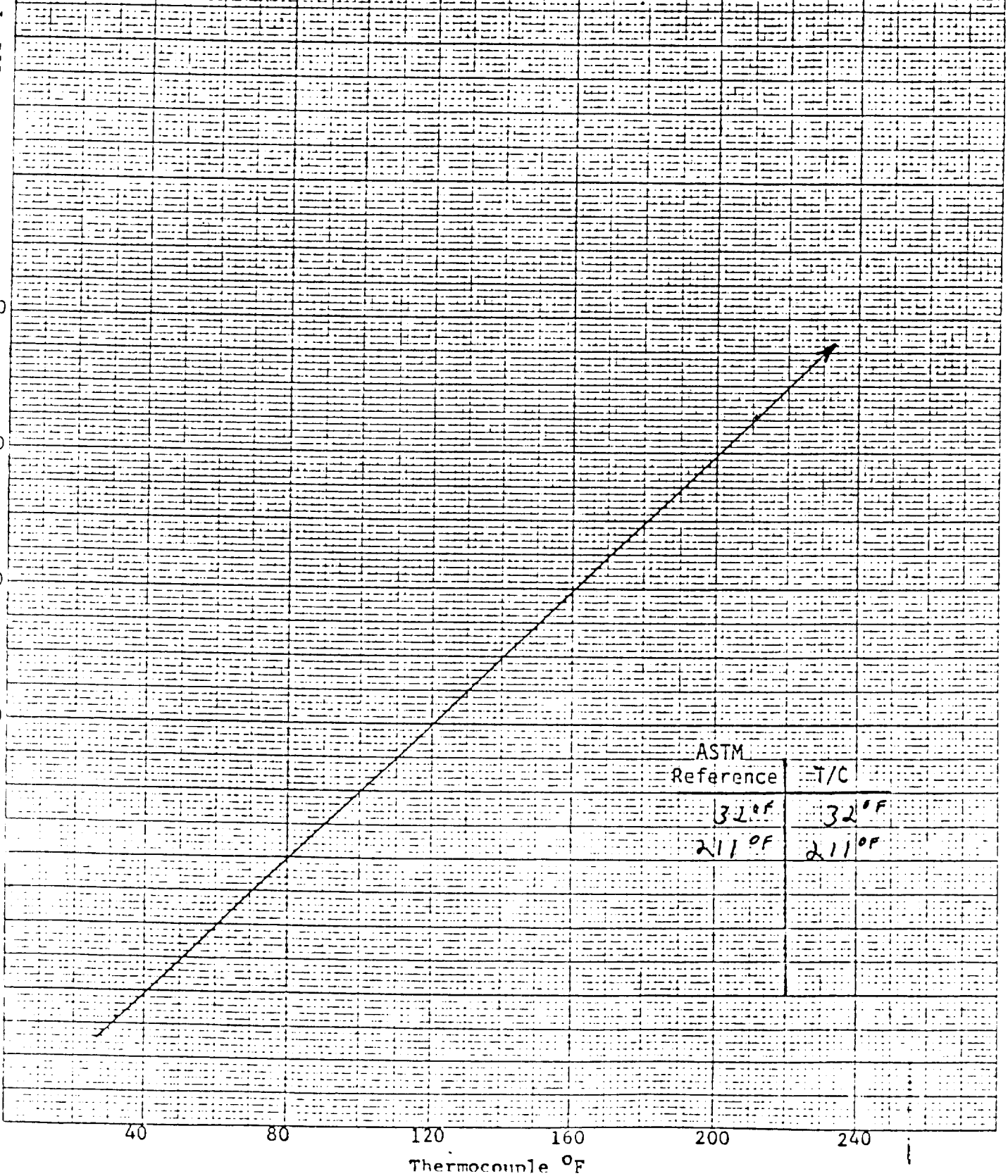


ASTM Reference	T/C
32°F	32°F
208°F	207°F

Thermocouple Calibration

Thermocouple: EPA Box #1 Filter T/C

Date performed: 8-20-87

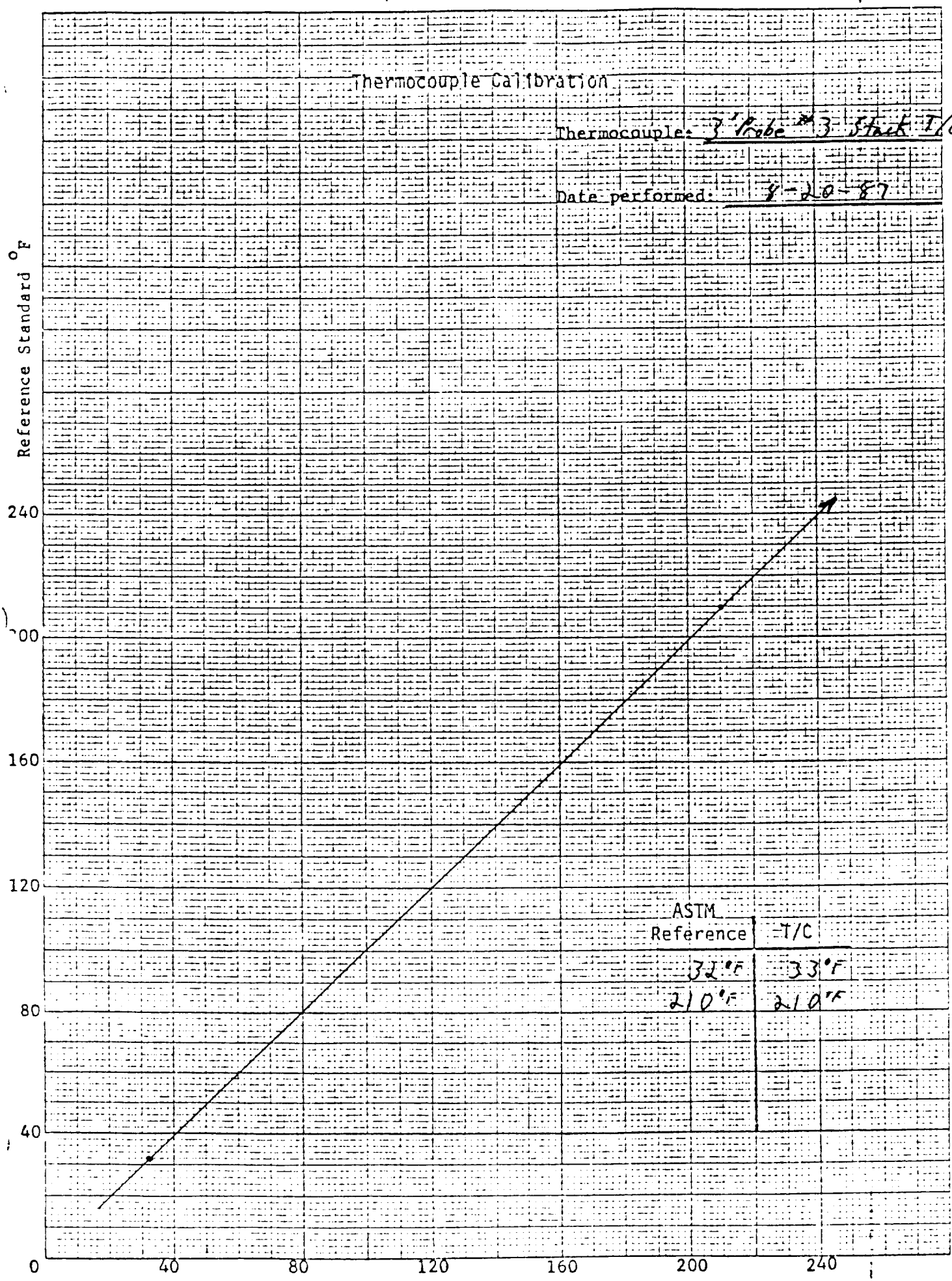


ASTM Reference	T/C
32°F	32°F
211°F	211°F

Thermocouple Calibration

Thermocouple: 3' Probe #3 Stack T/C

Date performed: 4-20-87



AIR TECHNIQUES, INC.
Pitot Calibration Form
Post Test Calibration

Date: July 14, 1987 Pitot Identification: 3' Probe #3

Barometric Pressure: 29.05 Nozzle Size: 1/2

Velocity ft/min	²P in H2O Standard Pitot Cp = 0.99		²P in H2O Type "S" Pitot		Cp	
Approximately	Side A	Side B	Side A	Side B	Side A	Side B
2000	0.28	0.28	0.42	0.43	0.808	0.799
4000	1.10	1.10	1.60	1.60	0.821	0.821
6000	2.70	2.70	4.00	4.00	0.813	0.813
			Side Cp Average:		0.814	0.811

Calculations:

