Attachment #5

EMCON ASSOCIATES
Consultants in Wastes Management and Environmental Control

June 20, 1988
Project 247-11.02

Mr. Chris E. Choate, P.E.
District Engineer
Waste Management of North America
2000 Embarcadero, Suite 300
Oakland, CA 94606

Re: Source Test - Altamont Landfill

Dear Chris:

The Bay Area Air Quality Maintenance District's (BAAQMD) Authority to Construct (AC) for the gas collection and flare station at the Altamont Landfill requires that a source test be run on the two flares installed at the site. TMA/Norcal conducted the source test on June 1, 1988. The results are attached. Prior to testing, we were notified by the source test division of the BAAQMD that testing for individual oxides of nitrogen and for particulates would not be required.

It should be noted that the NOx of emissions were measured at 31.2 to 38.4 pounds per day, TNMHC emissions at zero and CO emissions at 110.4 to 223.2 pounds per day. (See Tables I and II). These emissions should be acceptable to the BAAQMD. The test report should be forwarded to Craig Ullery at BAAQMD.

Should you have any questions, please call me.

Very truly yours,

EMCON Associates

Robert E. Van Heuit
Executive Manager

REVH:sp

1921 Ringwood Avenue, San Jose, California 95131, (408) 275-1444

Thermo Analytical Inc.

EMCON
1921 RINGWOOD AVENEUE
SAN JOSE, CA 95131

ATTN: ROBERT E. VAN HEVIT, P.E.

Reference: TMA/Norcal C.N. 2170-189

Industrial Gases
Division of Airco, Inc.
660 North Baldwin Park Blvd.
P.O. Box 1290
City of Industry
California 91749
Telephone: (818) 369-2871

# ANALYTICAL REPORT

To: Atlas Welding Supply
1224 6th Street
Berkeley, CA 94710

Date Reported: 4-30-87

Reference: 309882
467-11859
467-11860

Material Submitted: Four size #082 cylinders containing Nitric Oxide, balance Nitrogen

Information Requested: Certification of Analysis

Method of Analysis: Chemiluminescence

Result of Investigation:

| Component | Cylinder | Specification | Concentration |
|---|---|---|---|
| NO | LL10224 | 700-800 ppm | 748 ppm |
| NO | LL9829 | 700-800 ppm | 751 ppm |
| | | Balance Nitrogen | |
| NO | LL4140 | 60-80 ppm | 69.9 ppm |
| NO | LL10062 | 60-80 ppm | 69.8 ppm |
| | | Balance Nitrogen | |

By [signature]
PRINCIPAL GAS ANALYST

"This report states accurately the results of the investigation made upon the materials submitted to the Analytical Laboratory. ...y effort has been made to determine objectively, the information requested; HOWEVER, in connection with its rendering of ... report, AIRCO shall have no liability in excess of its established charge for the service. Any use of this report or the information contained herein shall be at the sole risk of the user."

TMA Thermo Analytical Inc.

EMCON
1921 RINGWOOD AVENEUE
SAN JOSE, CA 95131

ATTN: ROBERT E. VAN HEVIT, P.E.

Reference: TMA/Norcal C.N. 2170-189

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2-Emcon June 9, 1988

Instruments: The following continuous monitors were used:

Infrared $CO/CO_2$ NDIR Analyzer Model #7752/7020
Ratfisch FID, THC Analyzer Model RS55
Teco Model 14A $NO-NO_2-NO_x$ Analyzer
TAI Series 325 A $O_2$ Monitor

The velocity and volumetric air flow was determined at each of the specified traverse points (ST 18) by an S-type pitot tube and magnehelic pressure gauge. The gas temperature was measured with a potentiometer and thermocouple.

Comments: All strip chart data from the continuous monitoring instruments, air flow and emission calculations, standard gases calibration certifications, and field data sheets are appended to this report.

Submitted by:

Michelle S. Pappe for

Juan J. Rios
Technical Director

JJR/aer

TABLE I

Unit Tested: Flare 1434-1
Operating Temperature: 1680°F
Sampling Date: June 2, 1988
Sampling Location: Altamont Landfill

| TEST # | 1 | 2 | 3 | AVG |
|---|---|---|---|---|
| Time | | | | |
| Duct Temp. °F | | | | 1492 |
| Volume Flow, CFM | | | | 45,144 |
| Volume Flow, SDCFM | | | | 11,127 |
| Water Vapor, vol % | | | | 7.3 |
| Oxygen % | 11.8 | 11.9 | 11.9 | 11.9 |
| Carbon Dioxide % | 8.9 | 8.4 | 8.4 | 8.6 |
| $NO_x$ Concentration, ppm (v/v) | 18 | 16 | 17 | 17 |
| $NO_x$ Emissions as $NO_2$, lbs/hr | 1.5 | 1.3 | 1.4 | 1.4 |
| TNMHC Concentration, ppm (v/v) | ND | ND | ND | ND |
| TNMHC Emissions as $C_1$, lbs/hr | ND | ND | ND | ND |
| CO Concentration, ppm (v/v) | 95 | 118 | 115 | 109 |
| CO Emissions, lbs/hr | 4.6 | 5.7 | 5.6 | 5.3 |

$NO_x$ - Oxides of Nitrogen

$NO_2$ - Nitrogen Dioxide

TNMHC - Total Nonmethane Hydrocarbons

CO - Carbon Monoxide

TABLE II

Unit Tested: Flare 1469-1
Operating Temperature: 1700°F
Sampling Date: June 2, 1988
Sampling Location: Altamont Landfill

| TEST # | 1 | 2 | 3 | AVG |
|---|---|---|---|---|
| Time | 1149 - 1219 | 1255 - 1325 | 1342 - 1410 | |
| Duct Temp. °F | | | | 1557 |
| Volume Flow, CFM | | | | 53,460 |
| Volume Flow, SDCFM | | | | 12,651 |
| Water Vapor, vol % | | | | 8.0 |
| Oxygen % | 11.6 | 11.4 | 12.0 | 11.7 |
| Carbon Dioxide % | 8.3 | 8.8 | 8.7 | 8.6 |
| $NO_x$ Concentration, ppm (v/v) | 18 | 17 | 18 | 18 |
| $NO_x$ Emissions as $NO_2$, lbs/hr | 1.6 | 1.6 | 1.6 | 1.6 |
| TNMHC Concentration, ppm (v/v) | ND | ND | ND | ND |
| TNMHC Emissions as $C_1$, lbs/hr | ND | ND | ND | ND |
| CO Concentration, ppm (v/v) | 152 | 170 | 145 | 156 |
| CO Emissions, lbs/hr | 8.3 | 9.3 | 8.0 | 8.6 |

$NO_x$ - Oxides of Nitrogen

$NO_2$ - Nitrogen Dioxide

TNMHC - Total Nonmethane Hydrocarbons

CO - Carbon Monoxide

# APPENDIX I

# FLOW DATA

SITE h T.

# THERMO ANALYTICAL

Client : EMCON FLARE 1434-1 Date Tested :6/1/89

Test No. :1 Time :1920

Gas Flow Rate Data

| Point | h | T. | Vel.Ft/Sec |
|---|---|---|---|
| 1 | .075 | 1492 | 29.8 |
| 2 | .005 | 1492 | 7.7 |
| 3 | .01 | 1492 | 10.9 |
| 4 | .01 | 1492 | 10.9 |
| 5 | .01 | 1492 | 10.9 |
| 6 | .01 | 1492 | 10.9 |
| 7 | .01 | 1492 | 10.9 |
| 8 | .01 | 1492 | 10.9 |
| 9 | .01 | 1492 | 10.9 |
| 1 | .005 | 1492 | 7.7 |
| 2 | .005 | 1492 | 7.7 |
| 3 | .01 | 1492 | 10.9 |
| 4 | .01 | 1492 | 10.9 |
| 5 | .01 | 1492 | 10.9 |
| 6 | .01 | 1492 | 10.9 |
| 7 | .01 | 1492 | 10.9 |
| 8 | .01 | 1492 | 10.9 |
| 9 | .01 | 1492 | 10.9 |

Vs - Cp [h *(T + 460)]^.5 [1/M.W. * Ps]^.5 * 85.49

Conc. of CO2 = 8.4 % Conc. of O2 = 11.9 %

Conc. of H2O = 7.3 %

Avg. Gas Velocity; Vs, Avg. 11.4 Ft/Sec

Pitot Tube Correction Factor, Cp .84

Duct Gas Molecular Weight, M.W. 29.07

Duct Pressure, Ps. 29.3 ''Hg Barometric Pressure 29.3 ''Hg

Duct Size Round 110 In. Diameter Static Pressure -.04 ''H2O

Duct Area 66 Sq. Ft Avg. Gas Temp. 1492

Gas Flow Rate 11.4 Ft/Sec * 66 Sq. Ft * 60 = 45144 CFM

45144 CFM * 530 / 1952 * 29.3 /29.92*(1.00- 7.3 /100%H2O)= 11127 SDCF.

M.W. Factor = .0342 Standard Cond. Temp. 70

# THERMO ANALYTICAL

Client : EMCON FLARE 1469-1 Date Tested : 6/1/88

Test No. : 2 Time : 1342

GAS SAMPLE DATA

Avg Gas Meter Pressure 0 "Hg

Avg Gas Meter Temp 90

Barometric Pressure 29.3 "Hg

Condensate 28 ml

Sample Volume 16.91 CF

Condensed Water Vapor:

Vw = 0.00267 * 28 * 530 / 29.92 = 1.32 SDCF

Corected Meter Volume:

Vo = 16.91 * 29.3 / 29.92 * 530 / 550 = 15.96 SDCF

Percent Water Vapor:

% H2O = 1.32 / 17.28 * 100 = 7.7 %

# THERMO ANALYTICAL

Client : EMCON 1469-1 Date Tested : 6/1/88

Test No. : 1 Time : 1238

## GAS SAMPLE DATA

Avg Gas Meter Pressure 0 ''Hg

Avg Gas Meter Temp 91

Barometric Pressure 29.3 ''Hg

Condensate 43 ml

Sample Volume 24.32 CF

Condensed Water Vapor:

Vw = 0.00267 * 43 * 530 / 29.92 = 2.03 SDCF

Corected Meter Volume:

Vo = 24.32 * 29.3 / 29.92 * 530 / 551 = 22.91 SDCF

Percent Water Vapor:

% H2O = 2.03 / 24.94 * 100 = 8.2 %

# THERMO ANALYTICAL

Client : EMCON FLARE 1434-1 Date Tested : 6/1/88

Test No. : 2 Time : 1829

GAS SAMPLE DATA

Avg Gas Meter Pressure 0 ''Hg

Avg Gas Meter Temp 91

Barometric Pressure 29.3 ''Hg

Condensate 28 ml

Sample Volume 17.82 CF

Condensed Water Vapor:

Vw = 0.00267 * 28 * 530 / 29.92 = 1.32 SDCF

Corected Meter Volume:

Vo = 17.82 * 29.3 / 29.92 * 530 / 551 = 16.79 SDCF

Percent Water Vapor:

% H2O = 1.32 / 18.11 * 100 = 7.3 %

# THERMO ANALYTICAL

Client : EMCON FLARE 1434-1 Date Tested : 6/1/88

Test No. : 1 Time : 1740

GAS SAMPLE DATA

Avg Gas Meter Pressure 0 ''Hg

Avg Gas Meter Temp 91

Barometric Pressure 29.3 ''Hg

Condensate 28 ml

Sample Volume 17.88 CF

Condensed Water Vapor:

Vw = 0.00267 * 28 * 530 / 29.92 = 1.32 SDCF

Corected Meter Volume:

Vo = 17.88 * 29.3 / 29.92 * 530 / 551 = 16.84 SDCF

Percent Water Vapor:

% H2O = 1.32 / 18.17 * 100 = 7.3 %

SITE h T.

# THERMO ANALYTICAL

Client : EMCON FLARE 1469-1 Date Tested :6/1/88

Test No. :1 Time :1420

## Gas Flow Rate Data

| Point | h | T. | Vel.Ft/Sec |
|---|---|---|---|
| 1 | .015 | 1557 | 13.5 |
| 2 | .015 | 1557 | 13.5 |
| 3 | .015 | 1557 | 13.5 |
| 4 | .015 | 1557 | 13.5 |
| 5 | .015 | 1557 | 13.5 |
| 6 | .015 | 1557 | 13.5 |
| 7 | .015 | 1557 | 13.5 |
| 8 | .015 | 1557 | 13.5 |
| 9 | .015 | 1557 | 13.5 |
| 1 | .015 | 1557 | 13.5 |
| 2 | .015 | 1557 | 13.5 |
| 3 | .015 | 1557 | 13.5 |
| 4 | .015 | 1557 | 13.5 |
| 5 | .015 | 1557 | 13.5 |
| 16 | .015 | 1557 | 13.5 |
| 17 | .015 | 1557 | 13.5 |
| 18 | .015 | 1557 | 13.5 |
| 19 | .015 | 1557 | 13.5 |

Vs = Cp [h *(T + 460)]^.5 [1/M.W. * Ps]^.5 * 85.49

Conc. of CO2 = 8.7 % Conc. of O2 = 12 %

Conc. of H2O = 8 %

Avg. Gas Velocity; Vs, Avg. 13.5 Ft/Sec

Pitot Tube Correction Factor, Cp .84

Duct Gas Molecular Weight, M.W. 29.03

Duct Pressure, Ps. 29.29 ''Hg Barometric Pressure 29.3 ''Hg

Duct Size Round 110 In. Diameter Static Pressure -.095 ''H2O

Duct Area 66 Sq. Ft Avg. Gas Temp. 1557

Gas Flow Rate 13.5 Ft/Sec * 66 Sq. Ft * 60 = 53460 CFM

53460 CFM * 530 / 2017 * 29.29 /29.92*(1.00- 8 /100%H2O)= 12651 SDCFM

M.W. Factor = .0342 Standard Cond. Temp. 70

# APPENDIX II

# FIELD DATA

51% of 1500 cfm

DATE: 6-1-88
PLANT: ALTAMONT LANDFILL
SAMPLE TYPE: $H_2O$, VELOCITY,
DUCT LOCATION:

