Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

# Background Report Reference

**AP-42 Section Number:** 3.4

**Background Chapter:** 3

**Reference Number:** 7

**Title:** Environmental Assessment of NOx Control on a Compression Ignition Large Bore Reciprocating Internal Combustion Engine, Volume II: Data Supplement

EPA-600/7-86/001B

US EPA

April 1984

EPA/600/7-86/001B

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Hung

Acurex Technical Report TR-81-81/EE

# ENVIRONMENTAL ASSESSMENT OF $NO_x$ CONTROL ON A COMPRESSION IGNITION LARGE BORE RECIPROCATING INTERNAL COMBUSTION ENGINE

## Volume II
## Data Supplement

AP 42
Sect 3.4


By

C. Castaldini
Acurex Corporation
Energy & Environmental Division
555 Clyde Avenue
P.O. Box 7555
Mountain View, California 94039



April 1984

Acurex Project 7600
Contract No. 68-02-3188

Project Officer
R.E. Hall

Combustion Research Branch
Energy Assessment and Control Division
Industrial Environmental Research Laboratory
Research Triangle Park, North Carolina 27711

INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Acurex Technical Report TR-81-81/EE

# ENVIRONMENTAL ASSESSMENT OF $NO_x$ CONTROL ON A COMPRESSION IGNITION LARGE BORE RECIPROCATING INTERNAL COMBUSTION ENGINE

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# SECTION 1

# INTRODUCTION

The purpose of this Data Supplement is to document data in greater detail than was practical in the technical report for this field test [1]. It is intended to provide sufficient detail for researchers to perform their own analysis of the data obtained. Readers are referred to the technical report for objectives, description of the source emission results, interpretation and conclusions. The data supplement contains the following information in corresponding sections:

2. PRELIMINARY EQUIPMENT CALIBRATION AND TESTS

   Calibration data for the dry gas meters used to sample exhaust gas for both EPA Method 5 and Source Assessment Sampling System (SASS) trains. Exhaust gas velocity traverse data across exhaust duct.

3. ENGINE OPERATING DATA

   Complete operating data of test engine including fuel and airflow, power output and inlet and exhaust temperatures. Data recorded by engine operators (employees of Colt Industries).

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[1]Castaldini, C. "Environmental Assessment of $NO_x$ Control on a Compression Ignition Large Bore Reciprocating Internal Combusion Engine -- Volume I: Technical Results," Acurex Report TR-81-81/EE, April 1984.

4. SAMPLING DATA SHEETS

Emission data obtained with continuous monitoring instrumentation. Operating data tables for EPA Method 5 (for particulate mass emissions), EPA Method 8 (for $SO_2$ and $SO_3$ sampling) and Source Assessment Sampling System (for particulate, trace element and organic sampling).

5. ANALYTICAL LABORATORY RESULTS

Ultimate analysis of lube oil and distillate oil used in the engine. Laboratory analysis reports on particulate emissions by gravimetric analysis; sulfur emissions by turbimetric analysis; trace element emissions by Spark Source Mass Spectrometry (SSMS) and Atomic Absorption Spectroscopy (AAS) analyses; total chromatographable organic (TCO) and gravimetry results (GRAV); infrared (IR) spectra of total sample extracts; determination of organic compounds by Gas Chromatography/Mass Spectrometry (GC/MS); liquid chromatography (LC) separation of selected sample extracts with TCO, GRAV, and IR analysis results for LC fractions; low resolution mass spectrometry (LRMS) analysis results for selected LC fractions and total sample extracts; and biological assay results of exhaust gas samples for both baseline and controlled $NO_x$ tests.

# SECTION 2

# PRELIMINARY EQUIPMENT CALIBRATION AND TESTS

# The Almega Corporation

## PITOT TUBE CORRECTION FACTOR AND CALIBRATION DATA

Probe Description: —

Pitot Tube Type: S TYPE

Identification No.: #4 09 A side numbered

Calibration Date: 4/17/80

Calibrated By: Eric AYNSLEY

WIND TUNNEL SPECIFICATIONS

Type: Plexiglass (Round)

Inside Diameter: 12 inches

Length: 10 feet

Port Locations: 8 feet downstream

Cp std = .99 70°

"A" SIDE CALIBRATION

| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
|---|---|---|---|---|
| 1 | 0.16<br>0.17 | 0.22<br>0.24 | 0.8442<br>0.8332 | |
| 2 | 0.42<br>0.41 | 0.59<br>0.56 | 0.8353<br>0.8471 | |
| 3 | 0.78<br>0.78 | 1.08<br>1.06 | 0.8413<br>0.8492 | |
| | | AVERAGE | .842 | |

"B" SIDE CALIBRATION

| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
|---|---|---|---|---|
| 1 | 0.15<br>0.16 | 0.21<br>0.23 | 0.8417<br>0.8257 | |
| 2 | 0.39<br>0.40 | 0.54<br>0.55 | 0.8413<br>0.8337 | |
| 3 | 0.80<br>0.80 | 1.09<br>1.09 | 0.8534<br>0.8481 | |
| | | AVERAGE | .840 | |

"A" Side Average Deviation =
"B" Side Average Deviation = Must be ≤ 0.01

# The Almega Corporation

## PITOT TUBE CORRECTION FACTOR AND CALIBRATION DATA

Probe Description: /

Pitot Tube Type: S TYPE

Identification No.: #3 11 'A' side numbered

Calibration Date: 4/17/80

Calibrated By: ERIC AMNSLSY

WIND TUNNEL SPECIFICATIONS

Type: Plexiglass (Round)

Inside Diameter: 12 inches

Length: 10 feet

Port Locations: 8 feet downstream

Cp std = .99 70°

| | | "A" SIDE CALIBRATION | | |
|---|---|---|---|---|
| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
| 1 | 0.11<br>0.11 | 0.15<br>0.16 | 0.8477<br>0.8209 | |
| 2 | 0.39<br>0.39 | 0.54<br>0.55 | 0.8418<br>0.8337 | |
| 3 | 0.19<br>0.78 | 1.11<br>1.06 | 0.8352<br>0.8492 | |
| | | AVERAGE | 0.838 | |

| | | "B" SIDE CALIBRATION | | |
|---|---|---|---|---|
| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
| 1 | 0.12<br>0.11 | 0.17<br>0.15 | 0.8317<br>0.8477 | |
| 2 | 0.39<br>0.41 | 0.55<br>0.57 | 0.8337<br>0.8396 | |
| 3 | 0.81<br>0.79 | 1.10<br>1.10 | 0.8495<br>0.8390 | |
| | | AVERAGE | 0.840 | |

"A" Side Average Deviation =

"B" Side Average Deviation = Must be ≤ 0.01

# The Almega Corporation

PITOT TUBE CORRECTION FACTOR AND CALIBRATION DATA

Probe Description:

Pitot Tube Type: S TYPE

Identification No.: #1 #50 Mathe&on Bird

Calibration Date: 4/17/80

Calibrated By: ERIC AYNSLEY

WIND TUNNEL SPECIFICATIONS

Type: Plexiglass (Round)

Inside Diameter: 12 inches

Length: 10 feet

Port Locations: 8 feet downstream

Cp std = .99 @ 70°

"A" SIDE CALIBRATION

| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
|---|---|---|---|---|
| 1 | 0.08<br>0.08 | 0.11<br>0.11 | 0.8443<br>0.8443 | |
| 2 | 0.41<br>0.42 | 0.57<br>0.58 | 0.8396<br>0.8425 | |
| 3 | 0.79<br>0.78 | 1.11<br>1.08 | 0.8352<br>0.8413 | |
| | | AVERAGE | .841 | |

"B" SIDE CALIBRATION

| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
|---|---|---|---|---|
| 1 | 0.05<br>0.11 | 0.11<br>0.15 | 0.8443<br>0.8447 | |
| 2 | 0.40<br>0.40 | 0.56<br>0.55 | 0.8367<br>0.8443 | |
| 3 | 0.78<br>0.80 | 1.10<br>1.10 | 0.8337<br>0.8442 | |
| | | AVERAGE | .841 | |

"A" Side Average Deviation =

"B" Side Average Deviation =

Must be ≤ 0.01

# The Almega Corporation

PITOT TUBE CORRECTION FACTOR AND CALIBRATION DATA

Probe Description: —

Pitot Tube Type: STYLE

Identification No.: #2 #10 A side

Calibration Date: 4/17/80

Calibrated By: ERIC AYNSLEY

WIND TUNNEL SPECIFICATIONS

Type: Plexiglass (Round)

Inside Diameter: 12 inches

Length: 10 feet

Port Locations: 8 feet downstream

Cp std = .99 70°

| | | "A" SIDE CALIBRATION | | |
|---|---|---|---|---|
| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
| 1 | 0.16<br>0.17 | 0.22<br>0.23 | 0.8442<br>0.8511 | |
| 2 | 0.39<br>0.40 | 0.54<br>0.56 | 0.8413<br>0.8367 | |
| 3 | 0.81<br>0.79 | 1.10<br>1.09 | 0.8495<br>0.8428 | |
| | | AVERAGE | .8447 | |

| | | "B" SIDE CALIBRATION | | |
|---|---|---|---|---|
| RUN NO. | $\Delta p_{std}$ (IN. $H_2O$) | $\Delta p_{(s)}$ (IN. $H_2O$) | $Cp_{(s)}$ | DEV. |
| 1 | 0.15<br>0.15 | 0.21<br>0.21 | 0.8367<br>0.8367 | |
| 2 | 0.42<br>0.41 | 0.58<br>0.58 | 0.8425<br>0.8326 | |
| 3 | 0.81<br>0.80 | 1.11<br>1.10 | 0.8457<br>0.8443 | |
| | | AVERAGE | .839 | |