Cp = 0.99 * [SQRT (²P (Std) / ²P (Type "S")]

Person performing calibration: Bill Tunjan

AIR TECHNIQUES, INC.

ANALYTICAL BALANCE CALIBRATION FORM

Balance Name Mettler H80

Serial Number G0403E009

Calibration Date 8-27-87

Class S Weight	Balance Reading
50.0 mg	50.0 mg
500.0 mg	500.4 mg
1.0000 g	1.0000 g
20.0000 g	20.0000 g
100.0000 g	100.0002 g

Calibrated by Russell Barton

AIR TECHNIQUES INC. 1724 Nekoma Street, NE • Marietta, Georgia 30067 • 404/977-7090

Barometer Calibration

Barometer No. 6

Date 11-4-87

Ambient Temperature 68°

Corrected Mercury Barometer Reading 28.94

Initial Aneroid Barometer Reading 29.12

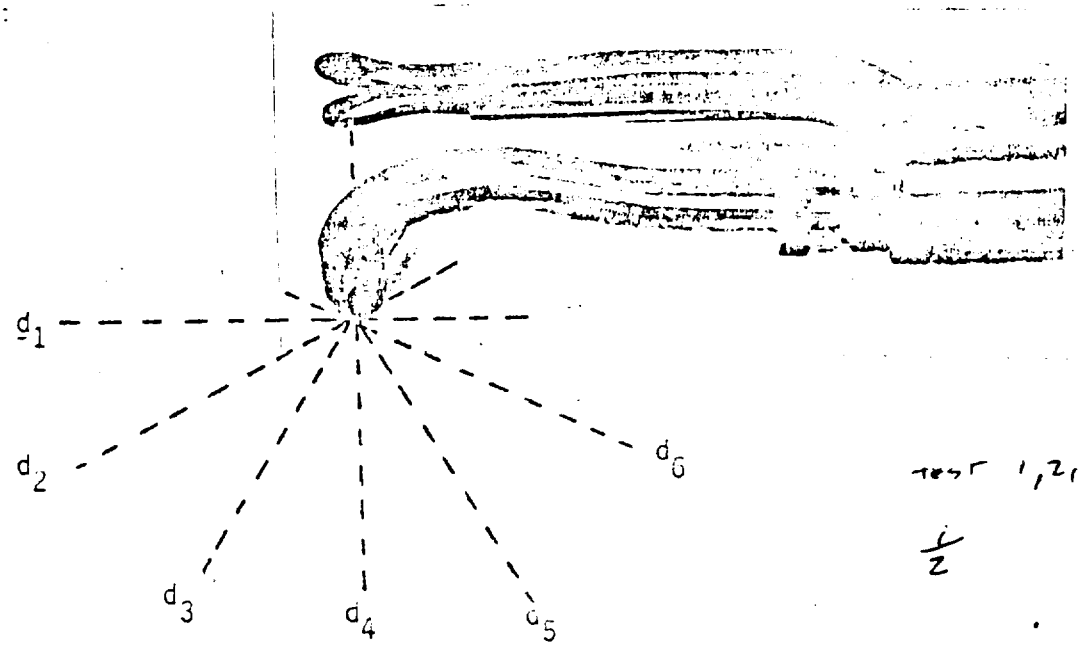
Final Aneroid Barometer Reading 28.94
(After Adjustment, If Necessary)

Calibrated By John H. Sullivan

Comments

AIR TECHNIQUES, INC.