DUCT DIAM: 9'2"
FITTING SIZE:
WALL THICKNESS:
DUCT STATIC PRESS: -0.04

THERMO-ANALYTICAL NORCAL CO.
AIR POLLUTION ANALYSIS

Source Test Field Data Sheet
#1434-1
Test Number
35' FLARE

| | |
|---|---|
| | THIMBLE NO. |
| | NOZZLE DIAM |
| | NOZZLE TYPE |
| | GAS COLLECTOR |
| 062 | METER NO. |
| 29.30 | BAROMETRIC PRESS. |
| Red Mag | DRAFT GAGE |
| 8'S. | TRAVERSE PITOT TUBE |
| | MONITORING PITOT TUBE |
| 25ml / 28 mL | CONDENSATE |

| | PITOT TRAVERSE | | | | PITOT MONITOR | | | SAMPLING | | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point | +5.5" In from Cent. | Time: Δh "$H_2O$ | Duct Temp °F | Vel FPS | Δh "$H_2O$ | Duct Temp °F | Vel FPS | Time | Point | Meter Rate CFM | Meter Temp °F | Meter Press "Hg | Vol Ft³ | Orif. Sett. | Pump Vac. | |
| 1 | 7.8 | .005 | | | | | | 1740 | G | | 92/93 | 9 | 86.50 | | | |
| 2 | 12.9 | .005 | 1492 | | | | | 1810 | | | 90/92 | | 104.48 | | | |
| 3 | 18.5 | .01 | | | | | | | | | | | | | | |
| 4 | 25.0 | .01 | | | | | | | | | 92 | | 17.88 | | | |
| 5 | 33.0 | .01 | | | | | | | | | | | | | | |
| 6 | 44.7 | .01 | | | | | | | | | | | | | | |
| 7 | 76.3 | .01 | | | | | | | | | | | | | | |
| 8 | 88.0 | .01 | | | | | | 1829 | G | | 90/92 | 0 | 104.38 | | | |
| 9 | 96.0 | .01 | | | | | | 1859 | | | 88/91 | | 122.20 | | | |
| 10 | 102.5 | | | | | | | | | | | | | | | |
| 11 | 108.1 | | | | | | | | | | | | | | | |
| 12 | 113.2 | | | | | | | | | | | | 17.82 | | | |
| 1 | | .005 | 1470 | | | | | | | | | | | | | |
| 2 | | .005 | | | | | | | | | | | | | | |
| 3 | | .01 | | | | | | | | | | | | | | |
| 4 | | .01 | | | | | | | | | | | | | | |
| 5 | | .01 | | | | | | | | | | | | | | |
| 6 | | .01 | | | | | | | | | | | | | | |
| 7 | | .01 | | | | | | | | | | | | | | |
| 8 | | .01 | | | | | | | | | | | | | | |
| 9 | | .005 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | |

JW

+4.1 .58% of 1500 cfm. 8.12% $H_2O$

DATE: 6-1-88

PLANT: ALTAMONT SANITARY LANDFILL

SAMPLE TYPE: VEL / $H_2O$

DUCT LOCATION:

DUCT DIAM: OD 9'6" - 2" (ID = 9'.2") 110"

FITTING SIZE: 3" MALE

WALL THICKNESS: 2" PORT LENGTH 5½"

DUCT STATIC PRESS: -0.095

THERMO-ANALYTICAL HORCAL CO.

AIR POLLUTION ANALYSIS

Source Test Field Data Sheet

1469-1

Test Number

40' FLARE

| | |
|---|---|
| | THIMBLE NO. |
| | NOZZLE DIAM |
| | NOZZLE TYPE |
| [illegible] | GAS COLLECTOR |
| 062 | METER NO. |
| 29.30 | BAROMETRIC PRESS. |
| Red Mag | DRAFT GAGE |
| 0.84 8's | TRAVERSE PITOT TUBE |
| | MONITORING PITOT TUBE |
| 43 ml / 26 ml | CONDENSATE |

| | | PITOT TRAVERSE | | | PITOT MONITOR | | | SAMPLING | | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point | +5.5" In from [illegible] | Time: 1420 Δh "$H_2O$ | Duct Temp °F | Vel FPS | Δh "$H_2O$ | Duct Temp °F | Vel FPS | Time | Point | Meter Rate CFM | Meter Temp °F | Meter Press "Hg | Vol Ft³ | Orif. Sett. | Pump Vac. | |
| 2.1 1 | 7.8" | .005 | .557 | | | | | 1238 | | | 90/91 | 0 | 023.31 | | | |
| 6.7 2 | 12.9 | .005 | | | | | | 1301 | | | 85/90 | | 036.6 | | | |
| 1.8 3 | 18.5 | .005 | | | | | | 1321 | | | 85/90 | | 047.63 | | | |
| 7.7 4 | 25.0 | .005 | | | | | | | | | | | | | | |
| 25.0 5 | 33.0 | .005 | | | | | | | | | 88.5 | | 024.32 | | | |
| 35.6 6 | [illegible] | .005 | | | | | | | | | | | | | | |
| 64.4 7 | 76.3 | .005 | | | | | | | | | | | | | | |
| 75.0 8 | 88.0 | .005 | | | | | | | | | | | | | | |
| 82.3 9 | 96.0 | .005 | | | | | | 1342 | | | 88/92 | 0 | 047.63 | | | |
| 88.2 10 | 102.5 | | | | | | | 1408 | | | 92/98 | | [illegible] | | | |
| 93.3 11 | 108.1 | | | | | | | | | | | | 16.94 | | | |
| 97.9 12 | 113.2 | | | | | | | | | | | | | | | |
| 1 | | .02 | 1670 | | | | | | | | | | | | | |
| 2 | | .015 | | | | | | | | | | | | | | |
| 3 | | .015 | | | | | | | | | | | | | | |
| 4 | | .015 | | | | | | | | | | | | | | |
| 5 | | .015 | | | | | | | | | | | | | | |
| 6 | | .015 | | | | | | | | | | | | | | |
| 7 | | .015 | | | | | | | | | | | | | | |
| 8 | | .015 | | | | | | | | | | | | | | |
| 9 | | .015 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | |

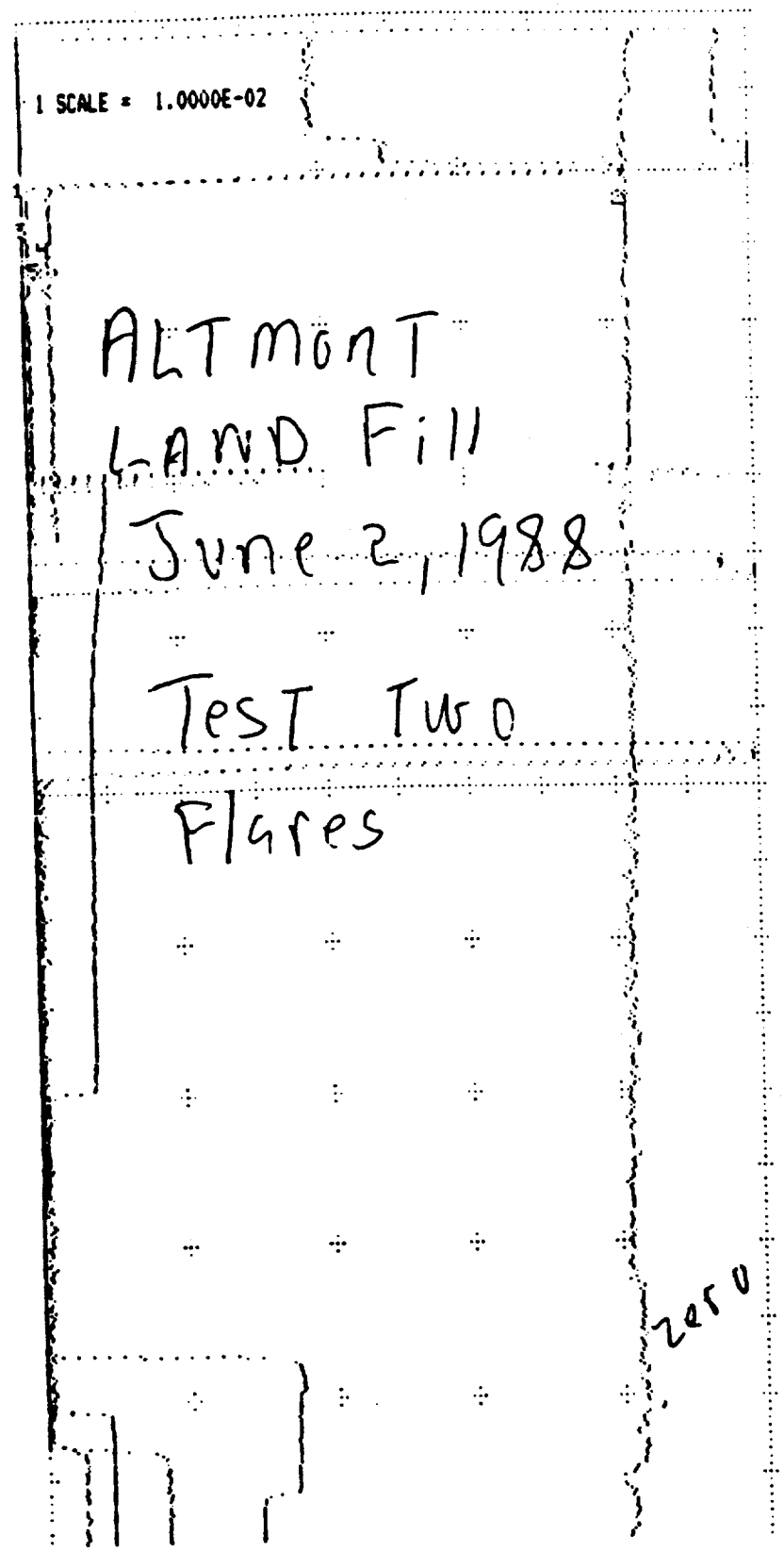
PST 1

PST 2

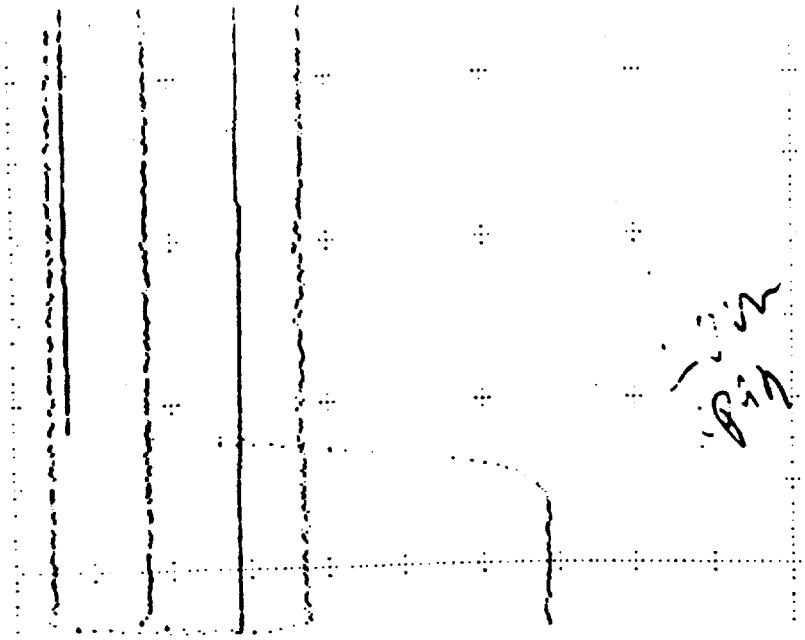
GW

# APPENDIX III

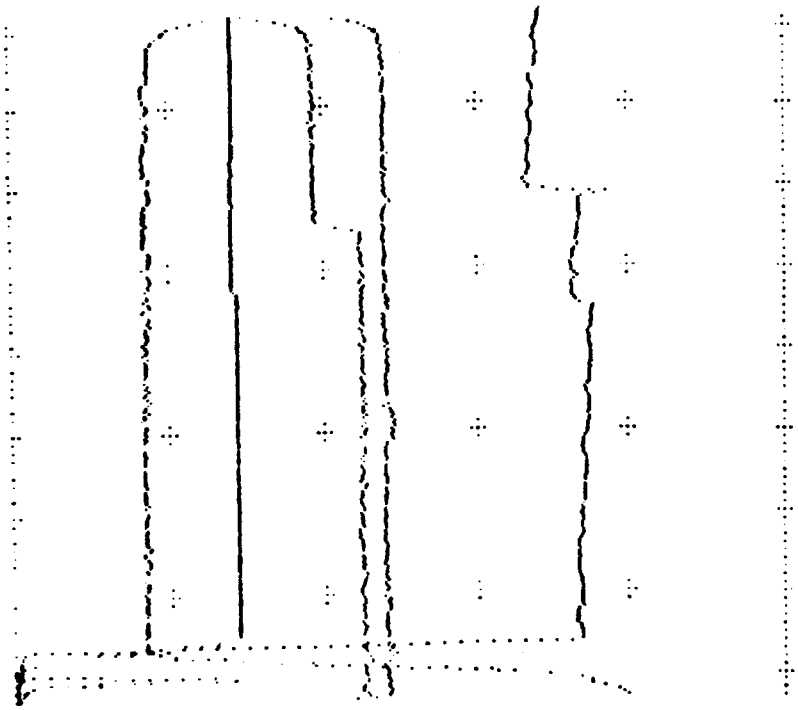
## STRIP CHART




| TIME H M S | NOx PPM | $O_2$ PCT | THC PPM | CO PPM | $CO_2$ PCT |
|---|---|---|---|---|---|
| 10:43:37 | -37.680 | 20.930 | -0.0139 | 3530.0 | 7.7810 |
| 10:44:36 | -38.200 | 20.650 | 0.0227 | EEEEE | 14.630 |
| 10:45:36 | -38.180 | 20.720 | 0.0166 | 381.40 | .13620 |
| 10:46:36 | -38.200 | 20.710 | 0.0188 | 383.20 | .14480 |
| 10:47:36 | -38.630 | 20.760 | 0.0184 | 382.60 | .16030 |
| 10:48:36 | -460.00 | 24.610 | 184.00 | 423.80 | 6.2790 |
| 10:49:36 | -36.450 | 20.520 | 99.940 | 3537.0 | 18.630 |
| 10:50:36 | -36.800 | 20.460 | 88.790 | -105.50 | .14060 |
| 10:51:36 | -38.260 | 20.560 | 82.640 | -106.40 | -.16150 |
| 10:52:36 | -38.060 | 20.580 | 79.830 | 113.20 | -.14660 |
| 10:53:36 | -37.780 | 20.710 | 78.830 | 55.450 | -.16800 |
| 10:54:36 | -21.920 | 20.550 | 78.220 | 44.110 | -.19490 |
| 10:55:36 | .19170 | 20.370 | 78.040 | 83.750 | -.21570 |
| 10:56:36 | .26750 | 20.370 | 3.0040 | 174.30 | -.15200 |
| 10:57:36 | .23210 | 20.440 | 2.2440 | 125.10 | -.11800 |
| 10:58:36 | .23910 | 20.350 | .60940 | 78.980 | -0.0762 |
| 10:59:36 | .24350 | 20.690 | -1.6270 | 64.370 | -.14300 |
| 11:00:36 | .14960 | 20.760 | 343.20 | 97.750 | 0.0810 |
| 11:01:36 | 89.550 | 20.220 | 342.50 | 517.10 | 3.3300 |
| 11:02:36 | 89.290 | 19.540 | 293.20 | 505.70 | 3.3450 |
| 11:03:36 | 66.610 | 18.540 | 291.90 | 537.30 | 3.3050 |
| 11:04:36 | 66.450 | 18.060 | 290.00 | 512.60 | 3.[illegible] |