"A" Side Average Deviation =
"B" Side Average Deviation = Must be ≤ 0.01

Date 8-27-79

Flow

Barometric Pressure 29.91

Ambient Temperature 77

Orifice Meter

Orifice Magnehelic

Primary Calibration Meter

Control Module

Operators

Wet Bulb Temperature

187

METER CALIBRATION DATA

| Orifice Manometer $\Delta H_{@}$ (in. wg) | Orifice Magnehelic $\Delta H_c$ (in. wg) | Primary Meter $\Delta H_p$ (in. wg) | Dry Test Meter $P_{cg}$ (in. wg) | Gas Volume Primary Meter $V_p$ (ft³) | Gas Volume Dry Test Meter $V_d$ (ft³) | Temperature: Primary Meter Inlet, $T_{pi}$ (°F) | Primary Meter Outlet, $T_{po}$ (°F) | Primary Meter Avg., $T_{pa}$ (°F) | Dry Test Meter Inlet, $T_{di}$ (°F) | Dry Test Meter Outlet, $T_{do}$ (°F) | Dry Test Meter Avg., $T_{da}$ (°F) | Flow t (min.) | $\alpha$ | $K_o$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 414.890 | 269.758 | | | | | | | | | |
| .80 | =.8 | | | 434.978 | 259.758 | 78 / 78 | 78 / 79 | 78.25 | 77 / 79 | 78 / 78 | 78 | 19.4 | 1.011 | 1.380 |
| | | | | 9.912 | 10.000 | | | | | | | | | |
| 1.80 | =1.8 | | | 454.860 / 444.890 | 279.758 / 269.758 | 76 / 76 | 77 / 78 | 76.75 | 75 / 76 | 76 / 76 | 75.75 | 13.5 | 1.001 | 1.429 |
| | | | | 9.970 | 10.000 | | | | | | | | | |
| 2.82 | =2.8 | | | 464.860 / 454.860 | 289.758 / 279.758 | 77 / 79 | 77 / 78 | 77.75 | 78 / 81 | 76 / 77 | 78 | 10.9 | 1.008 | 1.437 |
| | | | | 10.000 | 10.000 | | | | | | | | | |
| 3.85 | =3.8 | | | 478.837 / 468.837 | 303.000 / 293.000 | 79 / 79 | 79 / 80 | 79.25 | 81 / 83 | 79 / 79 | 80.5 | 9.4 | 1.004 | 1.444 |
| | | | | 10.026 | 10.000 | | | | | | | | | |
| | | | | | | | | | | | | | Average | |

$\alpha$ avg = 1.005

$K_o$ avg = 1.423

Date 11/30/[illegible]
Time 0[illegible]
Barometric Pressure 3[illegible]
Ambient Temperature 6[illegible]

Orifice Meter
Orifice Magnehelic 8117WW38
Primary Calibration Meter 259453
Control Module 520-088

Operators DARMAN
Wet Bulb Temperature

METER CALIBRATION DATA  Orifice plate # 060

| Orifice Manometer $\Delta H_{ref}$ (in. wg) | Orifice Magnehelic $\Delta H_D$ (in. wg) | Primary Meter $\Delta H_p$ (in. wg) | Dry Test Meter $P_{d_1}$ (in. wg) | Gas Volume Primary Meter $V_p$ (ft.³) | Gas Volume Dry Test Meter $V_d$ (ft.³) | Temperature: Primary Meter Inlet $T_{p_1}$ (°F) | Primary Meter Outlet $T_{p_2}$ (°F) | Primary Meter Avg. $T_{p_a}$ (°F) | Dry Test Meter Inlet $T_{d_1}$ (°F) | Dry Test Meter Outlet $T_{d_2}$ (°F) | Dry Test Meter Avg. $T_{d_a}$ (°F) | Time θ (min.) | α | $K_D$ | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .59 | .6 | | | 935.151<br>929.700 | 143.845<br>139.785 | 66<br>66 | 64<br>65 | 65.25 | 63<br>64 | 64<br>63 | 63.5 | 34.0 | 1.004 | .710 | |
| | | | | 14.451 | 14.06 | | | | | | | | | | $K_D$ = .714 |
| 1.6 | 1.6 | | | 950.084<br>935.151 | 158.755<br>143.845 | 66<br>65 | 65<br>65 | 65.25 | 64<br>64 | 64<br>64 | 64.25 | 21.0 | 1.013 | .727 | |
| | | | | 14.933 | 14.910 | | | | | | | | | | α = 1.0[illegible] |
| 2.6 | 2.6 | | | 965.232<br>950.151 | 173.032<br>158.255 | 64<br>72 | 65<br>67 | 67.25 | 63<br>65 | [illegible] | 65.75 | 17.0 | [illegible] | .710 | |
| | | | | 15.081 | 14.777 | | | | | | | | | | |
| 3.6 | 3.6 | | | 980.5[illegible]<br>965.232 | [illegible]<br>173.032 | [illegible]<br>75 | 67<br>68 | 70.25 | 65<br>66 | 65<br>[illegible] | 65.25 | 15.0 | [illegible] | .711 | |
| | | | | 15.65[illegible] | 15.1[illegible] | | | | | | | | | | |
| .59 | .6 | | | 996.188<br>981.137 | 203.061<br>188.2[illegible] | 69<br>[illegible] | 69<br>[illegible] | [illegible] | 65<br>[illegible] | 65<br>[illegible] | 65.50 | 14.0 | [illegible] | 1.293 | |
| | | | | 15.051 | 14.668 | | | | | | | | | | $K_D$ = 1.75[illegible] |
| 1.6 | 1.6 | | | 1011.554<br>996.188 | 218.225<br>203.061 | 69<br>[illegible] | 68<br>68 | 69.75 | 66<br>66 | 66<br>66 | [illegible] | 9.0 | [illegible] | 1.743 | α = 1.037 |
| | | | | 15.366 | 15.144 | | | | | | | | | | |
| 2.61 | 2.6 | | | 26.909<br>11.554 | 233.273<br>218.205 | 73<br>82 | 69<br>70 | 74.0 | 67<br>67 | 66<br>66 | 66.5 | 7.0 | [illegible] | 1.756 | |
| | | | | 15.355 | 15.068 | | | | | | | | | | |
| 3.6 | 3.6 | | | 44.832<br>26.909 | 250.828<br>233.273 | 78<br>84 | 70<br>72 | 76.0 | 67<br>68 | 67<br>67 | 67.25 | 7.0 | 1.116 | 1.741 | |
| | | | | 17.923 | 17.555 | | | | | | | | | | |
| .59 | 6 | | | 62.737<br>44.832 | [illegible]<br>250.828 | 75<br>81 | 71<br>72 | 74.75 | 68<br>69 | 67<br>68 | 68.5 | 7.0 | 1.083 | 3.7[illegible] | 81 |
| | | | | 15.905 | 15.65 | | | | | | | | | | |
| 1.6 | 1.6 | | | 74.914<br>60.737 | 276.515<br>266.498 | 81<br>79 | 72<br>74 | 79.0 | 69<br>70 | 68<br>66 | 68.25 | 4.0 | [illegible] | 2.6[illegible] | 1 α = 1.166 |
| | | | | 14.177 | 14.037 | | | | | | | | | | $K_D$ = 3.589 |
| 2.62 | 2.6 | | | 92.659<br>74.914 | 297.257<br>280.515 | 87<br>92 | 74<br>77 | 82.75 | 70<br>71 | 68<br>68 | 69.25 | 4.0 | .195 | 3.5[illegible] | 3 |
| | | | | 17.745 | 17.744 | | | | | | | | | | |
| 3.6 | 3.6 | | | 107.771<br>92.659 | 313.557<br>297.257 | 90<br>94 | 77<br>78 | 89.75 | 71<br>71 | 68<br>69 | 69.75 | 3.0 | .239 | 3.4[illegible] | 21 |
| | 4.0 | | | 15.132 | 15.298 | | | | | | | | | | |
| | 5.0 | | | | | | | | | | | | | | |

Date 4/19/80
Time 11:00
Barometric Pressure 29.78
Ambient Temperature 72°F

Orifice Meter
Orifice Manometer 4-07250321
Primary Calibration Meter 259453
Control Module 0016