NOZZLE CALIBRATION FORM



test 1, 2, 3

$\frac{1}{2}$

	d_1	d_2	d_3	d_4	d_5	d_6
nozzle calibration (inches)	.495	.495	.497	.497	.495	.497
Average diameter					.496	

APPENDIX H

SUMMARY OF TEST RESULTS

SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov 12, 1987
Particulate

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	Ø.256	Ø.226	Ø.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.Ø5
Volume in Impingers (mls):	135.Ø	88.5	91.5
Static Pressure (in. wc.):	-Ø.1	-Ø.1	-Ø.1
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	Ø.976	Ø.988	Ø.976
Pitot Coefficient (Cp):	Ø.814	Ø.814	Ø.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	Ø.55	Ø.55	Ø.55
Area Nozzle (An):	Ø.ØØ1342	Ø.ØØ1342	Ø.ØØ1342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	1Ø.6	15.6	13.4
Percent N2 (%):	82.Ø	81.Ø	81.9
Milligrams:	74.8	56.5	26.4
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Stack Gas Moisture (%):	14.3	11.1	1Ø.7
Molecular Weight Wet (Ms):	27.94	27.93	28.Ø7
Volume Gas Sampled (Vma):	131.867	112.Ø31	114.2Ø7
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	8Ø6	713	698
Grainloading, gr/dscf (cs):	Ø.Ø3Ø4	Ø.Ø261	Ø.Ø114
Grainloading, gr/ACF (csi):	Ø.ØØ88	Ø.ØØ78	Ø.ØØ36
Emission Rate, #/Hour (E):	Ø.Ø6	Ø.Ø5	Ø.Ø2
Percent Isokinetic Sampling:	1Ø4.9Ø	1ØØ.75	1Ø4.89

SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov. 12, 1987
HCL

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	Ø.256	Ø.226	Ø.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.Ø5
Volume in Impingers (mls):	135.Ø	88.5	91.5
Static Pressure (in. wc.):	-Ø.Ø6	-Ø.Ø6	-Ø.Ø6
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	Ø.976	Ø.988	Ø.976
Pitot Coefficient (Cp):	Ø.814	Ø.814	Ø.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	Ø.55	Ø.55	Ø.55
Area Nozzle (An):	Ø.ØØ1342	Ø.ØØ1342	Ø.ØØ1342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	1Ø.6	15.6	13.4
Percent N2 (%):	82.Ø	81.Ø	81.9
Lab Data:	31230.Ø	1Ø4.Ø	9Ø42.Ø
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Wet Fraction (Bws):	Ø.143	Ø.111	Ø.1Ø7
Molecular Weight Wet (Ms):	27.94	27.93	28.Ø7
Volume Gas Sampled (Vma):	131.867	112.Ø31	114.2Ø7
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	8Ø6	713	698
Concentration (PPM):	822	3	253
Concentration, mg/cu m:	1224.42	4.64	376.62
Emission Rate, #/Hour:	1.Ø99	Ø.Ø04	Ø.318
Percent Isokinetic Sampling:	1Ø4.9Ø	1ØØ.75	1Ø4.89

SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov. 12, 1987
Chlorine

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	0.256	0.226	0.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.05
Volume in Impingers (mls):	135.0	88.5	91.5
Static Pressure (in. wc.):	-0.06	-0.06	-0.06
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	0.976	0.988	0.976
Pitot Coefficient (Cp):	0.814	0.814	0.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	0.55	0.55	0.55
Area Nozzle (An):	0.001342	0.001342	0.001342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	10.6	15.6	13.4
Percent N2 (%):	82.0	81.0	81.9
Lab Data:	43.5	19.7	69.1
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Wet Fraction (Bws):	0.143	0.111	0.107
Molecular Weight Wet (Ms):	27.94	27.93	28.07
Volume Gas Sampled (Vma):	131.867	112.031	114.207
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	806	713	698
Concentration (PPM):	1	1	2
Concentration, mg/cu m:	3.32	1.71	5.60
Emission Rate, #/Hour:	0.003	0.001	0.005
Percent Isokinetic Sampling:	104.90	100.75	104.89

AIR TECHNIQUES, INC.
Field Data Sheet Summary

Number of Points: 8
Minutes per Point: 8.0
Test Location: Humana East Ridge Waste Incinerator
Test Date: November 12, 1987
Test No. 1

Point	Volume Meter	Del P	SQRT Del P	Del H	Stack Temp	Meter Inlet	Temp Outlet
1	451.682	0.08	0.283	1.3	1010	71	75
2		0.09	0.300	1.4	1252	75	76
3		0.05	0.224	0.9	1152	76	76
4		0.06	0.245	1.2	1007	78	77
5		0.07	0.265	1.4	1086	74	74
6		0.08	0.283	1.6	1145	76	75
7		0.05	0.224	1.0	1150	77	74
8		0.05	0.224	1.0	965	80	77
FINAL	491.445						
			AVERAGES				
	39.763		0.256	1.22	1556		536

AIR TECHNIQUES, INC.
Field Data Sheet Summary

Number of Points: 8
Minutes per Point: 8.0
Test Location: Humana East Ridge Waste Incinerator
Test Date: November 12, 1987
Test No. 2