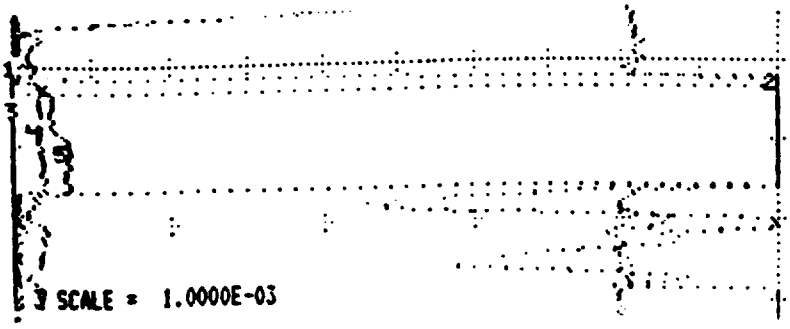


| | | | | | |
|---|---|---|---|---|---|
| 11:06:36 | 66.000 | 9.1340 | 287.70 | 487.00 | 3.3840 |
| 11:07:36 | 66.150 | 9.2240 | 286.30 | 470.90 | 3.4430 |
| 11:08:36 | 65.780 | 9.0970 | 289.40 | 511.40 | 3.3130 |
| 11:09:36 | 67.580 | 8.9860 | 288.40 | 473.20 | 3.4310 |
| 11:10:36 | 70.130 | 9.1420 | 287.80 | 495.90 | 3.3670 |
| 11:11:36 | 661.60 | 9.1120 | 286.80 | 472.90 | 3.4270 |
| 11:12:36 | 686.80 | 9.1870 | 285.80 | 466.10 | 3.3980 |



| | | | | | |
|---|---|---|---|---|---|
| 11:13:36 | 681.00 | 4.9690 | 284.60 | 3738.0 | 9.3500 |
| 11:14:36 | 673.40 | 4.4550 | 283.50 | 3910.0 | 9.7430 |
| 11:15:36 | 665.00 | 4.3960 | 282.90 | 3884.0 | 9.6370 |
| 11:16:36 | 726.20 | 4.1940 | 282.70 | 4512.0 | 9.5700 |
| 11:17:36 | 751.10 | 4.2910 | 288.80 | 4513.0 | 9.7180 |
| 11:18:36 | 747.90 | 4.2620 | 288.30 | 4547.0 | 9.8320 |
| 11:19:36 | 740.50 | 4.2760 | 287.90 | 4485.0 | 9.6320 |
| 11:20:36 | 740.20 | 4.2170 | 288.00 | 4484.0 | 9.6670 |
| 11:21:36 | 6.6460 | 16.570 | 271.10 | 4549.0 | 9.6290 |

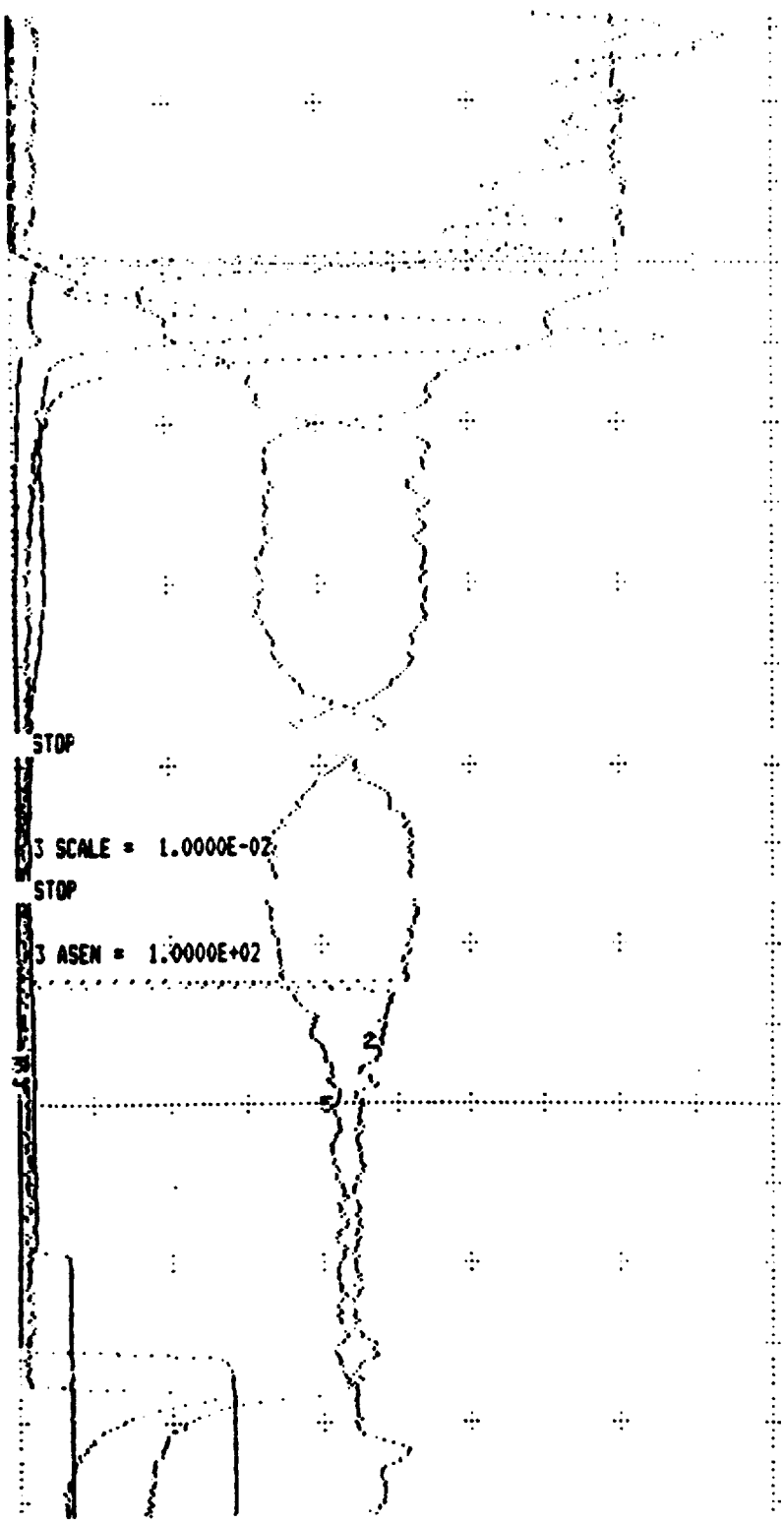
Figure #1 START TEST 1




| | | | | | |
|---|---|---|---|---|---|
| 11:22:36 | 2.0360 | 20.750 | 27.990 | 66.160 | 0.0536 |
| 11:23:36 | 1.6240 | 33.640 | -999.60 | 361.80 | 1.4340 |
| 11:24:36 | 1.2760 | 21.480 | 990.70 | 114.70 | .76770 |
| 11:25:36 | .45380 | 19.930 | 7769.0 | 83.750 | .73730 |

Flare
#1469-1

| | | | | | |
|---|---|---|---|---|---|
| 11:27:36 | [illegible] | 20.180 | [illegible] | 54.540 | [illegible] |
| 11:28:36 | .36530 | 19.960 | 7393.0 | 93.280 | .58770 |

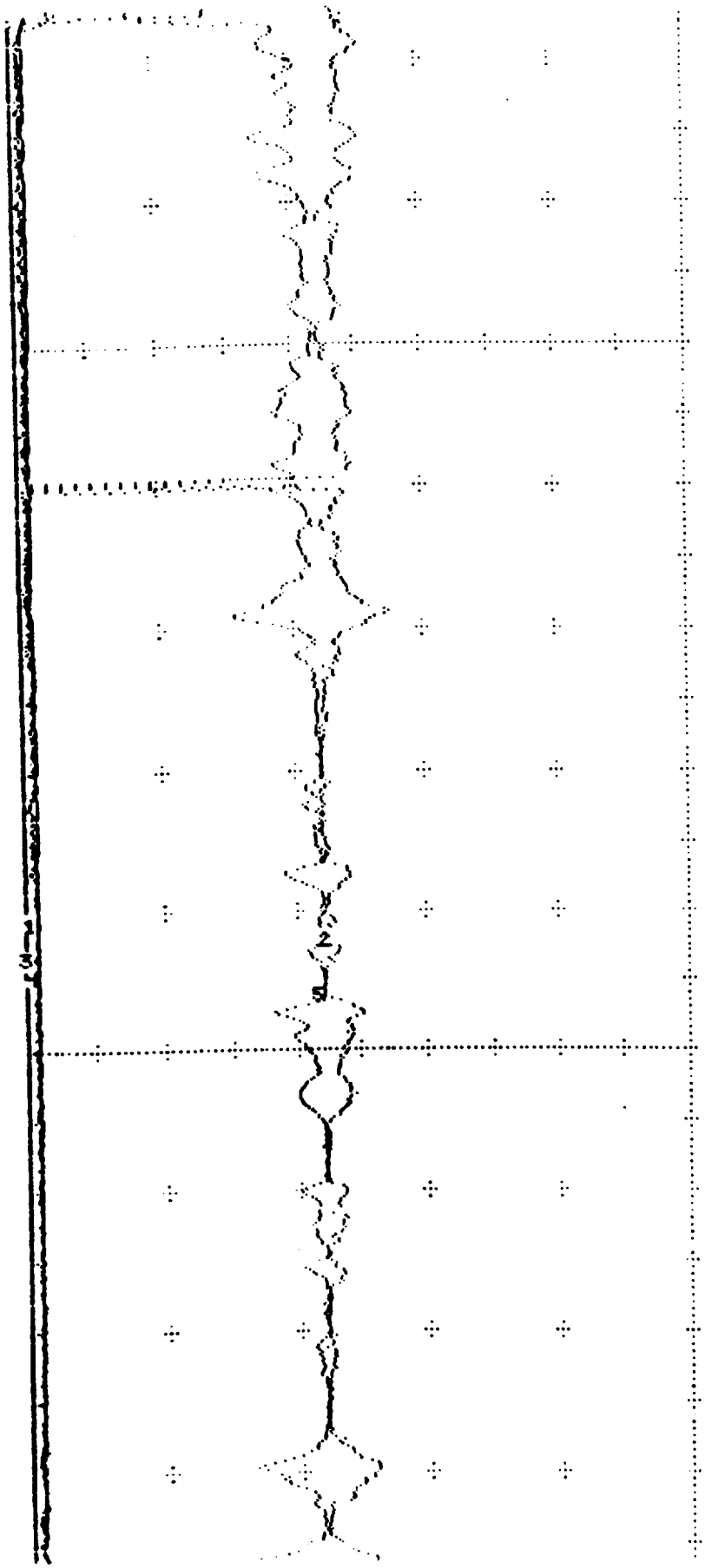



| | | | | | |
|---|---|---|---|---|---|
| 11:29:36 | .24890 | 19.960 | 8585.0 | 35.160 | .76360 |
| 11:30:36 | .17070 | 20.150 | 8163.0 | 75.700 | .74630 |
| 11:31:36 | .12900 | 20.370 | 6550.0 | 53.050 | .59490 |
| 11:32:36 | 39.490 | 11.850 | 798.00 | 372.20 | 8.4280 |
| 11:33:36 | 184.60 | 5.0960 | 272.10 | 8143.0 | 13.830 |
| 11:34:36 | 39.700 | 9.9620 | 77.930 | 467.30 | 8.6640 |
| 11:35:36 | 38.630 | 8.2930 | 53.260 | 265.20 | 10.950 |
| 11:36:36 | 41.120 | 8.2250 | 41.090 | 163.00 | 10.710 |
| 11:37:36 | 29.690 | 8.7920 | 30.800 | 186.20 | 10.390 |
| 11:38:52 | 20.590 | 11.140 | 24.300 | 152.80 | 8.5340 |
| 11:39:52 | 17.200 | 13.030 | 2.1710 | 66.460 | 6.7510 |
| 11:41:07 | 17.560 | 12.920 | 1.6040 | 87.620 | 6.8760 |
| 11:42:07 | 19.890 | 12.100 | -4.0430 | 105.50 | 7.7470 |
| 11:43:07 | 20.700 | 11.310 | -6.0380 | 101.00 | 8.4140 |
| 11:44:07 | 21.760 | 11.250 | -7.3270 | 155.80 | 8.4620 |
| 11:45:07 | 68.030 | 11.070 | -8.0940 | 123.30 | 8.4720 |
| 11:46:07 | 69.650 | 11.720 | -7.8430 | 135.60 | 8.8270 |
| 11:47:07 | 70.360 | 11.060 | 282.10 | 1381.0 | 4.3780 |
| 11:48:07 | 70.670 | 12.010 | 281.30 | 606.80 | 3.4160 |