Operators Rehder, Kaufman, Miceli
Wet Bulb Temperature

Orifice Plate # 0009

METER CALIBRATION DATA

| Orifice Manometer $\Delta H_{ref}$ (in. wg.) | Orifice Manometer $\Delta H_o$ (in. wg.) | Primary Meter $\Delta H_p$ (in. wg.) | Dry Test Meter $P_{dg}$ (in. wg.) | Gas Volume Primary Meter $V_p$ (ft.³) | Gas Volume Dry Test Meter $V_d$ (ft.³) | Temperature: Primary Meter Inlet $T_{pi}$ (°F) | Primary Meter Outlet $T_{po}$ (°F) | Primary Meter Avg. $T_{pa}$ (°F) | Dry Test Meter Inlet $T_{di}$ (°F) | Dry Test Meter Outlet $T_{do}$ (°F) | Dry Test Meter Avg. $T_{da}$ (°F) | Time t (min.) | α | $K_o$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.6 | | | 968.107<br>955.594 | 826.451<br>814.100 | 83<br>84 | 84<br>83 | 83.5 | 79<br>79 | 79<br>79 | 79 | 28 | .997 | .691 |
| | 0.4 | | | 12.513 | 12.351 | | | | | | | | | |
| .6 | 1.6 | | | 778.540<br>968.107 | 836.643<br>826.451 | 84<br>87 | 83<br>84 | 84.5 | 77<br>80 | 79<br>79 | 79 | 15 | .991 | .686 |
| | 0.8 | | | 10.435 | 10.192 | | | | | | | | | |
| | 2.6 | | | 973.301<br>978.542 | 851.973<br>836.643 | 87<br>89 | 84<br>85 | 86 | 80<br>80 | 79<br>80 | 80 | 17 | .996 | .680 |
| | 1.2 | | | 14.759 | 14.450 | | | | | | | | | |
| | 3.6 | | | 1016.400<br>973.301 | 863.708<br>851.973 | 87<br>85 | 85<br>84 | 85 | 80<br>80 | 80<br>80 | 80 | 13 | .996 | .671 |
| | 1.6 | | | 13.099 | 12.815 | | | | | | | | | |
| | .6 | | | 1021.791<br>1016.400 | 878.752<br>863.708 | 88<br>85 | 85<br>84 | 86 | 80<br>79 | 80<br>79 | 79.5 | 13 | .997 | .930 |
| | 2.0 | | | 15.371 | 15.044 | | | | | | | | | |
| 31 | .6 | | | 1037.515<br>1021.791 | 894.382<br>878.752 | 88<br>87 | 85<br>86 | 88 | 80<br>80 | 80<br>80 | 80 | 9 | .999 | 1.748 |
| | 2.4 | | | 15.744 | 15.430 | | | | | | | | | |
| | 2.6 | | | 1055.312<br>1037.515 | 911.777<br>894.382 | 95<br>102 | 87<br>88 | 93 | 80<br>80 | 80<br>80 | 80 | 8 | 1.001 | .744 |
| | 2.8 | | | 17.797 | 17.395 | | | | | | | | | |
| | 3.6 | | | 1065.658<br>1055.312 | 921.834<br>911.777 | 101<br>105 | 88<br>90 | 96 | 80<br>81 | 80<br>80 | 80 | 4 | 1.015 | .723 |
| | 3.2 | | | 10.346 | 10.107 | | | | | | | | | |
| | 3.4 | | | | | | | | | | | | | |
| 2 | 1.6 | | | 1088.974<br>1072.237 | [illegible] | 94<br>102 | 90<br>91 | 96 | 81<br>81 | 81<br>81 | 81 | 3 | [illegible] | [illegible] |
| | 3.8 | | | 11.737 | [illegible] | | | | | | | | | |
| 3 | 2.6 | | | 1103.318<br>1088.974 | 938.845<br>924.722 | 104<br>105 | 92<br>92 | 99 | 81<br>81 | 81<br>81 | 81 | 3.5 | 1.031 | 3.771 |
| | 4.2 | | | 14.344 | 14.125 | | | | | | | | | |
| 3 1 | .6 | | | 1077.897<br>1065.658 | 933.185<br>921.881 | 99<br>102 | 89<br>90 | 95 | 81<br>81 | 80<br>80 | 80.5 | 5 | 1.031 | 3.716 |
| | 4.6 | | | 11.579 | 11.304 | | | | | | | | | |
| 4 | 3.6 | | | 1113.626<br>1103.318 | 949.581<br>938.845 | 109<br>110 | 97<br>96 | 102 | 82<br>82 | 82<br>81 | 80 | 2 | 1.031 | 3.437 |
| | 5.0 | | | 10.308 | 10.013 | | | | | | | | | |
| | | | | | | | | | | | | | Average | |

α .995
$K_o$ .694
α 1.003
$K_o$ 1.786
α 1.020
$K_o$ 3.579

Date 4/17/80
Time 1100
Barometric Pressure 29.80
Ambient Temperature 65°F

Orifice Meter 42 C 274
Orifice Manometer 0032 3MH63
Primary Calibration Meter 259453
Control Module 0038

Operator Rauhmann
Wet Bulb Temperature

Orifice plate # 0038

## METER CALIBRATION DATA

| Orifice Manometer $\Delta H_{ref}$ (in. wg.) | Orifice Manometer $\Delta H_0$ (in. wg.) | Primary Meter $\Delta H_p$ (in. wg.) | Dry Test Meter $P_{dg}$ (in. wg.) | Gas Volume Primary Meter $V_p$ (ft.³) | Gas Volume Dry Test Meter $V_d$ (ft.³) | Temperature: Primary Meter Inlet $T_{pi}$ (°F) | Primary Meter Outlet $T_{po}$ (°F) | Primary Meter Avg. $T_{pa}$ (°F) | Dry Test Meter Inlet $T_{di}$ (°F) | Dry Test Meter Outlet $T_{do}$ (°F) | Dry Test Meter Avg. $T_{da}$ (°F) | Time t (min.) | α | $K_0$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .6 | | | 492.198<br>492.500 | 556.948<br>547.043 | 67<br>68 | 66<br>67 | 67 | 67<br>67 | 65<br>67 | 67 | 20 | .997 | .764 |
| | 0.4 | | | 9.998 | 9.905 | | | | | | | | | |
| | 1.6 | | | 492.965<br>492.198 | 567.801<br>556.948 | 69<br>75 | 67<br>68 | 69 | 68<br>68 | 67<br>67 | 68 | 15 | .998 | .739 |
| | 0.8 | | | 10.787 | 10.653 | | | | | | | | | |
| | 2.6 | | | 516.613<br>509.985 | 581.071<br>567.667 | 73<br>76 | 68<br>69 | 72 | 69<br>69 | 68<br>68 | 69 | 15 | 1.000 | .732 |
| | 1.2 | | | 13.628 | 13.464 | | | | | | | | | |
| | 3.6 | | | 530.583<br>516.613 | 596.806<br>581.071 | 77<br>69 | 73<br>72 | 75 | 69<br>70 | 68<br>69 | 69 | 15 | 1.007 | .728 |
| | 1.6 | | | 15.950 | 15.735 | | | | | | | | | |
| | .6 | | | 551.130<br>533.563 | 615.779<br>596.807 | 70<br>75 | 70<br>70 | 71 | 70<br>70 | 70<br>70 | 70 | 17 | .993 | 1.855 |
| | 2.0 | | | 19.168 | 18.972 | | | | | | | | | |
| | 1.6 | | | 565.465<br>551.130 | 649.138<br>615.779 | 81<br>92 | 78<br>72 | 82 | 70<br>71 | 70<br>71 | 71 | 16 | [redacted] | 1.860 |
| | 2.4 | | | 33.731 | 33.419 | | | | | | | | | |
| | 2 | | | 609.114<br>585.462 | 672.394<br>649.138 | 88<br>95 | 76<br>78 | 84 | 72<br>73 | 71<br>71 | 72 | 10 | .999 | 1.866 |
| | 2.8 | | | 23.652 | 23.256 | | | | | | | | | |
| | 3.6 | | | 628.185<br>609.114 | 697.314<br>672.394 | 73<br>85 | 73<br>74 | 76 | 70<br>71 | 70<br>71 | 71 | 7 | 1.003 | 1.866 |
| | 3.2 | | | 19.019 | 18.920 | | | | | | | | | |
| | .6 | | | 653.673<br>628.133 | 717.515<br>697.314 | 80<br>88 | 77<br>76 | 80 | 71<br>71 | 71<br>71 | 71 | 11 | 1.005 | 3.711 |
| | 3.6 | | | 26.539 | 26.201 | | | | | | | | | |
| | 2.6 | | | 680.972<br>654.673 | 743.186<br>717.515 | 84<br>86 | 76<br>80 | 84 | 72<br>74 | 71<br>72 | 72 | 7 | 1.017 | 3.774 |
| | 4.0 | | | 25.920 | 25.671 | | | | | | | | | |
| | 2.6 | | | 703.637<br>680.972 | 766.980<br>743.186 | 94<br>100 | 80<br>83 | 89 | 74<br>76 | 72<br>72 | 74 | 5 | 1.020 | 3.654 |
| | 4.4 | | | 23.045 | 22.894 | | | | | | | | | |
| | 3.6 | | | 730.086<br>703.637 | 792.556<br>766.980 | 91<br>103 | 83<br>86 | 92 | 76<br>78 | 73<br>73 | 75 | 5 | 1.044 | 3.541 |
| | 4.8 | | | 26.449 | 26.476 | | | | | | | | | |
| | 5.0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | Average | |

α = 0.999

$K_0$ = 0.741

α = 1.005

$K_0$ = 1.860

α 1.024

$K_0$ = 3.719

# TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT Colt - Beloit, Ws.
DATE 4-21-80
SAMPLING LOCATION Diesel Stack
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE A) See Schematic
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE, (DISTANCE B) " "
STACK I.D., (DISTANCE A - DISTANCE B) 15.375 avg.
NEAREST UPSTREAM DISTURBANCE 2.34 diam.
NEAREST DOWNSTREAM DISTURBANCE 3.90 diam.
CALCULATOR DaRos

SAME AS 4-21-80
DATA
(DIESEL ENGINE STACK)