Point	Volume Meter	Del P	SQRT Del P	Del H	Stack Temp	Meter Inlet	Temp Outlet
1	5.728	0.06	0.245	1.5	1118	83	74
2		0.07	0.265	1.6	1095	91	74
3		0.04	0.200	0.9	1015	95	77
4		0.03	0.173	0.7	1025	95	79
5		0.07	0.265	1.6	1105	87	81
6		0.07	0.265	1.6	1126	103	81
7		0.05	0.224	1.1	1193	106	84
8		0.03	0.173	0.7	1095	94	85
FINAL	41.048						
			AVERAGES				
	35.320		0.226	1.21	1557		547

AIR TECHNIQUES, INC.
Field Data Sheet Summary

Number of Points: 8
Minutes per Point: 8.0
Test Location: Humana East Ridge Waste Incinerator
Test Date: November 12, 1987
Test No. 3

Point	Volume Meter	Del P	SQRT Del P	Del H	Stack Temp	Meter Inlet	Temp Outlet
1	492.093	0.06	0.245	1.2	1068	70	69
2		0.06	0.245	1.2	1087	74	70
3		0.04	0.200	0.8	1016	78	71
4		0.03	0.173	0.6	973	82	73
5		0.07	0.265	1.4	1044	77	74
6		0.07	0.265	1.4	1050	79	74
7		0.05	0.224	1.0	1048	82	76
8		0.04	0.200	0.8	927	83	76
FINAL	529.650						
			AVERAGES				
	37.557		0.227	1.05	1487		536

APPENDIX I

LABORATORY DATA

AIR TECHNIQUES, INC.
CHAIN OF CUSTODY FORM

Plant: HUMANA HOSPITAL Source: INCINERATOR

Date Sampled: 11-12-87 Run No.: TEST #2 + #3 + #1

SAMPLE RECOVERY

Container No.	Description (if filter, give filter No.)
AS MARKED	TEST #1-#3 5% NAOH
AS MARKED	TEST #1-#3 H_2O IMPINGER CATCH
AS MARKED	5% NAOH BLANK
AS MARKED	DISTILLED WATER BLANK

Person Engaged in Sample Recovery:

Signature & Title: [signature]

Recovery Location: ON SITE

Date & Time of Recovery: 12 NOV 87

Sample Recipient, upon Recovery, if not Recovery person:

Signature: _____

Date & Time of Receipt: _____

Sample Storage: _____

Laboratory Person Receiving Sample:

Signature & Title: [signature], Chemist

Date & Time of Receipt: 16 NOV 87

Sample Storage: _____

AIR TECHNIQUES, INC.
CHAIN OF CUSTODY FORM

Plant: Humana Hospital Source: Incinerator

Date Sampled: 11-12-87 Run No.: 2 + 3

SAMPLE RECOVERY

Container No.	Description (if filter, give filter No.)
As Marked	Tests 2+3 Probe Washes
As Marked	Tests 2+3 Filters
	Acetone Blank

Person Engaged in Sample Recovery:

Signature & Title: [signature]

Recovery Location: ON SITE

Date & Time of Recovery: 11-12-87

Sample Recipient, upon Recovery, if not Recovery person:

Signature:

Date & Time of Receipt:

Sample Storage:

Laboratory Person Receiving Sample:

Signature & Title: [signature]

Date & Time of Receipt: 11-13-87

Sample Storage: Lab

SAMPLE ANALYSIS

Beaker Number	Method of Analysis	Date and Time
163	Test 2 Gravimetric	11/1 - 11/17
182	Test 3 "	11/8 - 11/17
183	Acetone BLK. "	11/8 - 11/17

FILTERS

Container No.	Filter No.	Filter Analysis & Analysis Signature	Date
Test 2 ~~1768~~	1768	Gravimetric	11/6 - 11/16
Test 3 ~~1769~~	1769	"	11/6 - 11/16

CHAIN OF CUSTODY FORM

Plant Humana Hospital East Ridge Source Summary 251 B

Date Sampled 11/12/87 Test # 1 Run # 1

SAMPLE RECOVERY

Container #	Description (if filter, then give filter #)
Filter 1267	Run #1 0.4542 g
cwsl.	Run #1
blank	Run #1

Person Engaged in Sample Recovery:

Signature and Title JCB Jr

Recovery Location at site

Date & Time of Recovery 11/12/87 1:45 - 2:26 PM

Sample(s) Recipient, upon Recovery if not Recovery Person

Signature [illegible]

Date & Time of Receipt 11/12/87 2:26 PM

Sample Storage automobile

Laboratory Person Receiving Sample

Signature & Title W Harris Rec

Date & Time of Receipt 11/12/87 6 pm

Sample Storage Lab Hood

Chain of Custody Form

SAMPLE ANALYSIS

Container #	Method of Analysis	Date & Time of Analysis
Probe Wash Test #1	Gravimetric	11-20-87
Blank	Gravimetric	11-20-87

Filter(s)

Container #	Filter #	Filter Preweigh Date & Analyst Signature	Date & Time of Analysis	Method of Analysis
	1767		11-20-87	Gravimetric

Signature of Analyst: W. Harvey Rice Date: 11/20/87

TOTAL PARTICULATE MATTER COLLECTED

CLIENT: HUMANA EAST RIDGE DATE: 11/12/87

SOURCE: SIMONDS RUN #: 1-3

Acetone Blank Concentration (Equal to or less than 0.01 mg/g):

Ma = 0.0 mg Va = 210 Pa = 0.785

Ca = Ma / (Va * Pa) Ca = 0

	Test # 1	Test # 2	Test # 3
Acetone Wash Blank:			
Vaw =	ml	225 ml	190 ml
Wa = Ca * Vaw * Pa			
Wa =	mg	0.0 mg	0.0 mg
Particulate Matter Collected in Acetone Wash:			
Wf =	g	127.1881 g	125.8466 g
Wi =	g	127.1675 g	125.8377 g
Maw = 1000 (Wf - Wi) - Wa			
Maw =	mg	20.6 mg	8.9 mg
Particulate Matter Collected on the Filter:			
Wf =	g	0.4912 g	0.4795 g
Wi =	g	0.4553 g	0.4620 g
Mf = 1000 (Wf - Wi)			
Mf =	mg	35.9 mg	17.5 mg
Total Particulate Matter Collected (Mn = Maw + Mf):			
Mn =	74.8* mg	56.5 mg	26.4 mg

* PROVIDED BY HAMILTON COUNTY AIR POLLUTION CONTROL BUREAU - SEE FOLLOWING PAGE.