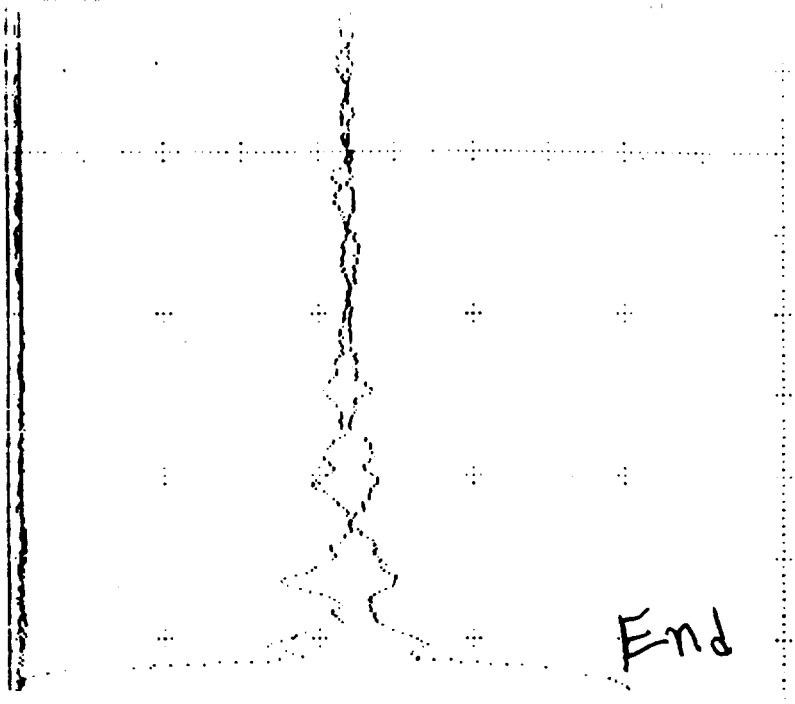
Test 1

Flare #1469-1

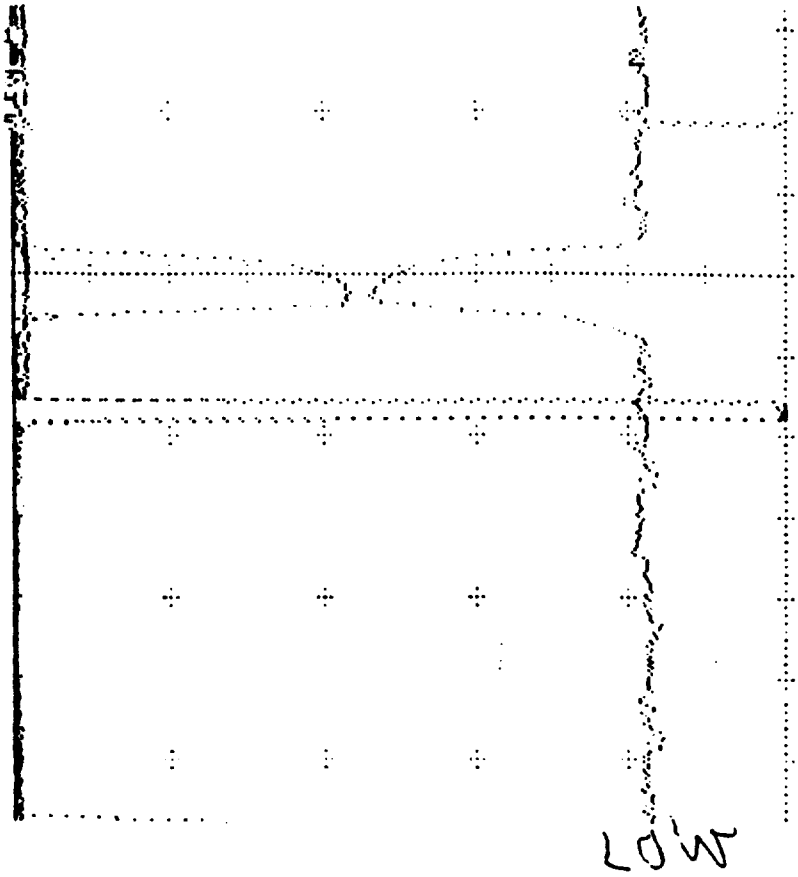
1700°F



| | NOx | O2 | THC | CO | CO2 |
|---|---|---|---|---|---|
| 11:49:07 | 20.340 | 12.010 | -10.800 | 124.80 | 8.0970 |
| 11:50:07 | 18.320 | 12.630 | -12.100 | 103.70 | 7.2650 |
| 11:51:07 | 20.130 | 11.630 | -13.060 | 101.60 | 8.4700 |
| 11:52:07 | 19.880 | 11.650 | -14.120 | 113.80 | 8.4760 |
| 11:53:07 | 19.290 | 11.220 | -15.390 | 178.20 | 8.6130 |
| 11:54:07 | 18.890 | 12.410 | -14.850 | 121.60 | 7.5830 |
| 11:55:07 | 18.620 | [illegible] | -15.190 | -75.100 | 6.8940 |
| 11:56:07 | 18.280 | 11.800 | -15.570 | 158.20 | 8.4600 |
| 11:57:07 | 18.730 | 12.400 | -15.710 | 141.80 | 8.0030 |
| 11:58:07 | 19.220 | 11.270 | -15.600 | 135.60 | 8.7480 |
| 11:59:07 | 18.630 | 11.020 | -15.530 | 132.60 | 8.8160 |
| 12:00:07 | 19.720 | 10.800 | -15.420 | 137.10 | 8.9660 |
| 12:01:07 | 18.490 | 11.130 | -16.130 | 164.80 | 8.7420 |
| 12:02:07 | 18.710 | 11.160 | -15.990 | 171.60 | 8.8600 |
| 12:03:07 | 18.750 | 11.780 | -16.260 | 123.90 | 8.3330 |
| 12:04:07 | 19.380 | 11.270 | -16.340 | 184.10 | 8.7100 |
| 12:05:07 | 18.950 | 11.840 | -16.450 | 168.90 | 8.0060 |
| 12:06:07 | 18.130 | 11.210 | -16.410 | 193.10 | 8.5290 |
| 12:07:07 | 16.890 | 11.160 | -16.400 | 171.90 | 8.9150 |
| 12:08:07 | 18.690 | 11.100 | -16.390 | 148.40 | 8.8100 |
| 12:09:07 | 15.640 | 12.960 | -16.030 | 139.70 | 7.0600 |
| 12:10:07 | 16.550 | 11.540 | -0.0171 | 135.30 | 8.1890 |

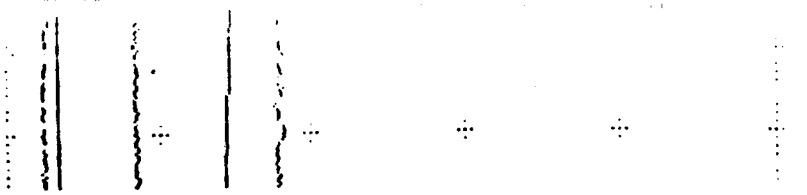



| | | | | | |
|---|---|---|---|---|---|
| 12:12:07 | 18.410 | 11.020 | -0.0166 | 179.10 | 8.5190 |
| 12:13:07 | 18.370 | 11.000 | -0.0101 | 134.40 | 8.9220 |
| 12:14:07 | 19.100 | 10.980 | -0.0129 | 123.30 | 9.0000 |
| 12:15:07 | 17.410 | 11.060 | -0.0128 | 166.60 | 8.7150 |
| 12:16:07 | 17.800 | 11.720 | -0.0141 | 188.00 | 8.1830 |
| 12:17:07 | 17.050 | 11.780 | -0.0134 | 175.50 | 8.2390 |
| 12:18:07 | 15.750 | 11.960 | 0.0087 | 224.70 | 8.4490 |
| 12:19:07 | 15.640 | 13.190 | 0.0267 | 176.10 | 7.2930 |
| | 18 | 11.6 | 0 | 152 | 8.3 |

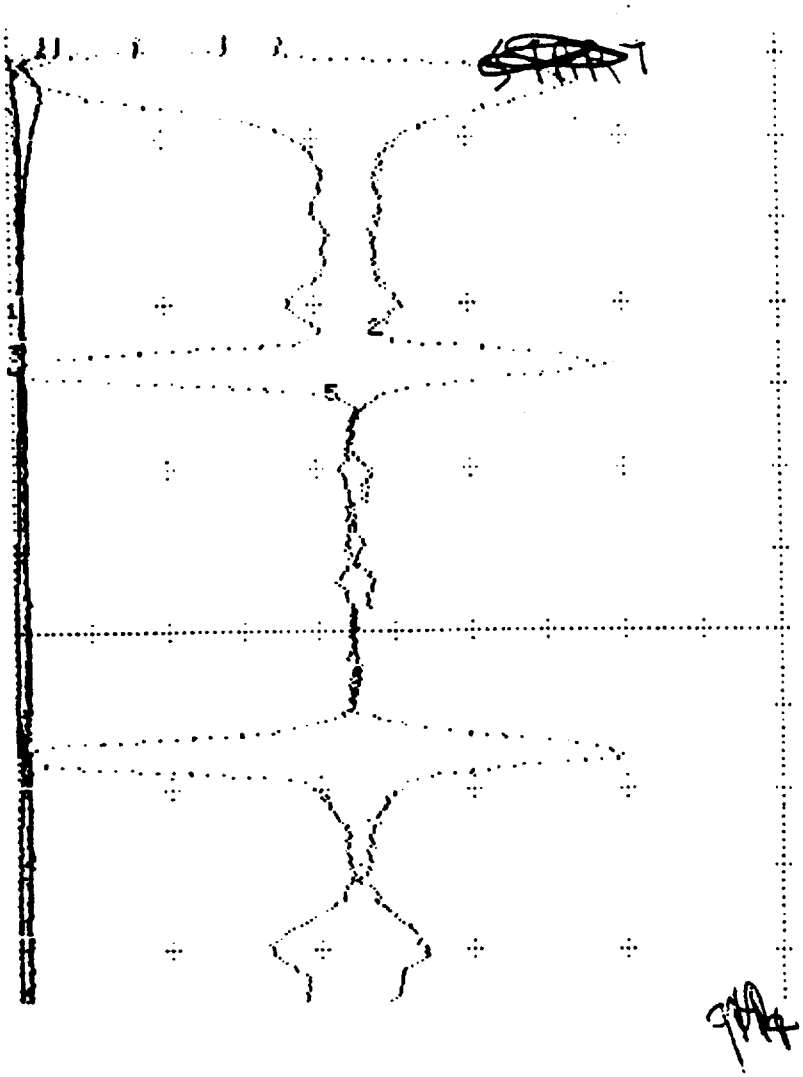



| | | | | | |
|---|---|---|---|---|---|
| 12:20:07 | .17200 | 20.660 | 0.0152 | 157.60 | .15020 |
| 12:21:07 | 0.0942 | 20.400 | -0.0028 | 112.00 | .13110 |
| 12:22:07 | .11120 | 20.310 | -65.510 | 143.60 | 0.0530 |
| 12:23:07 | 17.230 | 12.290 | -16.470 | 158.50 | 7.9040 |
| 12:24:07 | .11170 | 20.720 | -16.440 | 196.10 | 0.0816 |
| 12:25:07 | 0.0763 | 20.660 | -19.120 | 55.730 | 0.0792 |
| 12:26:07 | 0.0802 | 20.320 | 4.2270 | -107.20 | -.17160 |
| 12:27:07 | 0.0433 | 20.580 | 3.5170 | -109.90 | -.17340 |
| 12:28:07 | 0.0431 | 20.680 | 3.5570 | -92.090 | -.13590 |
| 12:29:07 | 0.0717 | 20.640 | 2.6590 | 81.360 | -.14720 |

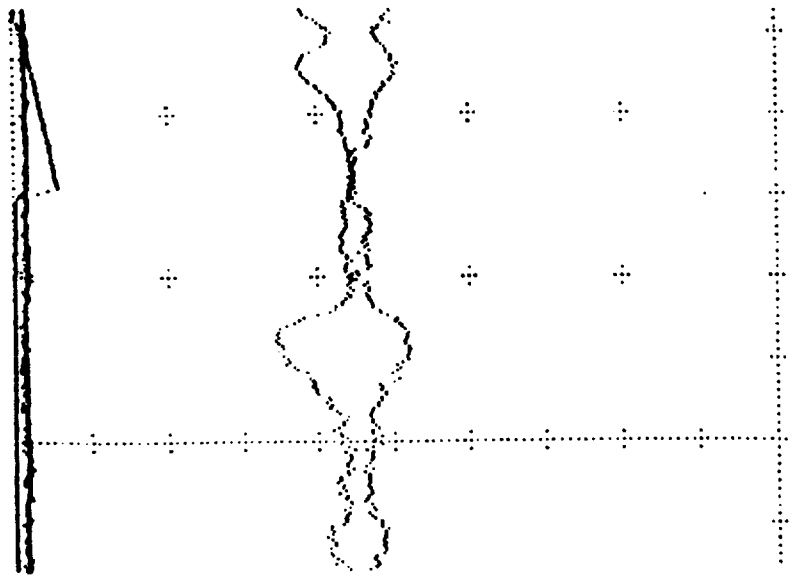
| | | | | | |
|---|---|---|---|---|---|
| 12:30:07 | 65.270 | 20.620 | 304.70 | 115.30 | -0.0762 |
| 12:31:07 | 67.430 | 9.2910 | 311.30 | 554.60 | 3.0910 |
| 12:32:07 | 68.030 | 9.4100 | 294.40 | 571.30 | 3.0500 |



| | | | | | |
|---|---|---|---|---|---|
| 12:34:07 | [illegible] | 9.0680 | 293.00 | 512.60 | 3.4180 |
| 12:35:07 | 68.880 | 9.1200 | 287.40 | 483.70 | 3.3970 |