SCHEMATIC OF SAMPLING LOCATION

| TRAVERSE POINT NUMBER | FRACTION OF STACK I.D. | INCH. STACK I.D. | PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH) | DISTANCE B | TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5) |
|---|---|---|---|---|---|
| 1 | | 15.375 | ~~.22~~ 1.0 | | |
| 2 | | | ~~.68~~ 1.0 | | |
| 3 | | | 1.15 | | |
| 4 | | | 1.68 | | |
| 5 | | | 2.24 | | |
| 6 | | | 2.90 | | |
| 7 | | | 3.63 | | |
| 8 | | | 4.60 | | |
| 9 | | | 5.87 | | |
| 10 | | | 9.50 | | |
| 11 | | | 10.82 | | |
| 12 | | | 11.75 | | |
| 13 | | | 12.45 | | |
| 14 | | | 13.13 | | |
| 15 | | | 13.70 | | |
| 16 | | | 14.20 | | |
| 17 | | | ~~14.70~~ 14.375 | | |
| 18 | | 15.375 | ~~15.10~~ 14.375 | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |

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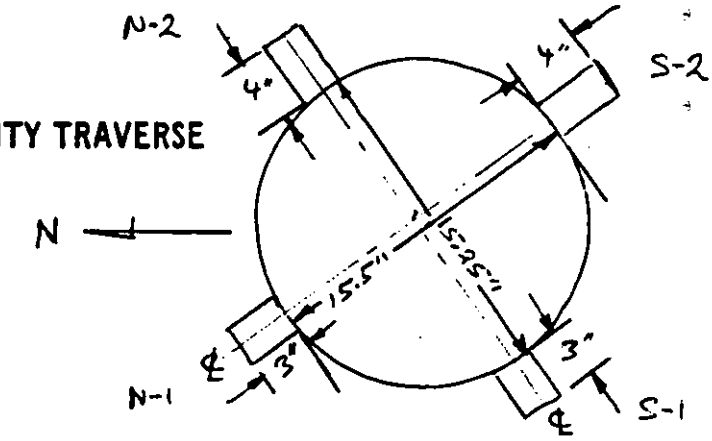
# PRELIMINARY VELOCITY TRAVERSE

PLANT Colt - Beloit, Ws
DATE 4-21-80
LOCATION Diesel - Stack - Baseline
STACK I.D. 15.375" average
BAROMETRIC PRESSURE, in. Hg 29.18
STACK GAUGE PRESSURE, in. $H_2O$ + 3.0 (29.70)
OPERATORS DaRos, Kaufmann




SCHEMATIC OF TRAVERSE POINT LAYOUT

PORT S-1

START: 1515 STOP: 1525

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| 1 | 2.8 | ~~515~~ 600 |
| 2 | 2.8 | ~~515~~ 600 |
| 3 | 4.0 | 605 |
| 4 | 4.4 | 605 |
| 5 | 5.2 | 615 |
| 6 | 5.2 | 615 |
| 7 | 5.5 | 620 |
| 8 | 6.3 | 625 |
| 9 | 6.9 | 630 |
| 10 | 6.8 | 630 |
| 11 | 7.4 | 630 |
| 12 | 7.2 | 630 |
| 13 | 7.2 | 625 |
| 14 | 7.2 | 620 |
| 15 | 6.6 | 620 |
| 16 | 6.8 | 620 |
| 17 | 6.5 | 620 |
| 18 | 6.5 | 620 |
| | 105.3 | |
| | | |
| $\Sigma\sqrt{43.14}$ | | |
| | | |
| Avg $\sqrt{\Delta P}$ 2.397 | | |
| AVERAGE | 5.85 | 618 |

PORT N-1

START: 1535 STOP: 1540

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| 1 | 4.5 | 600 |
| | 4.5 | 600 |
| | 5.0 | 615 |
| | 5.5 | 615 |
| | 5.7 | 620 |
| | 6.5 | 620 |
| | 7.0 | 615 |
| | 6.3 | 615 |
| | 7.1 | 625 |
| | 7.1 | 625 |
| | 6.8 | 625 |
| | 6.3 | 625 |
| | 6.3 | 625 |
| | 6.0 | 625 |
| | 5.7 | 620 |
| | 5.6 | 620 |
| | 5.7 | 620 |
| 18 | 5.7 | 620 |
| | 107.3 | |
| | | |
| $\Sigma\sqrt{43.852}$ | | |
| | | |
| Avg $\sqrt{\Delta P}$ 2.44 | | |
| AVERAGE | 5.96 | 618 |



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Pitot Tube I.D. = No 10. Ambient Temp. = 75°F
Cp = Side A .84 Side B .84

# PRELIMINARY VELOCITY TRAVERSE

PLANT Colt -- Beloit, WS
DATE 4-23-80
LOCATION Diesel - Stack Controlled
STACK I.D. 15.375" avg
BAROMETRIC PRESSURE, in. Hg 29.18 @ 0900
STACK GAUGE PRESSURE, in. $H_2O$ +3.2 [29.42]
OPERATORS Kaufmann, Rehder

SAME AS 4-21-80 DATA
(DEISEL ENGINE STACK)

PORT S-1

START: 0945

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| | 5.3 | 580 |
| | 4.8 | 580 |
| | 5.5 | 595 |
| | 6.2 | 600 |
| | 6.7 | 600 |
| | 6.8 | 600 |
| | 6.7 | 600 |
| | 8.3 | 610 |
| | 8.5 | 610 |
| | 8.1 | 610 |
| | 7.6 | 605 |
| | 8.6 | 605 |
| | 7.5 | 605 |
| | 7.5 | 605 |
| | 6.8 | 605 |
| | 7.7 | 605 |
| | 7.4 | 605 |
| | 7.0 | 605 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| AVERAGE | 7.05 | 601.4 |

SCHEMATIC OF TRAVERSE POINT LAYOUT

PORT N-1

STOP: 1010

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| | 5.1 | 590 |
| | 5.3 | 590 |
| | 5.1 | 585 |
| | 5.2 | 590 |
| | 6.0 | 600 |
| | 6.2 | 600 |
| | 6.3 | 600 |
| | 7.2 | 605 |
| | 7.4 | 605 |
| | 8.0 | 608 |
| | 8.3 | 608 |
| | 8.4 | 603 |
| | 7.6 | 605 |
| | 7.7 | 600 |
| | 7.5 | 603 |
| | 6.7 | 600 |
| | 7.0 | 600 |
| | 7.1 | 600 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| AVERAGE | 6.78 | 599.5 |
| | 6.92 | 600. |

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## SECTION 3

## ENGINE OPERATING DATA

Complete engine operating data were recorded during the duration of both the baseline and low-$NO_x$ tests. These field data appear in the following data sheets. The Method 8 baseline test for sulfate emissions was not done concurrent to the Method 5 particulate, hydrocarbon, and SASS tests because of sampling equipment malfunctions. That is why a separate set of engine data logs are provided for the baseline Method 8 test and not for the low-$NO_x$ test. Engine operating data during both runs at baseline condition were different slightly in load and combustion air flow. Changes in combustion air flow were caused by changes in inlet engine air temperature which varied from an average of 305 K (89°F) during the first baseline test to 281 K (46°F) during the second baseline test or Method 8 test. The cooler temperature of inlet combustion air resulted in an 8-percent increase in combustion air flow.

BF-4173C

| | |
|---|---|
| Ignition or Injection Timing | ~~29.9~~ CS 35.8° |
| Comp. Ratio | ~~[illegible]~~ OCS 36.15° |
| Gas Cam Timing | 137° BTDC @ .001 LFT |
| Cranked | 18° CL |
| K. W. Mtr. Constant | 1200 |
| Mobil Gard 446 #2 Shop | |

TEST LOG
EXPERIMENTAL DEPT.