Test performed by Hermone Hospital Enl Ridge on their Simonds Model 751 B INCINERATOR. The test was conducted on November 12, 1987 by Air Techniques, Inc The test was observed by Jim Weyker.

Acetone Blank	Final Weight	106.6640 gms
Blank Volume 175 ml	Initial Weight	106.6615 gms
		0.0025 gms
Acetone Probe Wash	Final Weight	90.4397 gms
Volume 175 ml	Initial Weight	90.4112 g.
		0.0285 gm.
Filter # 1767	Final Weight	0.5035 gm
	Initial Weight	0.4542 gm
		0.0463 gm

APPLIED TECHNICAL SERVICES, INCORPORATED

Main Office
1190 Atlanta Industrial Drive
Marietta, Georgia 30066
(404) 423-1400
Fax # 424-6415

Branch Office
90 Lenhardt Road
Piedmont, South Carolina 29673
(803) 299-0525

CERTIFIED TEST REPORT

REF. C8-1998 DATE November 23, 1987 PAGE 1 OF 1

CHEMICAL ANALYSIS

CUSTOMER Air Techniques, 1724 Nekoma Street, Marietta, Georgia 30067

Attention: Joe Barefoot

ORDER NO Verbal PART NO 'NAME See Below

MATERIAL DESIGNATION Absorbing Solutions

SPECIAL REQUIREMENT N/A

LAB COMMENT Procedure supplied by Air Techniques, Georgia EPD OSHA.

TEST RESULTS

	COMPOSITION									
IDENTIFICATION	Equation 5.52 Numerator			Equation 5.54 Numerator						
ALLOY OR SPEC REQ (1)		C_{Cl}		C_{HCl}						
Test 1		43.5		31,230						
Test 2		19.7		<104						
Test 3		69.1		9,042						
				**** LAST ITEM ****						

(1)

Patricia T. DuBose
Notary Public, Georgia, State at Large
My Commission Expires Jan. 29, 1988

Prepared by W. M. Katter

Approved by P. E. Rogers

APPLIED TECHNICAL SERVICES, INC

LAB DATA SHEET

TEST: HCl, Cl2 ATS JOB NO.: C81998

P/N: See Below DATE: 11/23/87

CUSTOMER: Air Technique

SPECIFICATION: ALAT TEST PROCEDURE: Supplied by Air Tech

TEST EQUIPMENT: TYPE N.A S/N N.A

CAL. N.A

(EXAMPLE HARDNESS - TEST BLOCK CAL., TEST READING)

TEST RESULTS:

	HCl Aliquot	HCl TOTAL VOL.	Titrant	Equation 5.54 C_{HCl}
TEST 1	25	385	24.2	(1) 31,230 VT
TEST 2	25	310	0. (Assume 0.1 ml)	(2) <104 VT
TEST 3	25	325	8.3	(3) 9042 VT
Blank	25		0	

	Cl_2 Aliquot	Cl_2 TOTAL VOL.	Titrant	Equation C_{Cl} 5.52
TEST 1	25	~~0.1~~ 260	0.1	(1) 435 VT
TEST 2	25	~~0.05~~ 235	0.05	(2) 19.7 VT
TEST 3	25	~~0.15~~ 275	0.15	(3) 69.1 VT
Blank	25	~~0~~	0	

WITNESSED BY _____ PREPARED BY _____ DATE 11/23/87

APPROVED BY P Rogers DATE 11-23-87

APPENDIX J

PROCESS INFORMATION

Humana Hospital East Ridge 11/12/87

Simonds Model 251 B
65/50
0123/4

charge	pounds	ounces
placenta	2.5	
labor + delivery	6.5	
	5.8	
	5.2	
	7.0	
	6.2	
	7.5	
needle sharps	3.0	
placenta	1.5	
labor + delivery	2.2	
	5.2	
	7.0	
	4.0	
placenta	2.2	
labor + delivery	5.5	
	3.8	
surgery	6.0	
	4.0	4.0
	8.0	1.9
	5.0	6.5
	2.0	5.6

373

charge	pounds	ounces
needle sharps	16.0	1.4
surgery	5.0	1.4
	5.0	1.1
	5.0	2.2
isolation	18.0	1.2
glass	13.0	6.8
	16.0	
lab	7.0	1.4
	13.0	1.4
	13.0	1.4
	2.0	8.2
	1.0	1.1
	1.0	1.2
	7.6	
	9.0	
surgery	10.5	
	5.0	
	6.0	
	12 0	9.6
	7.8	
	1.0	9.8
	3.0	1.6

TTL lbs burned
~~290.46~~
277.26

GAS		
TEST 1	2	3
300 ft³	230 ft³	300 ft³

INCINERATOR — Primary & SECONDARY TEMPS & GAS METER READINGS

TEST (1)

INCINERATOR GAS METER — BEGIN – 496800
END – 497100

TEST (2) BEGIN 497170
END 497400

(3) BEGIN 497,450
END 497750

	Primary			SECONDARY CARBURATOR		
1	450	850	1300	1650	1700	1650
2	450	900	1300	1650	1700	1650
3	500	900	1300	1700	1750	1650
4	550	950	1250	1650	1650	1650
5	600	1000	1250	1650	1700	1700
6	600	1000	1250	1700	1700	1650
	650	1000	1250	1650	1700	1700
8	650	1000	1250	1700	1700	1650
9	700	1050	1200	1700	1700	1650
10	700	1050	1200	1750	1700	1650
11	700	1100	1200	1750	1700	1700
12	750	1100	1200	1800	1700	1700
13	750	1150	1200	1800	1700	1650
14	750	1150	1200	1750	1700	1700
15	750	1200	1150	1800	1700	1700
16	750	1200	1200	1800	1650	1700
				①	②	③