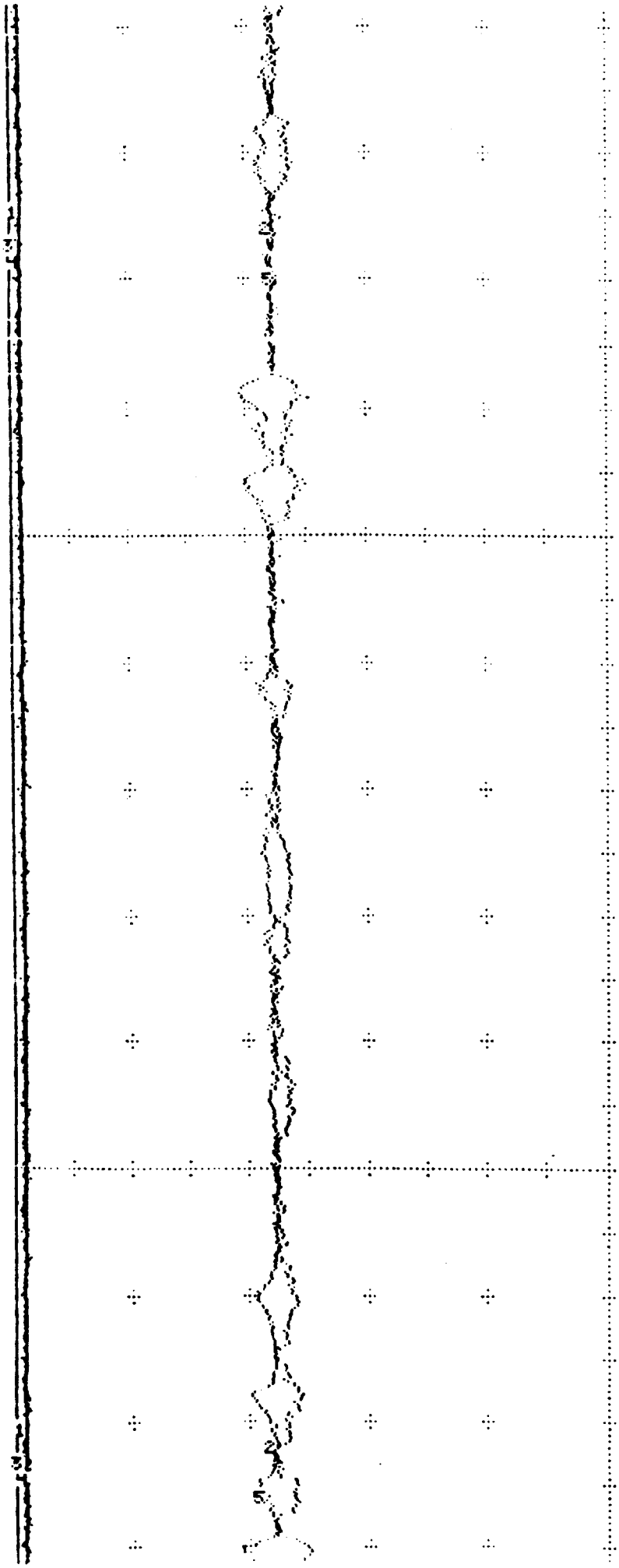
| | | | | | |
|---|---|---|---|---|---|
| 12:36:07 | 3.9750 | 10.170 | 23.610 | 318.90 | 1.7200 |
| 12:37:07 | 15.780 | 12.840 | 32.560 | 123.60 | 7.5280 |
| 12:38:07 | 16.530 | 12.180 | 19.600 | 103.40 | 8.0800 |
| 12:39:07 | 15.570 | 12.820 | 15.340 | 162.40 | 7.3480 |
| 12:40:07 | 17.120 | 13.680 | 10.290 | 150.50 | 5.8040 |
| 12:41:07 | 17.280 | 11.820 | 6.7090 | 177.30 | 8.6010 |
| 12:42:07 | 17.460 | 10.930 | 5.9500 | 163.60 | 9.1110 |
| 12:43:07 | 17.450 | 11.240 | 3.8100 | 156.10 | 8.8720 |
| 12:44:07 | 15.890 | 11.130 | 1.5700 | 176.40 | 8.9290 |
| 12:45:07 | 15.590 | 12.680 | 5.8620 | 119.20 | 7.8200 |
| 12:46:07 | 16.820 | 11.310 | 3.2030 | 148.40 | 8.8060 |
| 12:47:07 | 14.100 | 13.500 | 2.9130 | 157.00 | 6.7550 |



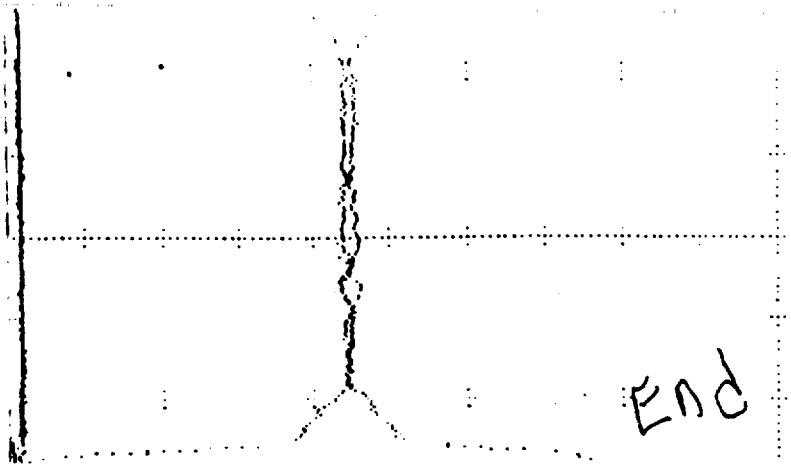
| | | | | | |
|---|---|---|---|---|---|
| 12:48:07 | 15.350 | 11.950 | 16.820 | 140.90 | 8.4290 |
| 12:49:07 | 16.810 | 11.810 | 38.220 | 142.40 | 8.6320 |
| 12:50:07 | 16.920 | 11.080 | 6.6670 | 160.60 | 8.8620 |
| 12:51:07 | 17.140 | 11.100 | 1.6600 | 168.60 | 8.8410 |
| 12:52:07 | 15.050 | 12.970 | .42830 | 87.920 | 7.2120 |
| 12:53:07 | 17.200 | 11.820 | .14550 | 139.10 | 8.6240 |
| 12:54:07 | 16.150 | 12.060 | 1.0490 | 148.40 | 8.6000 |

Figure 41469-1

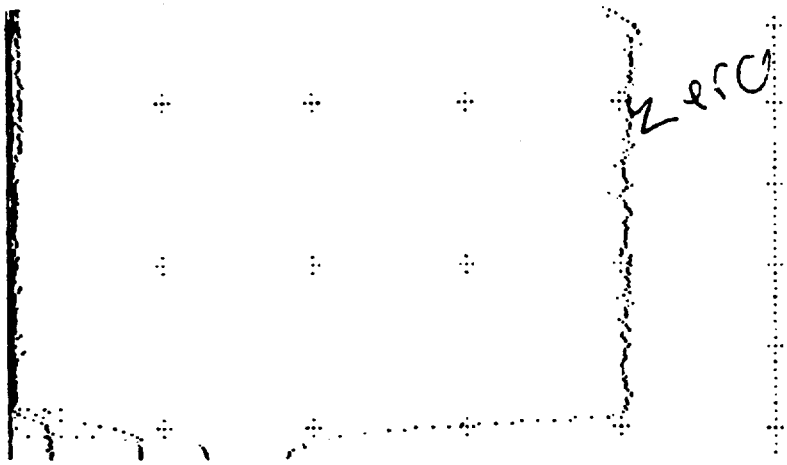
START TEST 2



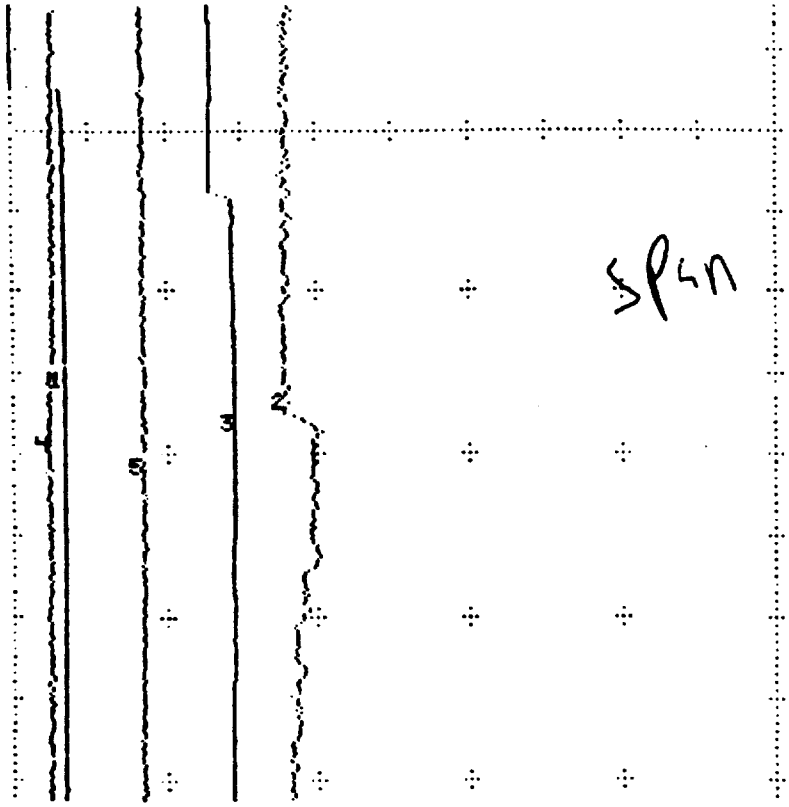
| | | | | | |
|---|---|---|---|---|---|
| 12:55:07 | 17.590 | 11.050 | .17600 | 138.50 | 9.0180 |
| 12:56:07 | 17.570 | 10.960 | -.17530 | 119.80 | 8.9860 |
| 12:57:07 | 16.660 | 11.780 | -0.0853 | 160.00 | 8.6940 |
| 12:58:07 | 17.550 | 11.360 | .26380 | 188.30 | 8.9720 |
| 12:59:07 | 17.520 | 11.230 | .12490 | 165.10 | 8.9800 |
| 13:00:07 | 17.450 | 11.080 | -.40160 | 197.90 | 8.9530 |
| 13:01:07 | 16.940 | 11.930 | -.33450 | 146.00 | 8.4260 |
| 13:02:07 | 15.680 | 11.980 | -1.0260 | 137.10 | 8.6650 |
| 13:03:07 | 17.340 | 11.180 | -.29370 | 182.70 | 8.8630 |
| 13:04:07 | 17.440 | 11.290 | -.57910 | 196.10 | 8.9750 |
| 13:05:07 | 17.040 | 11.160 | -2.1360 | 208.30 | 8.9640 |
| 13:06:07 | 17.950 | 11.160 | -2.5460 | 211.30 | 9.0090 |
| 13:07:07 | 18.200 | 11.130 | -2.5010 | 178.50 | 9.0890 |
| 13:08:07 | 18.910 | 10.660 | -1.9470 | 163.30 | 9.3480 |
| 13:09:07 | 17.820 | 11.150 | -1.5860 | 201.70 | 9.2890 |
| 13:10:07 | 17.510 | 11.350 | -1.7290 | 206.50 | 8.9420 |
| 13:11:07 | 17.690 | 11.120 | -2.0680 | 159.70 | 8.9080 |
| 13:12:07 | 17.480 | 11.720 | -2.1800 | 123.90 | 8.7280 |
| 13:13:07 | 17.570 | 11.160 | -2.6330 | 151.10 | 8.9560 |
| 13:14:07 | 18.110 | 11.120 | -2.3930 | 186.50 | 9.1050 |
| 13:15:07 | 16.950 | 12.010 | -2.5540 | 166.30 | 8.3130 |
| 13:16:07 | 17.140 | 11.090 | -2.9320 | 139.70 | 8.9680 |
| 13:17:07 | 17.320 | 11.580 | -1.1460 | 163.90 | 8.6990 |
| 13:18:07 | 16.820 | 11.970 | -.96780 | 199.00 | 8.4170 |
| 13:19:07 | 15.930 | 12.440 | -.43720 | 143.30 | 7.7630 |




| | | | | | |
|---|---|---|---|---|---|
| 13:21:07 | 16.640 | 10.960 | -3.0750 | 141.20 | 9.0140 |
| 13:22:07 | 16.280 | 11.070 | -2.7060 | 196.70 | 9.0600 |
| 13:23:07 | 16.420 | 11.000 | -2.9760 | 180.60 | 9.2000 |
| 13:24:07 | 16.010 | 11.190 | -3.1300 | 166.00 | 9.0700 |
| 13:25:07 | 16.400 | 11.760 | -3.3500 | 169.20 | 8.5900 |
| | 17 | 11.4 | 0 | 170 | 8.6 |

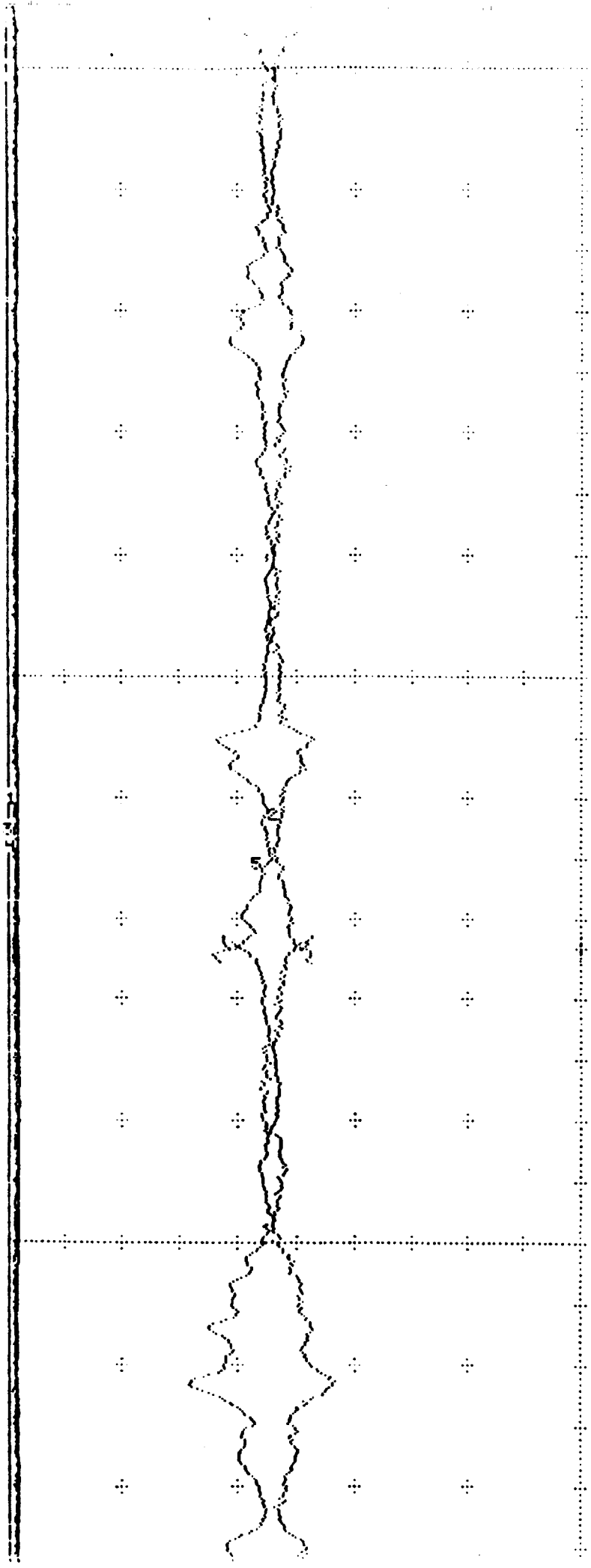



| | | | | | |
|---|---|---|---|---|---|
| 13:26:07 | .13960 | 20.500 | 11.590 | 159.40 | 0.0876 |
| 13:27:07 | 0.0980 | 20.340 | 7.7250 | 183.20 | 0.0606 |
| 13:28:07 | 0.0863 | 20.250 | 4.9590 | 91.500 | -.13680 |
| 13:29:07 | 0.0931 | 20.310 | 5.3520 | 111.40 | -.10370 |
| 13:30:07 | 0.0767 | 20.310 | 4.4530 | 77.490 | -.11080 |
| 13:31:07 | 0.0737 | 13.350 | 1.4940 | 474.40 | 2.7290 |