LOG NO. 4534
DATE: 4-22-80

POWER PARTS
C. RING
LINERS
PISTONS
SPECIAL

TEST: Emissions Baseline Diesel
ENGINE: E-6 8½x10 Turbo ENGINE NO. 87247

| Line No. | Time & Shift | Hour Meter Add 29400 | ENGINE POWER OUTPUT: RPM 900 | Sec. for 20 Turns (KW) | KW Meter % Reg. | Alt. KW Output | Alt. Eff. % | BHP | % Load | #1 Pump Rack C.S / D.C.S | MISCELLANEOUS: Room Temp. | Corrected Barometer | C.C. Vacuum | Gov. Load Limit | ENGINE AIR Press. In HG: Air Receiver | Press. In H.O.: Blower Suction | Temp. °F: Air Inlet | Temp. °F: Air Receiver | ENGINE H. O. PSIG: Pump Disch. | Temp. °F: To Engine | Temp. °F: From Engine | ENGINE LU Press.-PSIG: Pump Disch. | To Strainer | To Engine | Upper Header |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | @ 0720 | HRS. | START- | WARMING- | | | | | @ 0735 | | HRS. | OIL-LINE | | | 100% | Diesel | MODE. | ADVANCED | Timing | To get | 135 | | | | |
| 2 | 0815 | 32.7 | 900 | 57.4 | 99.8 | 1508 | 96.0 | 2105 | 100.25 | 99.5 | 97 | 29.04 | 1.6 | R.S. | 22.21 | 19.9 | | 147 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 3 | @ 0845 | HRS. | Removed | LOAD- | EVEN- | STOPPED | | | | | ENG. | TO | CHECK | ENG. | Timing. | | | C.S = | 35.8 | | 0 | CS = | 36.15 | | Out |
| 4 | up | Pu. | Ps | - 0937 | - 22 | 403.1 | | | START | | - @ | 0945 | - ON- | LINE | 100% | Diesel. | | | | | | | | | |
| 5 | 1154 | 85.4 | 900 | 57.83 | 99.8 | 1497 | 96.0 | 2090 | 99.5 | 99.6 | 106 | 28.92 | 1.5 | R.S. | 21.44 | 19.1 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 35 |
| 6 | 1330 | 87.0 | 900 | 57.38 | 99.8 | 1509 | 96.0 | 2106 | 100.28 | 99.6 | 107 | 28.87 | 1.5 | R.S. | 22.11 | 19.8 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.8 |
| 7 | 1400 | 87.5 | 900 | 57.75 | 99.8 | 1499 | 96.0 | 2092 | 99.64 | 99.6 | 109 | 28.86 | 1.5 | R.S. | 21.64 | 19.26 | | 151 | 44 | 157 | 161 | 59 | 43 | 42 | 34.8 |
| 8 | 1430 | 88.0 | 900 | 57.95 | 99.8 | 1494 | 96.0 | 2085 | 99.3 | 99.6 | 107 | 28.84 | 1.4 | R.S. | 21.44 | 19.09 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 9 | 1500 | 88.5 | 900 | 57.72 | 99.8 | 1499 | 96.0 | 2094 | 99.69 | 99.6 | 106 | 28.84 | 1.5 | RS | 21.45 | 19.1 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 10 | 1530 | 89.0 | 900 | 57.88 | 99.8 | 1496 | 96.0 | 2088 | 99.42 | 99.6 | 108 | 28.83 | 1.5 | RS | 21.5 | 19.15 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 11 | 1555 | 89.4 | 900 | 57.9 | 99.8 | 1495 | 96.0 | 2089 | 99.38 | 99.6 | 110 | 28.82 | 1.5 | RS | 21.48 | 19.13 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 12 | 1625 | 89.9 | 900 | 57.89 | 99.8 | 1495 | 96.0 | 2087 | 99.4 | 99.5 | 112 | 28.81 | 1.4 | RS | 21.47 | 19.08 | | 149 | 44 | 157 | 161 | 59 | 43 | 41.9 | 34.9 |
| 13 | 1655 | 90.4 | 900 | 57.91 | 99.8 | 1495 | 96.0 | 2087 | 99.37 | 99.4 | 113 | 28.80 | 1.3 | RS | 21.44 | 19.05 | | 149 | 44 | 157 | 161 | 59 | 43 | 41.9 | 34.9 |
| 14 | 1725 | 90.9 | 900 | 57.98 | 99.8 | 1493 | 96.0 | 2084 | 99.24 | 99.4 | 110 | 28.80 | 1.5 | RS | 21.45 | 19.09 | | 149 | 44 | 157 | 161 | 59 | 43 | 41.9 | 34.9 |
| 15 | 1755 | 91.4 | 900 | 57.94 | 99.8 | 1494 | 96.0 | 2086 | 99.3 | 99.4 | 109 | 28.80 | 1.4 | RS | 21.55 | 19.15 | | 148 | 44 | 157 | 161 | 59 | 43 | 41.9 | 34.9 |
| 16 | 1825 | 91.9 | 900 | 58.0 | 99.8 | 1493 | 96.0 | 2083 | 99.2 | 99.4 | 106 | 28.81 | 1.4 | RS | 21.66 | 19.36 | | 148 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 17 | 1855 | 92.4 | 900 | 57.04 | 99.8 | 1518 | 96.0 | 2119 | 100.88 | 99.4 | 106 | 28.82 | 1.3 | RS | 22.18 | 19.8 | | 148 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 18 | 1925 | 92.9 | 900 | 56.99 | 99.8 | 1519 | 96.0 | 2120 | 100.97 | 99.4 | 104 | 28.82 | 1.3 | RS | 22.25 | 19.93 | | 149 | 44 | 157 | 161 | 59 | 43 | 41.9 | 34.9 |
| 19 | 1955 | 93.4 | 900 | 56.83 | 99.8 | 1523 | 96.0 | 2126 | 101.3 | 99.4 | 102 | 28.83 | 1.3 | RS | 22.45 | 20.16 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 20 | 2020 | 93.8 | 900 | 56.92 | 99.8 | 1521 | 96.0 | 2123 | 101.09 | 99.4 | 102 | 28.84 | 1.3 | RS | 22.55 | 20.25 | | 149 | 44 | 157 | 161 | 59 | 43 | 42 | 34.9 |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | | |

19368 H.A.K.

| OIL | | | FUEL OIL | | | | | | NATURAL GAS FUEL | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp. °F | | | PSIG | | | | | | Press. "HG | | Temp. | | | | | | | | Press.-PSIG | | | | |
| To Engine | From Engine | Level in C.C. | Fuel Header | Sec. For Lbs. of Fuel | Fuel Cans Lbs./Hr. | Fuel Rate Lbs./BHP-Hr. | Corrected 19350 LB/BHP/HR | Fuel Rate BTU/BHP-Hr. | Meter Inlet | Meter Inlet ABS | Meter Inlet °F | Meter Inlet ABS °B | Sec. for Ft.³ Gas | Ft.³/Hr. @ Std. Temp. & Press. | Gas Heat Value BTU/Ft.³ | Gas Consumption BTU/Hr. x 10³ | Specific Gas Fuel Rate BTU/BHP-Hr. | Total Specific Fuel Rate BTU/BHP-Hr. | Supply To Engine | Cell Hdr. | Engine Hdr. | | | Line No. |
| | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 165 | 185 | -51 | 16.6 | 233.2 | 771.8 | .3666 | .3670 | | | | | | | | | | | | | | | | | 3 |
| | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 168 | 187 | -50 | 16.4 | 232.72 | 773.4 | .3700 | .3704 | | | | | | | | | | | | | | | | | 6 |
| 168 | 188 | -48 | 16.4 | 231.56 | 777.3 | .3691 | .3694 | | | | | | | | | | | | | | | | | 7 |
| 168 | 189 | -48 | 16.3 | 232.37 | 774.6 | .3702 | .3706 | | | | | | | | | | | | | | | | | 8 |
| 168 | 188 | -50 | 16.0 | 232.39 | 771.6 | .3715 | .3718 | | | | | | | | | | | | | | | | | 9 |
| 168 | 188 | -52 | 16.3 | 232.46 | 774.2 | .3698 | .3701 | | | | | | | | | | | | | | | | | 10 |
| 168 | 188 | -53 | 16.3 | 232.57 | 774.0 | .3707 | .371 | | | | | | | | | | | | | | | | | 11 |
| 168 | 188 | -51 | 16.3 | 233.18 | 771.9 | .3689 | .3702 | | | | | | | | | | | | | | | | | 12 |
| 168 | 188 | -50 | 16.5 | 233.3 | 771.5 | .3697 | .370 | | | | | | | | | | | | | | | | | 13 |
| 168 | 188 | -50 | 16.5 | 233.35 | 771.4 | .3696 | .3699 | | | | | | | | | | | | | | | | | 14 |
| 168 | 188 | -54 | 16.4 | 232.56 | 773 | .3709 | .3713 | | | | | | | | | | | | | | | | | 15 |
| 168 | 188 | -52 | 16.0 | 233.25 | 771.7 | .3699 | .3703 | | | | | | | | | | | | | | | | | 16 |
| 168 | 188 | -56 | 16.5 | 232.32 | 774.8 | .3719 | .3723 | | | | | | | | | | | | | | | | | 17 |
| 168 | 188 | -56 | 16.3 | 231.24 | 778.4 | .3673 | .3677 | | | | | | | | | | | | | | | | | 18 |
| 168 | 188 | -57 | 16.4 | 230.58 | 780.6 | .3682 | .3686 | | | | | | | | | | | | | | | | | 19 |
| 168 | 188 | -58 | 16.4 | 230.65 | 780.3 | .3670 | .3674 | | | | | | | | | | | | | | | | | 20 |
| 168 | 188 | -59 | 16.4 | 230.79 | 779.9 | .3674 | .3677 | | | | | | | | | | | | | | | | | 21 |
| | | | | | | | | | | | | | | | | | | | | | | | | 22 |
| | | | | | | | | | | | | | | | | | | | | | | | | 23 |
| | | | | | | | | | | | | | | | | | | | | | | | | 24 |
| | | | | | | | | | | | | | | | | | | | | | | | | 25 |
| | | | | | | | | | | | | | | | | | | | | | | | | 26 |
| | | | | | | | | | | | | | | | | | | | | | | | | 27 |
| | | | | | | | | | | | | | | | | | | | | | | | | 28 |
| | | | | | | | | | | | | | | | | | | | | | | | | 29 |
| | | | | | | | | | | | | | | | | | | | | | | | | 30 |
| | | | | | | | | | | | | | | | | | | | | | | | | 31 |
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| Line No. | TURBO RPM C.S. | TURBO RPM O.C.S. | COMPRESSOR AIR Pressure To Comp In 120 C.S. PSI | COMPRESSOR AIR Pressure To Comp In 120 O.C.S. | COMPRESSOR AIR Pressure From Comp. In PSI C.S. PSI | COMPRESSOR AIR Pressure From Comp. In PSI O.C.S. | COMPRESSOR AIR Temp. °F Inlet | COMPRESSOR AIR Temp. °F From Comp. C.S. | COMPRESSOR AIR Temp. °F From Comp. O.C.S. | BLOWER Disch PSI | BLOWER Suct T | BLOWER Disch °F | WATER Temps. °F From Turbo. C.S. | WATER Temps. °F From Turbo. O.C.S. | WATER Temps. °F Air Cooler In | WATER Temps. °F Air Cooler Out | LUBE OIL PSIG Turbo. Inlet | LUBE OIL Temp. °F From Turbo. C.S. | LUBE OIL Temp. °F From Turbo. O.C.S. | TURBINE EXHAUST Press. "HG To C.S. | TURBINE EXHAUST Press. "HG To O.C.S. | TURBINE EXHAUST Temp. °F To C.S. | TURBINE EXHAUST Temp. °F To O.C.S. | TURBINE EXHAUST From Turbine | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 17700 | | 21.7 | | 20.12 | | 76 | 281 | | 22.34 | 122 | 146 | 163 | | 58 | 76 | 28 | 210 | | 17.4 | | | | 669 | 809 |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 17625 | | 21.4 | | 19.35 | | 92 | 294 | | 21.57 | 124 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.76 | | | | 690 | 831 |
| 6 | 17750 | | 22.3 | | 20.14 | | 82 | 287 | | 22.29 | 124 | 148 | 164 | | 58 | 77 | 27.5 | 213 | | 17.39 | | | | 679 | 822 |
| 7 | 17700 | | 21.6 | | 19.56 | | 92 | 297 | | 21.79 | 125 | 150 | 165 | | 58 | 77 | 27.5 | 212 | | 16.95 | | | | 693 | 835 |
| 8 | 17700 | | 21.7 | | 19.36 | | 92 | 295 | | 21.6 | 124 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 693 | 829 |
| 9 | 17750 | | 21.7 | | 19.41 | | 93 | 296 | | 21.67 | 125 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 691 | 828 |
| 10 | 17750 | | 21.1 | | 19.45 | | 93 | 296 | | 21.7 | 125 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.85 | | | | 691 | 829 |
| 11 | 17750 | | 21.3 | | 19.42 | | 93 | 296 | | 21.65 | 124 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 691 | 828 |
| 12 | 17750 | | 21.4 | | 19.4 | | 93 | 296 | | 21.65 | 124 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 691 | 831 |
| 13 | 17750 | | 21.4 | | 19.35 | | 92 | 294 | | 21.62 | 124 | 149 | 164 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 691 | 830 |
| 14 | 17750 | | 21.5 | | 19.4 | | 91 | 293 | | 21.68 | 123 | 149 | 165 | | 58 | 77 | 27.5 | 212 | | 16.8 | | | | 689 | 829 |
| 15 | 17750 | | 21.2 | | 19.46 | | 90 | 292 | | 21.73 | 123 | 148 | 164 | | 58 | 77 | 27.5 | 212 | | 16.85 | | | | 687 | 828 |
| 16 | 17750 | | 21.3 | | 19.58 | | 88 | 290 | | 21.86 | 123 | 148 | 164 | | 58 | 76 | 27.5 | 211 | | 16.94 | | | | 685 | 822 |
| 17 | 17750 | | 21.6 | | 20.15 | | 86 | 292 | | 22.35 | 124 | 149 | 165 | | 58 | 77 | 27.5 | 212 | | 17.38 | | | | 686 | 827 |
| 18 | 17750 | | 22.4 | | 20.34 | | 84 | 290 | | 22.45 | 124 | 149 | 165 | | 58 | 77 | 27.5 | 212 | | 17.46 | | | | 683 | 824 |
| 19 | 17750 | | 22.4 | | 20.49 | | 80 | 287 | | 22.61 | 125 | 149 | 164 | | 60 | 79 | 27.5 | 213 | | 17.61 | | | | 679 | 821 |
| 20 | 17775 | | 21.8 | | 20.56 | | 79 | 286 | | 22.7 | 126 | 150 | 164 | | 60 | 80 | 27.5 | 212 | | 17.65 | | | | 676 | 821 |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 34 | | | | | | | | | | | | | | | | | | | | | | | | | |