TEST	① ↓	② ↓	③ ↓
TIME START	11:54	13:30	14:57
TIME FINISH	13:14	14:42	16:08

4 MIN between readings

AIR TECHNIQUES INC 1724 Nekoma Street, NE • Marietta, Georgia 30067 • 404/977-7090

SUPPLEMENTAL

1988

January 28, 1988

Mr. Jim Weyler
Chattanooga Hamilton County
Air Pollution Control Bureau
3511 Rossville Boulevard
Chattanooga, Tennessee 37407

Dear Mr. Weyler:

Attached is a copy of the most recent visible emissions certification for inclusion in the Humana East Ridge test report. The residence time calculations will follow. Thanks for your understanding in this matter.

Sincerely,

Bill Timpone

Bill Timpone
Testing Manager

BT/ad

Attachment

Georgia Department of Natural Resources
205 Butler Street, S.E., Floyd Towers East, Atlanta, Georgia 30334
J. Leonard Ledbetter, Commissioner
Harold F. Reheis, Assistant Director
Environmental Protection Division

November 16, 1987

John A. Soulsby
Air Techniques, Inc.
1724 Nekoma Street, N.E.
Marietta, GA 30067

Dear Mr. Soulsby:

Please be advised that you have successfully completed the field certification training of the Georgia Visible Emissions Evaluation Certification Course conducted at the Atlanta Civic Center parking lot on October 21-22, 1987.

Your plume evaluations were within the specifications of Federal Reference Method "9" which qualified you as a Visible Emissions Evaluator. Your average error on black and white smoke did not exceed 7.5% opacity and you incurred no single error exceeding 15% opacity during your qualifying run.

This letter serves as your official notice of certification which is valid for six months from the date you qualified (October 21, 1987), subject to the following visual restrictions: NONE.

If you desire a copy of your original qualified "field test form" or if we may be of any further assistance, feel free to contact our office.

It is our hope that the end result of your participation in this course will help in promoting cleaner and healthier air.

Yours for cleaner air,

Arthur D. Hollis
Environmental Specialist
Air Protection Branch
Planning & Technical
Support Program

RECEIVED
NOV 21 1987
AIR TECHNIQUES, INC.

ADH:cl

Grayarc
P.O. Box 2944
Hartford, CT 06104-2944
CALL TOLL FREE: 1-800-243-5250

REPLY MESSAGE

Fold At (▲) To Fit Grayarc Window Envelope # EW10P

REORDER ITEM # F270

TO
MR JIM WEYLER
CHATTANOOGA HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
3511 ROSSVILLE BOULEVARD
CHATTANOOGA, TENNESSEE 37407

FROM

AIR TECHNIQUES, INC.
1724 Nekoma Street
MARIETTA, GEORGIA 30067
(404) 977-7090

SUBJECT: RESIDENCE TIME - NUMANA EAST RIDGE DATE: 1/29/88

FOLD ▲ DEAR MR WEYLER;

ATTACHED ARE A REVISED SUMMARY SHEET AND EXAMPLE CALCULATION SHEET SHOWING THE INFORMATION YOU REQUESTED. THIS IS FOR THE CALCULATION OF GAS RESIDENCE TIME IN THE INCINERATOR SECONDARY CHAMBER. PLEASE CALL SHOULD YOU HAVE ANY FURTHER QUESTIONS

CC: JEFF PAINE

PLEASE REPLY TO ⟶ SIGNED Bill Timpson

REPLY

DATE: SIGNED

THIS COPY FOR PERSON ADDRESSED

SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov 12, 1987
Particulate

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	Ø.256	Ø.226	Ø.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.Ø5
Volume in Impingers (mls):	135.Ø	88.5	91.5
Static Pressure (in. wc.):	-Ø.1	-Ø.1	-Ø.1
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	Ø.976	Ø.988	Ø.976
Pitot Coefficient (Cp):	Ø.814	Ø.814	Ø.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	Ø.55	Ø.55	Ø.55
Area Nozzle (An):	Ø.ØØ1342	Ø.ØØ1342	Ø.ØØ1342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	1Ø.6	15.6	13.4
Percent N2 (%):	82.Ø	81.Ø	81.9
Milligrams:	74.8	56.5	26.4
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Stack Gas Moisture (%):	14.3	11.1	1Ø.7
Molecular Weight Wet (Ms):	27.94	27.93	28.Ø7
Volume Gas Sampled (Vma):	131.867	112.Ø31	114.2Ø7
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	8Ø6	713	698
Grainloading, gr/dscf (cs):	Ø.Ø3Ø4	Ø.Ø261	Ø.Ø114
Grainloading, gr/ACF (csi):	Ø.ØØ88	Ø.ØØ78	Ø.ØØ36
Emission Rate, #/Hour (E):	Ø.Ø6	Ø.Ø5	Ø.Ø2
Percent Isokinetic Sampling:	1Ø4.9Ø	1ØØ.75	1Ø4.89

Incinerator Secondary Chamber

Temperature, oR:	2179	2157	2132
Flowrate, ACFM:	1128	987	1ØØØ
Chamber Volume, Cu. Ft.:	16.8	16.8	16.8
Residence Time ,Seconds:	Ø.9	1.Ø	1.Ø

AIR TECHNIQUES

HUMANA - EAST RIDGE
HOSPITAL INCINERATOR
SECONDARY CHAMBER
RESIDENCE TIME CALCULATIONS

SECONDARY CHAMBER FLOW RATE:

$$Q_2 = Q_1\left(\frac{T_2}{T_1}\right)$$

RESIDENCE TIME:

$$T_R = \frac{V_2 \times 60}{Q_2}$$

WHERE:

Q_1 = STACK GAS FLOW RATE, ACFM
Q_2 = SECONDARY CHAMBER GAS FLOW RATE, ACFM
T_1 = STACK GAS TEMPERATURE, °R
T_2 = SECONDARY CHAMBER TEMPERATURE, °R
T_R = RESIDENCE TIME, SECONDS
V_2 = SECONDARY CHAMBER VOLUME, CUBIC FEET

Project: Work Order: 666 By: BT Date: 1/29/88 Sheet:

Grayarc
P.O. Box 2944
Hartford, CT 06104-2944
CALL TOLL FREE: 1-800-243-5250

REPLY MESSAGE

Fold At (▲) To Fit Grayarc Window Envelope # EW10P

REORDER ITEM # F270

TO
MR JIM WEYLER
CHATTANOOGA HAMILTON COUNTY
AIR POLLUTION CONTROL BUREAU
3511 ROSSVILLE BOULEVARD
CHATTANOOGA, TN 37407

FROM

AIR TECHNIQUES, INC.
1724 Nekoma Street
MARIETTA, GEORGIA 30067
(404) 977-7090

SUBJECT: NUMANA EAST RIDGE TEST REPORT DATE: 2/8/88

FOLD ▲ ATTACHED IS A REVISED SUMMARY SHEET WITH THE INFORMATION THAT YOU REQUESTED. ADDED ARE THE FUEL CONSUMPTION RATE AND THE GRAINS/DSCF CORRECTED TO 12% CO_2. HOPEFULLY, THIS WILL COMPLETE THIS TEST REPORT.

PLEASE REPLY TO ⟶ SIGNED Bill Tompson

REPLY

FEB 1988
RECEIVED

DATE: SIGNED

THIS COPY FOR PERSON ADDRESSED

SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov 12, 1987
Particulate

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	Ø.256	Ø.226	Ø.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.Ø5
Volume in Impingers (mls):	135.Ø	88.5	91.5
Static Pressure (in. wc.):	-Ø.1	-Ø.1	-Ø.1
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	Ø.976	Ø.988	Ø.976
Pitot Coefficient (Cp):	Ø.814	Ø.814	Ø.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	Ø.55	Ø.55	Ø.55
Area Nozzle (An):	Ø.ØØ1342	Ø.ØØ1342	Ø.ØØ1342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	1Ø.6	15.6	13.4
Percent N2 (%):	82.Ø	81.Ø	81.9
Fuel Consumption Rate (dscfm):	4.Ø	3.2	4.2
Milligrams:	74.8	56.5	26.4
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Stack Gas Moisture (%):	14.3	11.1	1Ø.7
Molecular Weight Wet (Ms):	27.94	27.93	28.Ø7
Volume Gas Sampled (Vma):	131.867	112.Ø31	114.2Ø7
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	8Ø6	713	698
gr/dscf (cs):	Ø.Ø3Ø	Ø.Ø26	Ø.Ø11
gr/dscf @ 12% CO2:	Ø.Ø49	Ø.Ø93	Ø.Ø29
gr/ACF (csi):	Ø.ØØ9	Ø.ØØ8	Ø.ØØ4
Emission Rate, #/Hour (E):	Ø.Ø6	Ø.Ø5	Ø.Ø2
Percent Isokinetic Sampling:	1Ø4.9Ø	1ØØ.75	1Ø4.89

Incinerator Secondary Chamber

Temperature, oR:	2179	2157	2132
Flowrate, ACFM:	1128	987	1ØØØ
Chamber Volume, Cu. Ft.:	16.8	16.8	16.8
Residence Time ,Seconds:	Ø.9	1.Ø	1.Ø

AIR TECHNIQUES

CALCULATIONS

PARTICULATE CONCENTRATION CORRECTED TO 12% CO_2.

CO_2 FROM INCINERATOR BURNERS = GAS CONSUMPTION OF BURNERS.

CO_2 RATE = GAS CONSUMPTION / TOTAL TEST TIME, MIN

% CO_2 FROM WASTE COMBUSTION =

$$\%\,CO_2\ \text{MEASURED} - \left(CO_2\ \text{RATE} / Q_S\right) 100$$

CONCENTRATION @ 12% CO_2 =

$$(\text{GRAINS/DSCF}) \times \frac{12}{\%\,CO_2\ \text{FROM WASTE COMBUSTION}}$$

Project: Work Order: By: Date: Sheet:

Grayarc
P.O. Box 2944
Hartford, CT 06104-2944
CALL TOLL FREE: 1-800-243-5250

REPLY MESSAGE

Fold At (▲) To Fit Grayarc Window Envelope # EW10P

REORDER ITEM # F270

TO
MR JIM WEYLER
CHATTANOOGA HAMILTON COUNTY
AIR POLLUTION CONTROL BOARD
3511 ROSSVILLE BOULEVARD
CHATTANOOGA, TN 37407

FROM

AIR TECHNIQUES, INC.
1724 Nekoma Street
MARIETTA, GEORGIA 30067
(404) 977-7090

SUBJECT: HUMANA EAST RIDGE TEST REPORT DATE: 2/15/88

FOLD ▲ HERE IS AMANDED SUMMARY SHEET. AS YOU REQUESTED, TWO CALCULATIONS FOR GRAINLOADING AT 12% CO_2 ARE INCLUDED. ONE EXCLUDES THE AUXILIARY FUEL COMBUSTION PRODUCTS AND THE OTHER INCLUDES THE SAME.