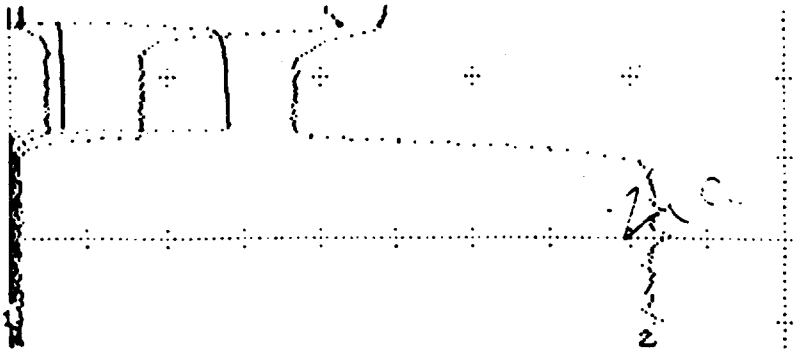

| | | | | | |
|---|---|---|---|---|---|
| 13:32:07 | 0.0746 | 9.1200 | 260.20 | 551.00 | 3.3410 |
| 13:33:07 | 67.870 | 8.9410 | 259.10 | 527.50 | 3.3790 |
| 13:34:07 | 68.520 | 8.9180 | 289.20 | 547.80 | 3.4200 |
| 13:35:07 | 68.640 | 8.9560 | 289.40 | 542.70 | 3.4000 |
| 13:36:07 | 69.450 | 8.9260 | 289.70 | 487.00 | 3.4170 |
| 13:37:07 | 68.970 | 9.8570 | 289.50 | 471.20 | 3.3580 |
| 13:38:07 | 68.920 | 9.8420 | 289.30 | 505.10 | 3.3620 |
| 13:39:07 | 69.080 | 9.5220 | 289.80 | 461.00 | 3.3820 |
| 13:40:07 | 69.230 | 9.3280 | 288.80 | 484.90 | 3.3730 |
| 13:41:07 | 69.420 | 9.1200 | 288.20 | 475.60 | 3.3580 |

Flare # 1469-1
Test 3

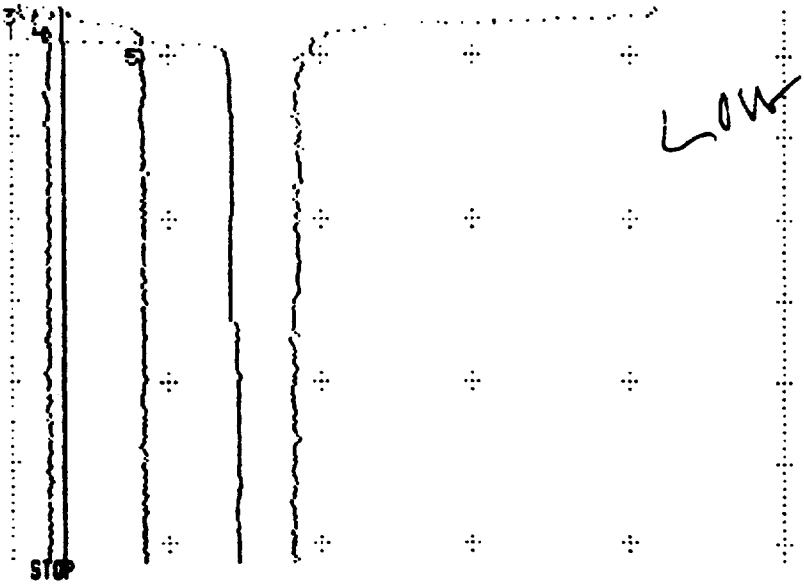


| | | | | | |
|---|---|---|---|---|---|
| 13:43:07 | 18.540 | 11.630 | -3.6620 | 172.00 | 4.0330 |
| 13:44:07 | 19.050 | 11.070 | -5.7340 | 178.20 | 9.4990 |
| 13:45:07 | 18.560 | 11.280 | -5.9060 | 185.00 | 9.2450 |
| 13:46:07 | 18.250 | 11.830 | -6.8810 | 166.60 | 9.0040 |
| 13:47:07 | 16.770 | 12.240 | -7.8640 | 137.40 | 8.2560 |
| 13:48:07 | 17.800 | 11.990 | -7.8090 | 175.20 | 8.7840 |
| 13:49:07 | 18.240 | 12.040 | -7.7020 | 164.50 | 8.9440 |
| 13:50:07 | 18.650 | 11.660 | -8.9460 | 132.60 | 9.0380 |
| 13:51:07 | 18.930 | 11.300 | -9.7120 | 124.50 | 9.3100 |
| 13:52:07 | 18.640 | 11.720 | -9.8680 | 132.00 | 9.1020 |
| 13:53:07 | 18.300 | 11.810 | -9.9200 | 134.40 | 8.9730 |
| 13:54:07 | 15.500 | 13.160 | -8.8210 | 163.30 | 7.4820 |
| 13:55:07 | 18.580 | 11.980 | -10.270 | 130.80 | 8.9020 |
| 13:56:07 | 18.060 | 11.720 | -10.180 | 121.30 | 9.2130 |
| 13:57:07 | 17.450 | 12.330 | -9.6890 | 124.80 | 8.2010 |
| 13:58:07 | 16.640 | 12.770 | -9.7960 | 123.60 | 7.7370 |
| 13:59:07 | 17.900 | 11.750 | -10.000 | 126.90 | 8.8840 |
| 14:00:07 | 19.150 | 11.260 | -11.290 | 154.90 | 9.2810 |
| 14:01:07 | 18.900 | 11.070 | -12.130 | 161.80 | 9.3170 |
| 14:02:07 | 18.010 | 11.820 | -12.050 | 141.80 | 8.8460 |
| 14:03:07 | 17.620 | 11.750 | -11.730 | 140.90 | 8.9150 |
| 14:04:07 | 16.350 | 12.650 | -11.250 | 131.70 | 7.8450 |
| 14:05:07 | 14.390 | 13.120 | -11.030 | 120.10 | 7.5700 |
| 14:06:07 | 16.420 | 12.390 | -10.960 | 132.90 | 8.5230 |
| 14:07:07 | 17.690 | 12.070 | -11.460 | 114.40 | 8.7400 |
| 14:08:07 | 15.780 | 12.970 | -11.140 | 138.20 | 7.6740 |

| | | | | | |
|---|---|---|---|---|---|
| 14:10:07 | 17.070 | 12.130 | -12.410 | 143.90 | 8.1430 |
| | 18 | 12.0 | 0 | 145 | 8.7 |

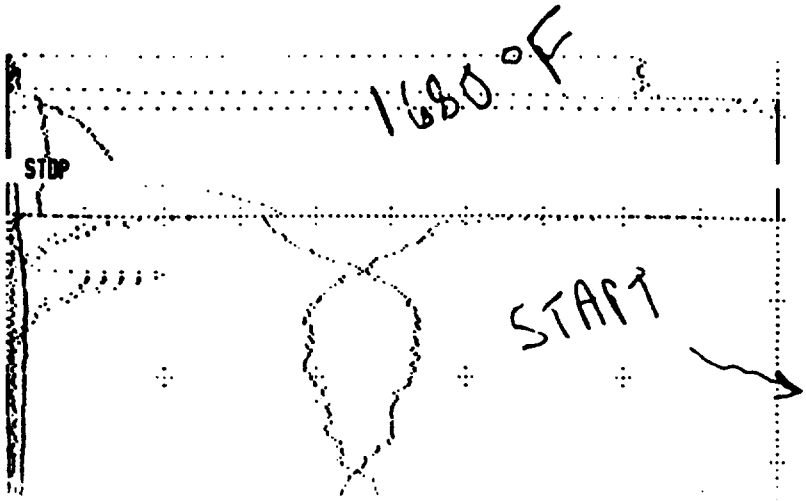


| | | | | | |
|---|---|---|---|---|---|
| 14:11:07 | 68.760 | 9.2170 | 276.20 | 491.10 | 3.3840 |
| 14:12:07 | .25690 | 19.230 | 3.1380 | 65.570 | .23120 |
| 14:13:07 | .13600 | 20.990 | -1.8170 | 169.50 | 0.0673 |
| 14:14:07 | .10590 | 21.010 | -2.2810 | 146.00 | 0.0917 |

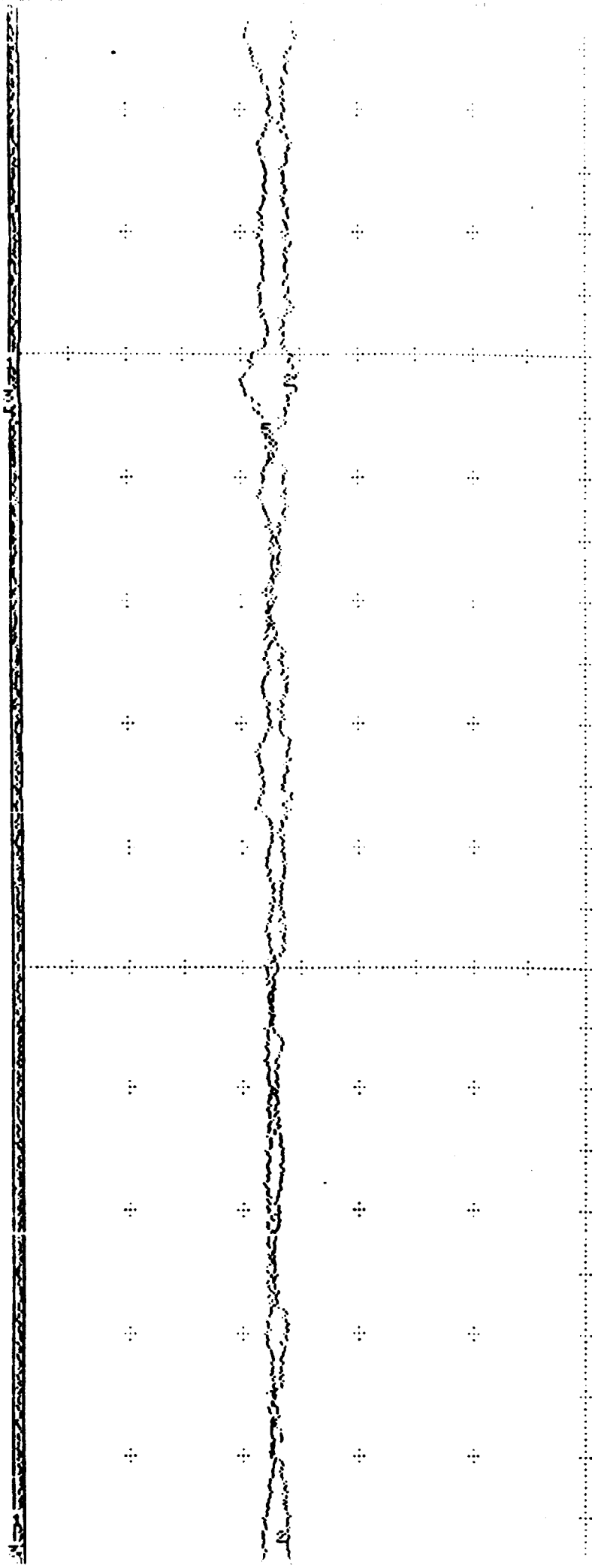



| | | | | | |
|---|---|---|---|---|---|
| 14:15:07 | 68.380 | 9.4550 | 276.50 | 496.60 | 3.3790 |
| 14:16:07 | 69.180 | 9.2990 | 283.50 | 502.20 | 3.3760 |
| 14:17:07 | 69.160 | 9.2390 | 282.30 | 493.50 | 3.4170 |
| 14:18:07 | 69.150 | 9.1120 | 281.50 | 472.90 | 3.4310 |
| 14:19:07 | 69.120 | 9.1420 | 293.30 | 502.50 | 3.4150 |
| 14:20:07 | 69.080 | 9.1570 | 293.30 | 480.70 | 3.3750 |
| 14:21:07 | 69.060 | 9.0450 | 291.90 | 500.10 | 3.3800 |