SHIFT: 0700-1500 DATE: 4-22-80 TESTER: MASON HR. MTR 22481.8 K.W. MTR 29145 F.O. MTR. 0270999

REMARKS:

SHIFT: 1500-2300 DATE: 4-22-80 TESTER: [illegible]

REMARKS:

| CYLINDER TEMP. °F 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | PD 10 PSI | IN 11 °F | OUT 12 °F | 123 Combined Exhaust | 456 Combined Exhaust | ~~789~~ 1-6 Combined Exhaust | 10-11-12 Combined Exhaust | Back Press. | Color | BOSCH | | AIR FLOW INLET °F | INLET H2O | ΔP H2O | MM/MIN | F/A RATIO | FOLL Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 816 | 756 | 870 | 898 | 794 | | | | 30 | 75 | 88 | 859 | 906 | 883 | | 8.1 | | .4 | | 76 | 4.8 | 9.8 | 544.5 | .02362 | 2 |
| | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| | | | | | | | | | | | | | | | | | | | 91 | | | | | 4 |
| 831 | 778 | 884 | 923 | 824 | | | | 32 | 85 | 97 | 885 | 922 | 904 | | 8.10 | | .5 | | 91 | 5.0 | 9.6 | 530.3 | .02493 | 5 |
| 834 | 779 | 876 | 906 | 812 | | | | 32 | 86 | 98 | 874 | 914 | 894 | | 8.2 | | .45 | | 91 | 5.13 | 10.1 | 543.3 | .02384 | 6 |
| 845 | 794 | 891 | 926 | 827 | | | | 32 | 87 | 99 | 888 | 931 | 910 | | 7.9 | | .60 | | 93 | 5.1 | 9.8 | 534.2 | .02416 | 7 |
| 831 | 789 | 887 | 928 | 829 | | | | 32 | 87 | 99 | 886 | 927 | 907 | | 7.8 | | .60 | | 93 | 5.1 | 9.8 | 534.0 | .02417 | 8 |
| 831 | 790 | 883 | 929 | 829 | | | | 32 | 87 | 99 | 885 | 926 | 906 | | 7.8 | | .60 | | 94 | 5.1 | 9.8 | 533.6 | .02419 | 9 |
| 832 | 789 | 885 | 929 | 829 | | | | 32 | 87 | 99 | 887 | 926 | 907 | | 8.2 | | .60 | | 94 | 5.0 | 9.8 | 533.5 | .02418 | 10 |
| 830 | 786 | 883 | 928 | 828 | | | | 32 | 87 | 100 | 886 | 925 | 906 | | 7.9 | | .60 | | 94 | 5.0 | 9.6 | 528.8 | .02437 | 11 |
| 834 | 788 | 884 | 926 | 830 | | | | 32 | 88 | 100 | 888 | 925 | 907 | | 8.6 | | .40 | | 94 | 5.1 | 9.7 | 530.6 | .02424 | 12 |
| 834 | 789 | 887 | 926 | 832 | | | | 32 | 88 | 100 | 887 | 926 | 907 | | 8.4 | | .40 | | 93 | 5.1 | 9.6 | 528.2 | .02434 | 13 |
| 831 | 787 | 883 | 921 | 830 | | | | 32 | 88 | 100 | 886 | 922 | 905 | | 7.6 | | .55 | | 92 | 5.1 | 9.8 | 534.2 | .02412 | 14 |
| 833 | 788 | 880 | 919 | 828 | | | | 32 | 88 | 100 | 884 | 920 | 903 | | 8.1 | | .60 | | 92 | 5.0 | 9.7 | 531.5 | .02422 | 15 |
| 827 | 781 | 879 | 916 | 823 | | | | 32 | 88 | 100 | 880 | 918 | 900 | | 7.8 | | .60 | | 90 | 4.9 | 9.6 | 529.9 | .02437 | 16 |
| 833 | 784 | 882 | 918 | 826 | | | | 32 | 88 | 100 | 885 | 921 | 903 | | 8.6 | | .59 | | 88 | 5.3 | 9.9 | 538.9 | .02407 | 17 |
| 830 | 780 | 877 | 917 | 824 | | | | 32 | 88 | 100 | 882 | 918 | 901 | | 8.4 | | .65 | | 85 | 5.3 | 10.0 | 543.0 | .02396 | 18 |
| 827 | 778 | 876 | 911 | 821 | | | | 32 | 89 | 101 | 879 | 915 | 898 | | 8.2 | | .50 | | 82 | 5.3 | 10.0 | 544.7 | .02388 | 19 |
| 828 | 779 | 870 | 907 | 832 | | | | 32 | 90 | 102 | 877 | 912 | 895 | | 8.2 | | .55 | | 80 | 5.4 | 10.1 | 548.3 | .0237 | 20 |
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HR. MTR. 22485 K.W. MTR. 3453 F.O. MTR. 027715

SHIFT: 2300 DATE: TESTER: HR. MTR. K.W. MTR. F.O. MTR.

REMARKS:

BF-4173C

| | |
|---|---|
| Ignition or Injection Timing | 35.9 C.S. |
| Comp. Ratio | 35.9 O.C.S. |
| Gas Cam Timing | 137° BIDC @ .020 LIFT |
| Crankled | 18" LL |
| K. W. Mtr. Constant | 1200 |
| MOBIL GAURD 446 | |
| #2 Shop F/O | |

TEST LOG
EXPERIMENTAL DEPT.