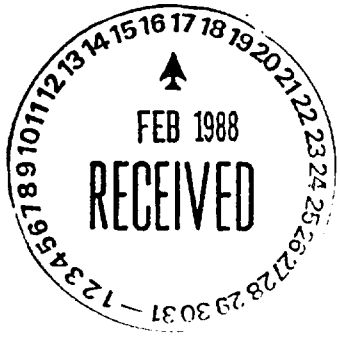
PLEASE REPLY TO → SIGNED Bill Timpora

REPLY

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
FEB 1988
RECEIVED

DATE: SIGNED

THIS COPY FOR PERSON ADDRESSED



SUMMARY OF TEST RESULTS
Humana
Incinerator
Nov 12, 1987
Particulate

	Test #1	Test #2	Test #3
Volume @ Meter (Vm):	39.763	35.320	37.557
Sqrt Delta P:	Ø.256	Ø.226	Ø.227
Sampling Time (min):	64	64	64
Barometric Pressure (Pb):	29.66	29.58	29.57
Delta H (H):	1.22	1.21	1.Ø5
Volume in Impingers (mls):	135.Ø	88.5	91.5
Static Pressure (in. wc.):	-Ø.1	-Ø.1	-Ø.1
Stack Pressure (Ps):	29.66	29.58	29.57
Stack Temperature (Ts):	1556	1557	1487
Meter Coefficient (Y):	Ø.976	Ø.988	Ø.976
Pitot Coefficient (Cp):	Ø.814	Ø.814	Ø.814
Meter Temperature (Tm):	536	547	536
Area Stack (As):	Ø.55	Ø.55	Ø.55
Area Nozzle (An):	Ø.ØØ1342	Ø.ØØ1342	Ø.ØØ1342
Percent CO2 (%):	7.4	3.4	4.7
Percent O2 (%):	1Ø.6	15.6	13.4
Percent N2 (%):	82.Ø	81.Ø	81.9
Fuel Consumption Rate (dscfm):	4.Ø	3.2	4.2
Milligrams:	74.8	56.5	26.4
Molecular Weight Dry (Md):	29.61	29.17	29.29
Volume Water (Vwstd):	6.35	4.17	4.31
Volume Gas Sampled (Vmstd):	37.997	33.388	35.765
Stack Gas Moisture (%):	14.3	11.1	1Ø.7
Molecular Weight Wet (Ms):	27.94	27.93	28.Ø7
Volume Gas Sampled (Vma):	131.867	112.Ø31	114.2Ø7
Stack Gas Velocity, (Vs):	24.41	21.59	21.14
Volumetric Flowrate (Qs):	232	212	218
Volumetric Flowrate (Qa):	8Ø6	713	698
gr/dscf (cs):	Ø.Ø3Ø	Ø.Ø26	Ø.Ø11
gr/dscf @ 12% CO2 (w/o fuel):	Ø.Ø64	Ø.166	Ø.Ø49
gr/dscf @ 12% CO2 (w/ fuel):	Ø.Ø49	Ø.Ø92	Ø.Ø29
gr/ACF (csi):	Ø.ØØ9	Ø.ØØ8	Ø.ØØ4
Emission Rate, #/Hour (E):	Ø.Ø6	Ø.Ø5	Ø.Ø2
Percent Isokinetic Sampling:	1Ø4.9Ø	1ØØ.75	1Ø4.89

Incinerator Secondary Chamber

Temperature, oR:	2179	2157	2132
Flowrate, ACFM:	1128	987	1ØØØ
Chamber Volume, Cu. Ft.:	16.8	16.8	16.8
Residence Time ,Seconds:	Ø.9	1.Ø	1.Ø

AIR TECHNIQUES

Run 1

CALCULATIONS

PARTICULATE CONCANTRATION CORRECTED TO 12% CO_2

CO_2 FROM INCINERATOR BURNERS = GAS CONSUMPTION OF BURNERS.

CO_2 RATE = GAS CONSUMPTION/TOTAL TEST TIME, MIN

4.0 dscfm

% CO_2 FROM WASTE COMBUSTION =

% CO_2 MEASURED $-$ (CO_2 RATE / RS) 100

7.4% $-$ (4.0 / 232) 100 = 5.67

CONCANTRATION @ 12% CO_2 =

$$(\text{GRAINS/DSCF}) \times \frac{12}{\%\ CO_2 \text{ FROM WASTE COMBUSTION}}$$

$$.030 \times \frac{12}{5.67} = 0.063 \text{ gr/dscf}$$

Project: Work Order: By: Date: Sheet:

AIR TECHNIQUES Run # 2

CALCULATIONS

PARTICULATE CONCENTRATION CORRECTED TO 12% CO_2

CO_2 FROM INCINERATOR BURNERS = GAS CONSUMPTION OF BURNERS.

CO_2 RATE = GAS CONSUMPTION / TOTAL TEST TIME, MIN

3.2

% CO_2 FROM WASTE COMBUSTION =

% CO_2 MEASURED $-$ (CO_2 RATE / Q_s) 100

3.4 $-$ (3.2 / 212) 100 = 1.89 %

CONCENTRATION @ 12% CO_2 =

(GRAINS/DSCF) $\times$ $\frac{12}{\%\ CO_2 \text{ FROM WASTE COMBUSTION}}$

0.026 $\times$ $\frac{12}{1.89}$ = 0.165

Project: Work Order: By: Date: Sheet:

AIR TECHNIQUES Run #3

CALCULATIONS

PARTICULATE CONCENTRATION CORRECTED TO 12% CO_2

CO_2 FROM INCINERATOR BURNERS = GAS CONSUMPTION OF BURNERS.

CO_2 RATE = GAS CONSUMPTION / TOTAL TEST TIME, MIN

$\frac{4.2}{=}$

% CO_2 FROM WASTE COMBUSTION =

$$\%\,CO_2\ \text{MEASURED} - \left(CO_2\ \text{RATE} / Qs\right) 100$$

$$4.7\% - \left(4.2 / 218\right) 100 = 2.77$$

CONCENTRATION @ 12% CO_2 =

$$(\text{GRAINS/DSCF}) \times \frac{12}{\%\,CO_2\ \text{FROM WASTE COMBUSTION}}$$

$$0.011 \times \frac{12}{2.77} = 0.047$$