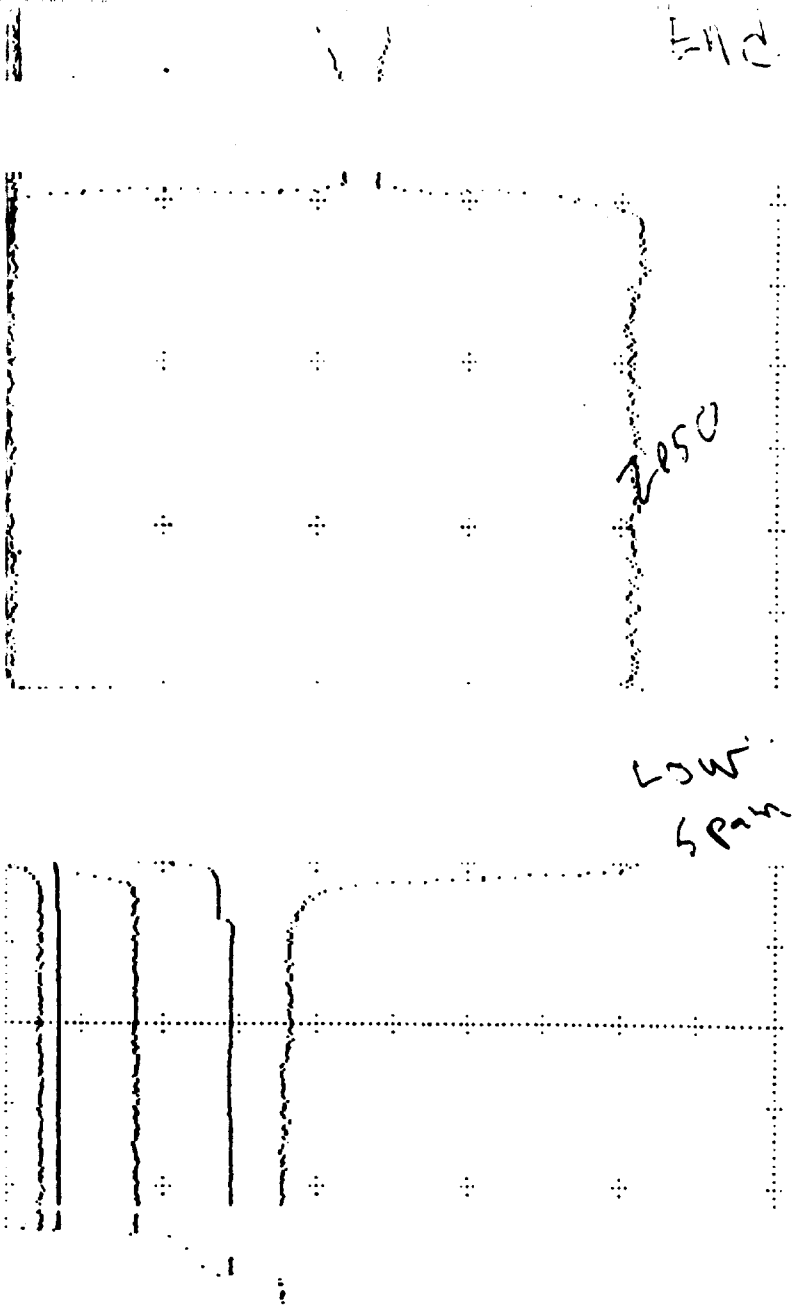
Flare #1434-1
Test 1



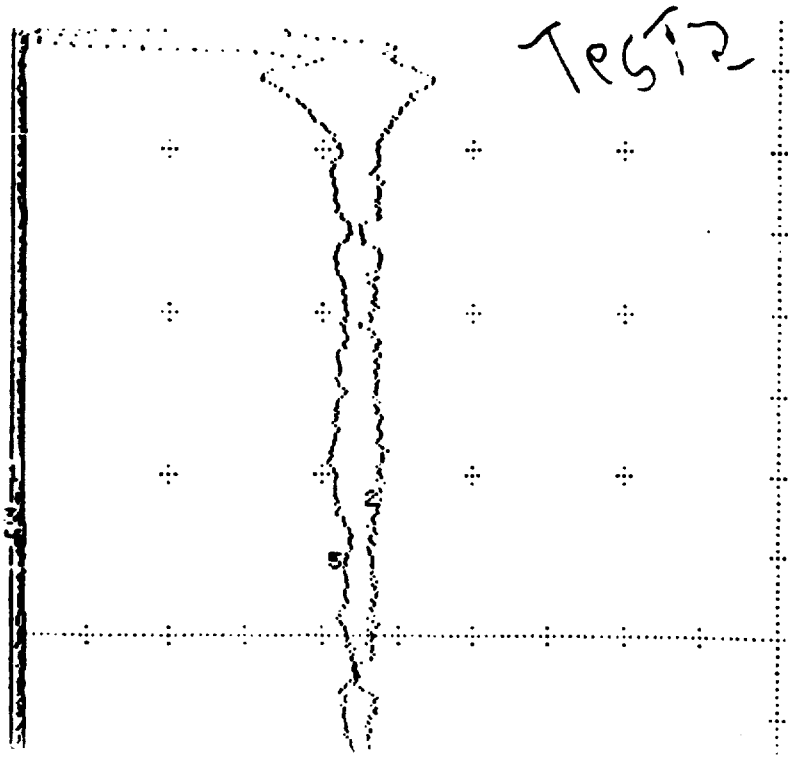

| | | | | | |
|---|---|---|---|---|---|
| 16:02:21 | ~~1.5480~~ | ~~32.790~~ | ~~-999.60~~ | ~~434.80~~ | ~~1.4270~~ |
| 16:57:28 | 14.480 | 19.290 | 252.10 | [illegible] | 6.8380 |
| 16:58:28 | 23.470 | 10.180 | 91.030 | 104.00 | 10.380 |
| 16:59:28 | 22.720 | 9.8720 | -.85490 | 101.30 | 10.550 |
| 17:00:28 | 18.860 | 10.820 | -9.6110 | 54.840 | 9.3530 |



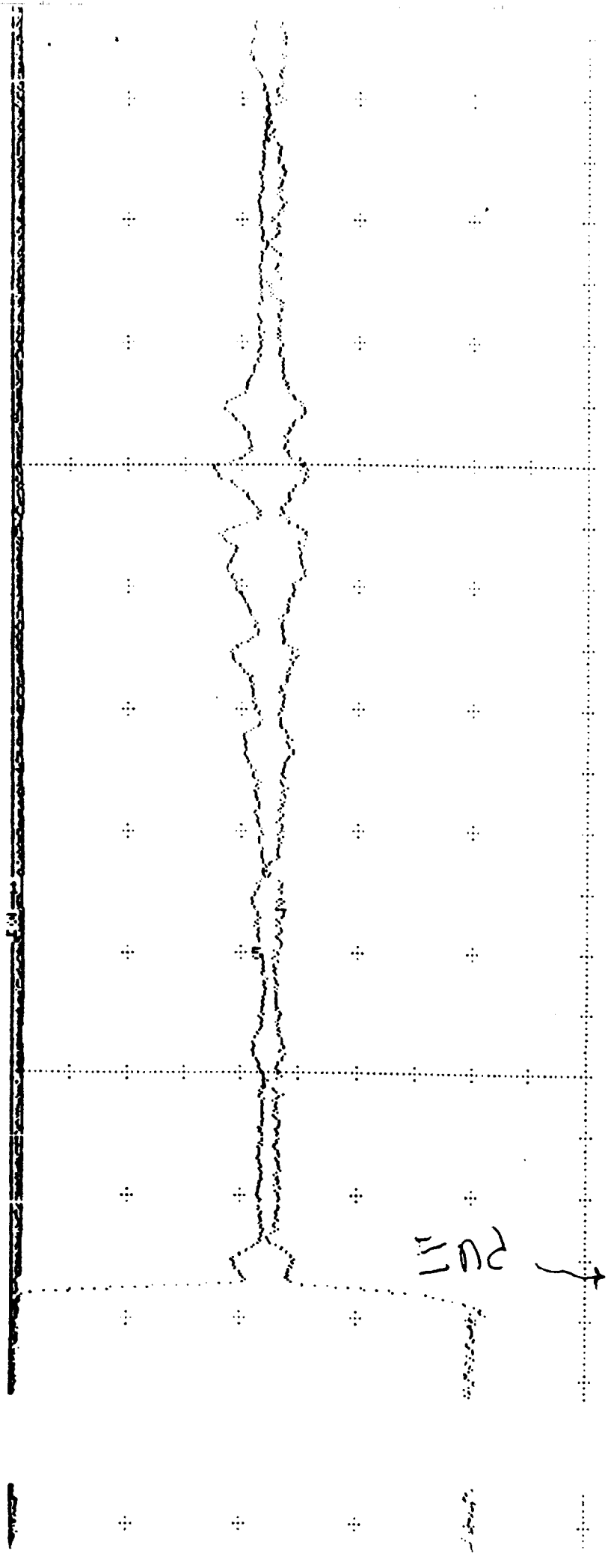
| | | | | | |
|---|---|---|---|---|---|
| 17:02:28 | 16.[illegible]90 | 12.160 | -15.630 | 54.240 | 8.4070 |
| 17:03:28 | 17.900 | 11.890 | -16.890 | 96.350 | 8.9520 |
| 17:04:28 | 17.760 | 11.850 | -18.560 | 104.90 | 8.8760 |
| 17:05:28 | 17.400 | 11.770 | -19.630 | 75.100 | 8.5000 |
| 17:06:28 | 17.340 | 12.060 | -20.640 | 71.820 | 8.6890 |
| 17:07:28 | 16.490 | 12.140 | -20.790 | 53.640 | 8.4090 |
| 17:08:28 | 17.780 | 11.860 | -21.750 | 79.870 | 8.7320 |
| 17:09:28 | 17.350 | 11.840 | -22.340 | 162.40 | 8.7760 |
| 17:10:28 | 18.140 | 11.510 | -22.970 | 68.550 | 9.0540 |
| 17:11:28 | 18.120 | 11.170 | -22.960 | 101.00 | 9.1020 |
| 17:12:28 | 17.710 | 11.750 | -23.370 | 124.50 | 8.9290 |
| 17:13:28 | 17.660 | 11.660 | -23.460 | 109.00 | 8.9440 |
| 17:14:28 | 17.250 | 11.710 | -23.360 | 86.130 | 8.7600 |
| 17:15:28 | 17.320 | 11.750 | -24.310 | 115.60 | 8.9570 |
| 17:16:28 | 17.820 | 11.670 | -24.600 | 111.10 | 9.0540 |
| 17:17:28 | 18.190 | 11.060 | -25.200 | 98.650 | 9.2190 |
| 17:18:28 | 18.550 | 11.140 | -25.240 | 78.980 | 8.8940 |
| 17:19:28 | 18.290 | 11.250 | -25.220 | 94.770 | 9.2130 |
| 17:20:28 | 18.830 | 11.130 | -25.770 | 114.10 | 9.3770 |
| 17:21:28 | 18.830 | 11.140 | -26.260 | 113.80 | 9.2080 |
| 17:22:28 | 18.150 | 11.080 | -26.240 | 58.710 | 9.0560 |
| 17:23:28 | 17.650 | 11.720 | -25.890 | 114.40 | 8.7630 |
| 17:24:28 | 18.130 | 11.300 | -26.880 | 105.80 | 9.1260 |
| 17:25:28 | 18.020 | 11.210 | -26.500 | 105.20 | 8.9630 |
| 17:26:28 | 17.360 | 11.970 | -26.340 | 96.260 | 8.7930 |



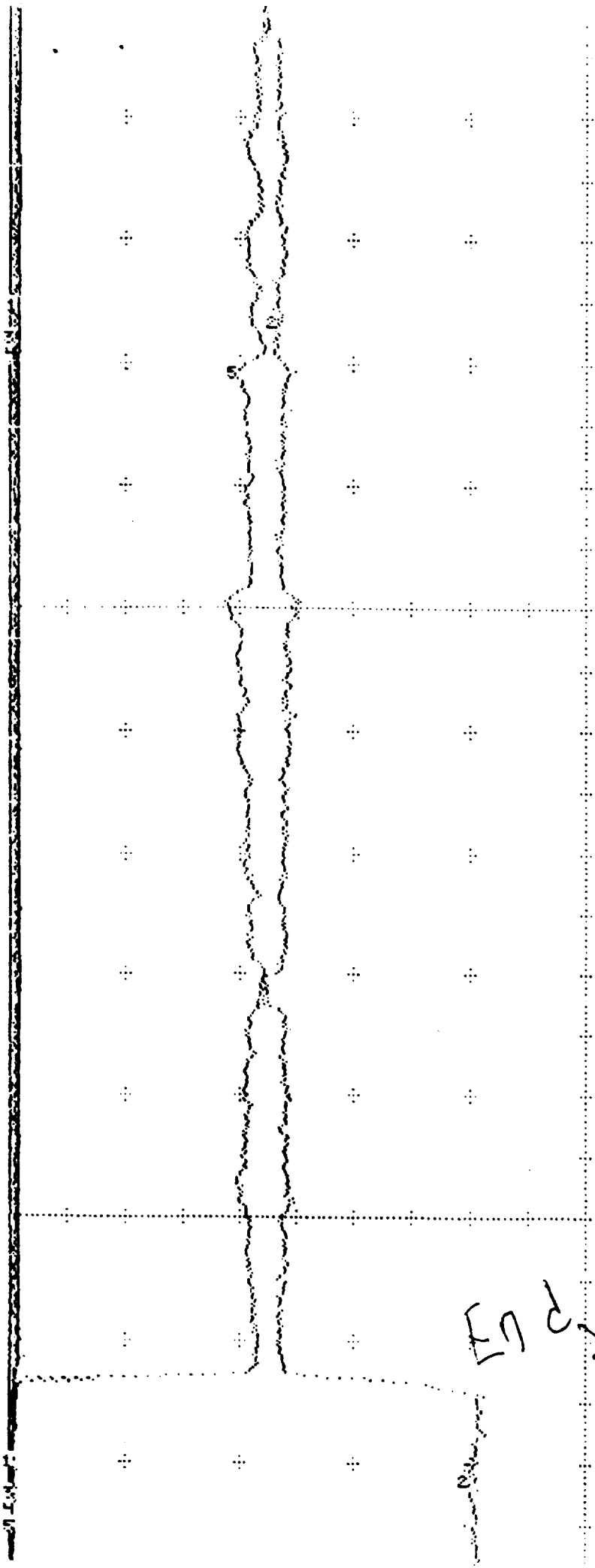

| | | | | | |
|---|---|---|---|---|---|
| 17:28:28 | 15.700 | 12.310 | -24.620 | 117.70 | 8.0830 |
| | 10 | 11.8 | 0 | 95 | 8.9 |
| 17:29:28 | .15020 | 18.470 | -14.410 | 59.310 | .25630 |
| 17:30:28 | 0.0634 | 20.590 | -14.880 | 43.210 | -.15430 |
| 17:31:28 | 0.0486 | 20.450 | -2.7880 | 61.990 | -.20680 |
| 17:32:28 | 0.0678 | 20.520 | -12.050 | 25.630 | -.19840 |
| 17:33:28 | 0.0615 | 20.360 | -5.4330 | 33.080 | -.17880 |
| 17:34:28 | 0.0634 | 20.600 | -.62210 | 107.20 | -.20500 |
| 17:35:28 | 65.330 | 20.550 | 214.70 | 89.710 | -.16350 |
| 17:36:28 | 70.720 | 9.2310 | 291.50 | 478.30 | 3.3910 |
| 17:37:28 | 70.820 | 9.2310 | 289.90 | 454.20 | 3.3500 |
| 17:38:28 | 71.670 | 9.0150 | 289.10 | 459.20 | 3.4440 |
| 17:39:28 | 71.950 | 8.8960 | 289.30 | 488.20 | 3.3750 |
| 17:40:28 | 12.780 | 12.950 | -2.7610 | 165.40 | 7.2490 |
| 17:41:28 | 16.450 | 11.800 | -10.640 | 147.80 | 8.4710 |
| 17:42:28 | 16.880 | 11.250 | -12.600 | 142.70 | 8.7030 |
| 17:43:28 | 16.820 | 11.480 | -12.460 | 109.60 | 8.6710 |
| 17:44:28 | 16.710 | 11.800 | -12.890 | 115.60 | 8.6200 |
| 17:45:28 | 16.670 | 11.940 | -12.890 | 113.50 | 8.3870 |
| 17:46:28 | 16.920 | 11.590 | -13.470 | 126.30 | 8.6580 |
| 17:47:28 | 17.140 | 11.660 | -13.300 | 123.60 | 8.6750 |
| 17:48:28 | 17.290 | 11.570 | -13.290 | 138.50 | 8.5720 |