LOG NO. 4536
DATE: 4-24-80

POWER PARTS
C. RING
LINERS
PISTONS
SPECIAL

TEST: Baseline Sulfate Test
ENGINE 6-6 8½x10 TURBO ENGINE NO. 87247

| Line No. | Time & Shift | Hour Meter Add 22500 | ENGINE POWER OUTPUT: RPM 900 | Sec. for 20 Turns (KW) | KW Meter % Reg. | Alt. KW Output | Alt. Eff. % | BHP | % Load | #1 Pump Rack C.S./O.C.S. | MISCELLANEOUS: Room Temp. | Corrected Barometer | C. C. Vacuum | Gov. Load Limit | ENGINE AIR Press. In HG: Air Receiver | Press. In H.O.: Blower Suction | Temp. °F: Air Inlet | Temp. °F: Air Receiver | ENGINE H. O. PSIG: Pump Disch. | Temp. °F: To Engine | Temp. °F: From Engine | ENGINE I Press.-PSIG: Pump Disch. | To Strainer | To Engine | Upper Header |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CHECKED TIMING CS = 35.9 | | | | | | | | | | OCS = 35.5 | | | | | | | | | | | | | | |
| 2 | 0700-1500 Checked IND. Timing - 36.2 C.S. - 36.45 O.C.S. · ADVANCED Timing 1½° FAST. NOW 35.9 C.S. | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 36.25 O.C.S. · @ 0820 HRS. START ENG. - WARMING - @ 0830 HRS ON LINE 1000 LOAD. | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 0935 | 06.5 | 900 | 57.58 | 99.8 | 1504 | 96.0 | 2099 | 99.43 | 9.0/9.2 | 97 | 29.11 | 1.5 | R.S. | 23.60 | 21.69 | | 148 | 44 | 155 | 159 | 60.5 | 46 | 45 | 36.3 |
| 5 | 1005 | 07.0 | 900 | 57.97 | 99.8 | 1493 | 96.0 | 2085 | 99.26 | 9.0/9.2 | 102 | 29.11 | 1.6 | R.S. | 23.65 | 21.55 | | 148 | 44 | 156 | 159 | 60.5 | 45.5 | 44.5 | 36.1 |
| 6 | 1030 | 07.4 | 900 | 57.49 | 99.8 | 1506 | 96.0 | 2102 | 100.1 | 9.1/9.3 | 99 | 29.10 | 1.5 | R.S. | 23.65 | 21.66 | | 148 | 44 | 155 | 159 | 60.5 | 45.5 | 44.5 | 36.1 |
| 7 | 1100 | 07.9 | 900 | 57.66 | 99.8 | 1501 | 96.0 | 2096 | 99.8 | 9.1/9.3 | 103 | 29.09 | 1.6 | R.S. | 23.52 | 21.59 | | 149 | 44 | 156 | 159 | 60 | 45.5 | 44 | 36 |
| 8 | 1130 | 08.4 | 900 | 57.55 | 99.8 | 1504 | 96.0 | 2100 | 100 | 9.2/9.4 | 99 | 29.10 | 1.5 | R.S. | 23.67 | 21.69 | | 149 | 44 | 156 | 159 | 60 | 45 | 44 | 36 |
| 9 | 1200 | 08.9 | 900 | 57.79 | 99.2 | 1498 | 96.0 | 2091 | 99.57 | 9.2/9.4 | 80 | 29.09 | 1.6 | R.S. | 23.46 | 21.45 | | 148 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |
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19368 H.H.V.

| OIL Temp. °F To Engine | OIL Temp. °F From Engine | OIL Level in C.C. | FUEL OIL PSIG Fuel Header | FUEL OIL Sec. For Lbs. of Fuel | FUEL OIL Fuel Cons Lbs./Hr. | FUEL OIL Fuel Rate Lbs./BHP-Hr. | FUEL OIL Corrected 19350 LB/BHP/HR | FUEL OIL Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Press. "HG Meter Inlet | NATURAL GAS FUEL Press. "HG Meter Inlet ABS | NATURAL GAS FUEL Temp. Meter Inlet °F | NATURAL GAS FUEL Temp. Meter Inlet ABS °B | NATURAL GAS FUEL Sec. for Ft.³ Gas | NATURAL GAS FUEL Ft.³/Hr. @ Std. Temp. & Press. | NATURAL GAS FUEL Gas Heat Value BTU/Ft.³ | NATURAL GAS FUEL Gas Consumption BTU/Hr. x 10³ | NATURAL GAS FUEL Specific Gas Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Total Specific Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Press.-PSIG Supply To Engine | NATURAL GAS FUEL Press.-PSIG Coll Hdr. | NATURAL GAS FUEL Press.-PSIG Engine Hdr. | | | Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 165° | 184 | -11 | 16.4 | 236.7 | 760.5 | .3623 | .3626 | | | | | | | | | | | | | | | | | 5 |
| 165° | 185 | -11 | 16.4 | 238.19 | 755.7 | .3624 | .3628 | | | | | | | | | | | | | | | | | 6 |
| 165° | 185° | -10 | 16.5° | 237.13 | 759.1 | .3611 | .3615 | | | | | | | | | | | | | | | | | 7 |
| 165 | 185° | -12 | 16.5 | 235.9 | 763.0 | .3640 | .3648 | | | | | | | | | | | | | | | | | 8 |
| 166 | 185° | -12 | 16.5° | 235.19 | 764.4 | .3640 | .3649 | | | | | | | | | | | | | | | | | 9 |
| 165° | 185 | -13 | 16.5° | 236.5° | 761.1 | .3639 | .3643 | | | | | | | | | | | | | | | | | 10 |
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| Line No. (OLD) | TURBO RPM C.S. | TURBO RPM O.C.S. | COMPRESSOR AIR Pressure To Comp In H2O C.S. | COMPRESSOR AIR Pressure To Comp In H2O O.C.S. | COMPRESSOR AIR Pressure From Comp. In PSI C.S. | COMPRESSOR AIR Pressure From Comp. In PSI O.C.S. | COMPRESSOR AIR Temp. °F Inlet | COMPRESSOR AIR Temp. °F From Comp. C.S. | COMPRESSOR AIR Temp. °F From Comp. O.C.S. | BLOWER Disch PSI | BLOWER Suct °F | BLOWER Disch °F | WATER Temps. °F From Turbo. C.S. | WATER Temps. °F From Turbo. O.C.S. | WATER Temps. °F Air Cooler In | WATER Temps. °F Air Cooler Out | LUBE OIL PSIG Turbo. Inlet | LUBE OIL Temp. °F From Turbo. C.S. | LUBE OIL Temp. °F From Turbo. O.C.S. | TURBINE EXHAUST Press. "HG To C.S. | TURBINE EXHAUST Press. "HG To O.C.S. | TURBINE EXHAUST Temp. °F To C.S. | TURBINE EXHAUST Temp. °F To O.C.S. | TURBINE EXHAUST Temp. °F From Turbine | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | 23.76 | | | | | | | | | | | | | | | |
| 4 | 17500 | | 22.9 | | 22.05 | | 112 | 243 | | ~~23.6~~ | 126 | 147 | 161 | | 59 | 95 | 28.2 | 208 | | 18.45 | | | | 621 | 768 |
| 5 | 17500 | | 22.7 | | 21.9 | | 44 | 245 | | 23.7 | 126 | 147 | 161 | | 59 | 94 | 28.1 | 209 | | 18.3 | | | | 622 | 770 |
| 6 | 17535 | | 22.9 | | 21.98 | | 45 | 247 | | 23.79 | 126 | 147 | 162 | | 59 | 94 | 28.1 | 209 | | 18.41 | | | | 624 | 773 |
| 7 | 17500 | | 22.9 | | 21.98 | | 46 | 248 | | 23.8 | 126 | 148 | 162 | | 59 | 95 | 28 | 209 | | 18.41 | | | | 626 | 775 |
| 8 | 17500 | | 22.5 | | 21.96 | | 48 | 250 | | 23.8 | 127 | 148 | 162 | | 59 | 94 | 28 | 210 | | 18.4 | | | | 630 | 781 |
| 9 | 17500 | | 22.3 | | 21.75 | | 49 | 251 | | 23.61 | 126 | 148 | 162 | | 58 | 95 | 28 | 209 | | 18.24 | | | | 629 | 784 |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | |
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SHIFT: 0700 - 1500 DATE: 4-24-80 TESTER: MASON HR. MTR. 22505.1 K.W. MTR. 3974 F.O. MTR. 0273610

SHIFT: 1500 DATE: TESTER:

REMARKS:

REMARKS:

| CYLINDER TEMP. °F 2 | 3 | 4 | 5 | 6 | 7 | SEA H2O PD 8 PSI | IN 9 °F | OUT 10 °F | 11 | 12 | 123 Combined Exhaust | 456 Combined Exhaust | 789 1-6 Combined Exhaust | 10-11-12 Combined Exhaust | Back Press. | Color | BOSCH | | AIR FLOW DATA INLET °F | INLET H2O | Δp H2O | H's/MIN | F/A RATIO | Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 769 | 717 | 816 | 845 | 763 | | 29 | 63 | 25 | | | 812 | 852 | 833 | | 8.0 | | .35 | | 38 | 5.4 | 10.4 | 582.3 | .02177 | 4 |
| 771 | 717 | 819 | 843 | 763 | | 29 | 65 | 78 | | | 814 | 852 | 834 | | 8.2 | | .30 | | 39 | 5.4 | 10.3 | 578.8 | .02175 | 5 |
| 776 | 723 | 820 | 848 | 769 | | 32 | 65 | 77 | | | 818 | 853 | 837 | | 8.3 | | .25 | | 40 | 5.4 | 10.4 | 581 | .02177 | 6 |
| 777 | 726 | 820 | 849 | 773 | | 28.5 | 66 | 79 | | | 821 | 852 | 839 | | 8.3 | | .30 | | 41 | 5.4 | 10.4 | 580.3 | .02191 | 7 |
| 783 | 735 | 825 | 846 | 771 | | 29 | 70 | 84 | | | 827 | 859 | 843 | | 8.3 | | .30 | | 43 | 5.1 | 10.4 | 579.5 | .02191 | 8 |
| 787 | 730 | 823 | 844 | 770 | | 29 | 74 | 87 | | | 830 | 859 | 844 | | 8.6 | | .25 | | 45 | 5.0 | 10.2 | 572.7 | .02215 | 9 |
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HR. MTR. K.W. MTR. F.O. MTR.