| | | | | | | |
|---|---|---|---|---|---|---|
| | 19:04:28 | 70.[illegible] | [illegible].1200 | 297.[illegible] | 537.[illegible] | 3.3[illegible] |
| STOP | 19:05:28 | 70.850 | 9.0450 | 298.40 | 538.20 | 3.3910 |




| | | | | | |
|---|---|---|---|---|---|
| 17:50:28 | 1[illegible] | 11.860 | -13.000 | 107.20 | 8.5250 |
| 17:51:28 | 17.590 | 11.750 | -12.590 | 133.20 | 8.8750 |
| 17:52:28 | 17.190 | 11.600 | -13.630 | 104.60 | 8.7630 |
| 17:53:28 | 17.190 | 11.400 | -13.730 | 139.40 | 8.7140 |
| 17:54:28 | 17.170 | 11.650 | -13.670 | 112.60 | 8.7060 |
| 17:55:28 | 17.020 | 11.750 | -13.450 | 137.10 | 8.6570 |
| 17:56:28 | 15.090 | 12.620 | -12.580 | 121.60 | 7.4550 |
| 17:57:28 | 14.400 | 12.620 | -11.180 | 79.280 | 7.1600 |
| 17:58:28 | 14.260 | 12.410 | -10.930 | 108.10 | 7.9500 |
| 17:59:28 | 15.900 | 12.270 | -12.440 | 98.350 | 7.8540 |
| 18:00:28 | 15.220 | 12.190 | -11.520 | 70.930 | 7.8830 |
| 18:01:28 | 17.300 | 11.710 | -12.350 | 118.30 | 8.4710 |
| 18:02:28 | 17.080 | 11.820 | -13.050 | 84.940 | 8.5350 |
| 18:03:28 | 17.200 | 11.750 | -13.790 | 116.50 | 8.7230 |
| 18:04:28 | 16.760 | 11.790 | -13.500 | 147.50 | 8.4680 |
| 18:05:28 | 17.470 | 11.620 | -14.100 | 132.60 | 8.7290 |
| 18:06:28 | 17.170 | 11.710 | -14.250 | 124.20 | 8.7470 |
| 18:07:28 | 17.590 | 11.690 | -14.190 | 115.00 | 8.7340 |
| 18:08:28 | 17.420 | 11.680 | -15.190 | 97.750 | 8.7910 |
| 18:09:28 | 17.340 | 11.680 | -15.170 | 126.60 | 8.6280 |
| 18:10:28 | 15.770 | 12.260 | -14.090 | 98.950 | 7.8060 |
| | 16 | 11.9 | 0 | 118 | 8.4 |
| 18:11:28 | 0.0768 | 19.960 | 10.580 | 92.690 | -.17400 |
| 18:12:28 | 0.0447 | 19.960 | -8.1720 | 27.120 | -.17700 |
| 18:13:28 | 0.0527 | 20.020 | -2.8690 | 55.730 | -.44460 |



| | | | | | |
|---|---|---|---|---|---|
| 18:38:28 | 17.540 | 11.720 | -.36600 | 81.960 | 8.5710 |
| 18:39:28 | 16.850 | 11.780 | -1.3460 | 142.70 | 8.5290 |
| 18:40:28 | 17.390 | 11.720 | -.21000 | 98.950 | 8.7610 |
| 18:41:28 | 16.510 | 12.000 | .24100 | 78.980 | 8.3160 |
| 18:42:28 | 16.990 | 11.730 | 1.6170 | 77.490 | 8.5790 |
| 18:43:28 | 15.420 | 12.060 | 1.2190 | 134.10 | 8.3480 |
| 18:44:28 | 16.490 | 11.910 | 1.4930 | 92.990 | 8.2710 |
| 18:45:28 | 16.390 | 11.980 | 1.3730 | 96.860 | 8.3280 |
| 18:46:28 | 16.740 | 11.780 | .79880 | 120.10 | 8.4250 |
| 18:47:28 | 15.390 | 12.350 | 2.4500 | 178.20 | 7.6820 |
| 18:48:28 | 16.100 | 12.320 | 2.0070 | 104.00 | 8.0620 |
| 18:49:28 | 15.800 | 12.170 | .96100 | 114.10 | 8.0550 |
| 18:50:28 | 16.230 | 12.040 | .88660 | 166.00 | 8.1990 |
| 18:51:28 | 16.220 | 11.930 | 1.9530 | 129.60 | 8.3520 |
| 18:52:28 | 16.480 | 11.940 | 1.6560 | 112.00 | 8.3920 |
| 18:53:28 | 17.260 | 11.620 | .58820 | 124.50 | 8.8750 |
| 18:54:28 | 16.330 | 12.070 | 1.8300 | 95.670 | 8.3170 |
| 18:55:28 | 16.560 | 12.190 | .91920 | 135.00 | 8.2600 |
| 18:56:28 | 16.240 | 12.070 | .97690 | 115.00 | 8.0820 |
| 18:57:28 | 16.710 | 11.840 | 1.4970 | 137.10 | 8.2740 |
| 18:58:28 | 16.590 | 11.670 | 1.2370 | 84.040 | 8.3260 |
| 18:59:28 | 16.910 | 11.660 | .50820 | 174.60 | 8.6490 |
| | 16.6 | 11.9 | 0 | 115 | 8.4 |
| 19:00:28 | 0.0732 | 20.280 | 8.9520 | 129.60 | .11080 |
| 19:01:28 | 0.0669 | 19.940 | 7.9320 | 81.660 | -.24850 |
| 19:02:28 | 0.0573 | 19.820 | 7.8270 | 82.850 | -.22710 |

End

| | | | | | |
|---|---|---|---|---|---|
| 18:38:28 | 17.540 | 11.720 | -.36600 | 81.940 | 8.5710 |
| 18:39:28 | 16.850 | 11.780 | -1.3460 | 142.70 | 8.5290 |
| 18:40:28 | 17.390 | 11.720 | -.21000 | 98.950 | 8.7610 |
| 18:41:28 | 16.510 | 12.000 | .24100 | 78.980 | 8.3160 |
| 18:42:28 | 16.990 | 11.730 | 1.6170 | 77.490 | 8.5790 |
| 18:43:28 | 15.420 | 12.060 | 1.2190 | 134.10 | 8.3480 |
| 18:44:28 | 16.490 | 11.910 | 1.4930 | 92.990 | 8.2710 |
| 18:45:28 | 16.390 | 11.980 | 1.3730 | 96.860 | 8.3280 |
| 18:46:28 | 16.740 | 11.780 | .79880 | 120.10 | 8.4250 |
| 18:47:28 | 15.390 | 12.350 | 2.4500 | 178.20 | 7.6820 |
| 18:48:28 | 16.100 | 12.320 | 2.0070 | 104.00 | 8.0620 |
| 18:49:28 | 15.800 | 12.170 | .96100 | 114.10 | 8.0550 |
| 18:50:28 | 16.230 | 12.040 | .88660 | 166.00 | 8.1990 |
| 18:51:28 | 16.220 | 11.930 | 1.9530 | 129.60 | 8.3520 |
| 18:52:28 | 16.480 | 11.940 | 1.6560 | 112.00 | 8.3920 |
| 18:53:28 | 17.260 | 11.620 | .58820 | 124.50 | 8.8750 |
| 18:54:28 | 16.330 | 12.070 | 1.8300 | 95.670 | 8.3170 |
| 18:55:28 | 16.560 | 12.190 | .91920 | 135.00 | 8.2600 |
| 18:56:28 | 16.240 | 12.070 | .97690 | 115.00 | 8.0820 |
| 18:57:28 | 16.710 | 11.840 | 1.4970 | 137.10 | 8.2740 |
| 18:58:28 | 16.590 | 11.670 | 1.2370 | 84.040 | 8.3260 |
| 18:59:28 | 16.910 | 11.660 | .50820 | 174.60 | 8.6490 |
| | 16.6 | 11.9 | 0 | 115 | 8.4 |
| 19:00:28 | 0.0732 | 20.280 | 8.9520 | 129.60 | .11080 |
| 19:01:28 | 0.0669 | 19.940 | 7.9320 | 81.660 | -.24850 |
| 19:02:28 | 0.0573 | 19.820 | 7.8270 | 82.850 | -.22710 |

End

| | | | | | | |
|---|---|---|---|---|---|---|
| | 19:04:28 | 70.00 | 9.1200 | 297.60 | 537.00 | 3.3[illegible] |
| STOP | 19:05:28 | 70.850 | 9.0450 | 298.40 | 538.20 | 3.3310 |

# APPENDIX IV

## GAS CALIBRATION SHEETS

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JOC Group, Inc. ha
JRPOSE, and any

AIRCO Industrial Gases

RARE & SPECIALTY GASES DEPT

## ANALYTICAL REPORT

To: Atlas Welding Supply
1224 6th Street
Berkeley, Ca. 94710

Date Reported: 12/15/86

Reference: 554539-00
Test No.: SC1286019
Po No.: 1492

Material Submitted: Oxygen/Carbon Dioxide/Carbon Monoxide/Nitrogen gas mixture

Information Requested: Ratio Analysis

Method of Analysis: Oxygen Analyzer/Gas Chromatograph

Result of Investigation: Cyl. No.: LL-10512

| Component | Specification | Concentration |
|---|---|---|
| Oxygen | 8 to 10% | 9.08% ± 0.18 |
| Carbon Dioxide | 3 to 4% | 3.42% ± 0.07 |
| Carbon Monoxide | 400 to 500 ppm | 487 ppm ± 10 ppm |
| Nitrogen | Balance | Balance |

By _____
PRINCIPAL GAS ANALYST

"This report states accurately the results of the investigation made upon the materials submitted to the Analytical Laboratory. Every effort has been made to determine objectively, the information requested; HOWEVER, in connection with its rendering of this report, AIRCO shall have no liability in excess of its established charge for the service. Any use of this report or the information contained herein shall be at the sole risk of the user."

AIRCO Industrial Gases

RARE & SPECIALTY GASES DEPT

## ANALYTICAL REPORT

To: Atlas Welding Supply
1224 6th Street
Berkely, CA. 94710

Date Reported: 9/21/87

Reference: PO#3884
SO#558865-00
Test# SC0987082

Material Submitted: Carbon Monoxide, Carbon Dioxide, Oxygen, Nitrogen Gas Mixture

Information Requested: Ratio Analysis

Method of Analysis: Gas Chromatograph, Oxygen Analyzer

Result of Investigation: Cyl# LL438

| Component | Specification | Concentration |
|---|---|---|
| Carbon Monoxide | 4000-5000 ppm | 4555 ppm |
| Carbon Dioxide | 9-11% | 9.69% |
| Oxygen | 3-5% | 4.22% |
| Nitrogen | Balance | Balance |

By _____
PRINCIPAL GAS ANALYST

This report states accurately the results of the investigation made upon the materials submitted to the Analytical Laboratory. The Laboratory has endeavored to use its resources to determine, and to present, the information requested objectively. HOWEVER, such investigation is undertaken and this report is rendered, on the condition that, under no circumstances (including negligence), shall The BOC Group, Inc. have any liability in excess of its established charge for such investigation. There is NO WARRANTY OF FITNESS FOR ANY PURPOSE, and any use of this report or the information contained herein shall be at the sole risk of the user.

GA 3099 D - 4/84
PRTD. IN USA

Industrial Gases
Division of Airco, Inc.
660 North Baldwin Park Blvd.
P.O. Box 1290
City of Industry
California 91749
Telephone: (818) 369-2871

# ANALYTICAL REPORT

To: Atlas Welding Supply
1224 6th Street
Berkeley, CA 94710

Date Reported: 4-30-87

Reference: 309882
467-11859
467-11860

Material Submitted: Four size #082 cylinders containing Nitric Oxide, balance Nitrogen

Information Requested: Certification of Analysis

Method of Analysis: Chemiluminescence

Result of Investigation:

| Component | Cylinder | Specification | Concentration |
|---|---|---|---|
| NO | LL10224 | 700-800 ppm | 748 ppm |
| NO | LL9829 | 700-800 ppm | 751 ppm |
| | | Balance Nitrogen | |
| NO | LL4140 | 60-80 ppm | 69.9 ppm |
| NO | LL10062 | 60-80 ppm | 69.8 ppm |
| | | Balance Nitrogen | |

By John Eucheon
PRINCIPAL GAS ANALYST

"This report states accurately the results of the investigation made upon the materials submitted to the Analytical Laboratory. ...y effort has been made to determine objectively, the information requested; HOWEVER, in connection with its rendering of ...report, AIRCO shall have no liability in excess of its established charge for the service. Any use of this report or the information contained herein shall be at the sole risk of the user."

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IN USA