SHIFT: 2300 DATE: TESTER: HR. MTR. K.W. MTR. F.O. MTR.

REMARKS:

BF-4173C

| | |
|---|---|
| Ignition or Injection Timing | 35.8 CS → 42 |
| Comp. Ratio | 36.15 O.C.S |
| Gas Cam Timing | 137° BIDC @ .020 Lift |
| Crankled | 18° LL |
| K. W. Mtr. Constant | 1200 |
| MOBIL GAURD H46 | |
| #2 Shop F/O | |

TEST LOG
EXPERIMENTAL DEPT.

LOG NO. 4535
DATE: 4-29-80

POWER PARTS
C. RING
LINERS
PISTONS
SPECIAL

TEST: Emission Test No. 2 Diesel Controlled
ENGINE: E-6 8⅛ x 10 TURBO ENGINE NO. 87247

| Line No. | Time & Shift | Hour Meter Add | ENGINE POWER OUTPUT: RPM 900 | Sec. for 20 Turns (KW) | KW Meter % Reg. | Alt. KW Output | Alt. Eff. % | BHP | % Load | #1 Pump Rack C.S. / O.C.S | MISCELLANEOUS: Room Temp. | Corrected Barometer | C.C. Vacuum | Gov. Load Limit | ENGINE AIR Press. In HG: Air Receiver | Press. In H.O.: Blower Suction | Temp. °F: Air Inlet | Temp. °F: Air Receiver | ENGINE H. O. PSIG: Pump Disch. | Temp. °F: To Engine | Temp. °F: From Engine | ENGINE I Press.-PSIG: Pump Disch. | To Strainer | To Engine | Upper Header |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0715 | - | START | - | WARM | ING | - | 0730 | HRS. | | ON-LINE | | 100% | | DIESEL | | REGRIND | | TIMING | | (4) | FULL | TURNS. | | |
| 2 | 0828 | 95.2 | 900 | 57.53 | 99.8 | 1505 | 96.0 | 2100 | 100 | 9.5/10.0 | 97 | 29.18 | 1.0 | R.S. | 25.54 | 23.32 | | 150 | 44 | 155 | 159 | 60.5 | 45 | 44 | 36.3 |
| 3 | 0930 | 96.2 | 900 | 57.92 | 99.8 | 1495 | 96.0 | 2086 | 99.35 | 9.5/10.0 | 99 | 29.17 | 1.0 | R.S. | 25.4 | 23.19 | | 150 | 44 | 156 | 159 | 60.3 | 45 | 44 | 36.2 |
| 4 | 1000 | 96.7 | 900 | 57.58 | 99.8 | 1504 | 96.0 | 2099 | 99.93 | 9.5/10.0 | 98 | 29.17 | 1.0 | R.S. | 25.55 | 23.33 | | 151 | 44 | 156 | 159 | 60.3 | 45 | 44 | 36.2 |
| 5 | 1030 | 97.2 | 900 | 58.06 | 99.8 | 1491 | 96.0 | 2081 | 99.11 | 9.5/10.0 | 95 | 29.17 | 1.1 | R.S. | 25.32 | 23.09 | | 150 | 44 | 156 | 159 | 60.3 | 45 | 44 | 36.3 |
| 6 | 1100 | 97.7 | 900 | 57.49 | 99.8 | 1506 | 96.0 | 2102 | 100.09 | 10.0/10.2 | 98 | 29.15 | 1.0 | R.S. | 25.64 | 23.41 | | 152 | 44 | 156 | 159 | 60.2 | 45 | 44 | 36.1 |
| 7 | 1130 | 98.2 | 900 | 57.9 | 99.8 | 1495 | 96.0 | 2087 | 99.38 | 10.0/10.2 | 92 | 29.15 | 1.0 | R.S. | 25.45 | 23.22 | | 151 | 44 | 156 | 159 | 60.2 | 45 | 44 | 36 |
| 8 | 1200 | 98.7 | 900 | 57.68 | 99.8 | 1501 | 96.0 | 2095 | 99.76 | 10.0/10.2 | 91 | 29.14 | 1.0 | R.S. | 25.46 | 23.24 | | 151 | 44 | 156 | 159 | 60.2 | 45 | 44 | 36 |
| 9 | 1230 | 99.2 | 900 | 57.77 | 99.8 | 1499 | 96.0 | 2092 | 99.6 | 10.0/10.2 | 92 | 29.11 | 1.0 | R.S. | 25.35 | 23.1 | | 151 | 44 | 156 | 160 | 60.1 | 45 | 44 | 36 |
| 10 | 1300 | 99.7 | 900 | 57.5 | 99.8 | 1506 | 96.0 | 2102 | 100.07 | 10.0/10.2 | 91 | 29.10 | 1.0 | R.S. | 25.41 | 23.19 | | 152 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 11 | 1330 | 00.2 | 900 | 56.93 | 99.8 | 1520 | 96.0 | 2122 | 101.0 | 10.0/10.2 | 90 | 29.09 | .8 | R.S. | 25.5 | 23.24 | | 153 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 12 | 1400 | 00.7 | 900 | 57.5 | 99.8 | 1505 | 96.0 | 2102 | 100.07 | 9.5/10.0 | 92 | 29.07 | 1.0 | R.S. | 25.45 | 23.19 | | 154 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 13 | 1430 | 01.2 | 900 | 57.5 | 99.8 | 1505 | 96.0 | 2102 | 100.07 | 9.5/10.0 | 94 | 29.06 | 1.0 | R.S. | 25.32 | 23.00 | | 153 | 44 | 156 | 160 | 60 | 45 | 44 | 36 |
| 14 | | 0 | 900 | 57.6 | 99.8 | | 96.0 | | | | | | | | | | | | | | | | | | |
| 15 | 1505 | 01.8 | 900 | 57.6 | 99.8 | 1503 | 96.0 | 2098 | 99.9 | 9.5/10.0 | 92 | 29.05 | .9 | RS | 25.34 | 23.05 | | 153 | 44 | 156 | 160 | 60 | 45 | 43.5 | 36 |
| 16 | 1535 | 02.3 | 900 | 57.28 | 99.8 | 1509 | 96.0 | 2106 | 100.3 | 9.8/10.1 | 90 | 29.04 | .8 | RS | 25.35 | 23.1 | | 153 | 44.5 | 156 | 160 | 60 | 45 | 43.5 | 36 |
| 17 | 1605 | 02.8 | 900 | 57.35 | 99.8 | 1510 | 96.0 | 2107 | 100.33 | 10.0/10.1 | 95 | 29.04 | .9 | RS | 25.41 | 23.15 | | 153 | 44.5 | 157 | 160 | 60 | 45 | 43.9 | 36 |
| 18 | 1635 | 03.3 | 900 | 57.41 | 99.8 | 1508 | 96.0 | 2105 | 100.23 | 10.0/10.1 | 93 | 29.04 | .8 | RS | 25.4 | 23.15 | | 153 | 44.5 | 156 | 160 | 61 | 45 | 44 | 36.5 |
| ~~19~~ | Add 6 | | 113.5 # MOBIL GAURD TO SYS. | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 1705 | 03.8 | 900 | 57.54 | 99.8 | 1505 | 96.0 | 2100 | 100.0 | 10.0/10.1 | 94 | 29.03 | 1.0 | RS | 25.34 | 23.07 | | 153 | 44.5 | 156 | 160 | 61 | 45 | 44 | 36.8 |
| 21 | 1735 | 04.3 | 900 | 57.58 | 99.8 | 1504 | 96.0 | 2099 | 99.93 | 10.0/10.1 | 91 | 29.02 | 1.0 | RS | 25.45 | 23.19 | | 154 | 44.5 | 157 | 160 | 60.5 | 45 | 44 | 36.1 |
| 22 | 1805 | 04.8 | 900 | 57.6 | 99.8 | 1503 | 96.0 | 2098 | 99.9 | 10.0/10.1 | 91 | 29.02 | 1.0 | RS | 25.45 | 23.19 | | 153 | 44.5 | 156 | 160 | 60.5 | 45 | 44 | 36 |
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| 28 | 3-11 | | | | | | | | | | | | | | | | | | | | | | | | |
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19368 HNK

| OIL Temp. °F To Engine | OIL Temp. °F From Engine | OIL Level in C.C. | FUEL OIL PSIG Fuel Header | FUEL OIL Sec. For Lbs. of Fuel | FUEL OIL Fuel Cans Lbs./Hr. | FUEL OIL Fuel Rate Lbs./BHP-Hr. | FUEL OIL Corrected 19350 LB/BHP/HR | FUEL OIL Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Press. "HG Meter Inlet | NATURAL GAS FUEL Press. "HG Meter Inlet ABS | NATURAL GAS FUEL Temp. Meter Inlet °F | NATURAL GAS FUEL Temp. Meter Inlet ABS °B | NATURAL GAS FUEL Sec. for Ft.³ Gas | NATURAL GAS FUEL Ft.³/Hr. @ Std. Temp. & Press. | NATURAL GAS FUEL Gas Heat Value BTU/Ft.³ | NATURAL GAS FUEL Gas Consumption BTU/Hr. x 10³ | NATURAL GAS FUEL Specific Gas Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Total Specific Fuel Rate BTU/BHP-Hr. | NATURAL GAS FUEL Press.-PSIG Supply To Engine | NATURAL GAS FUEL Press.-PSIG Cell Hdr. | NATURAL GAS FUEL Press.-PSIG Engine Hdr. | | | Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 165 | 184 | -65 | 15.8 | 22582 | 797 | .3795 | .3799 | | (START EXHAUST EMISSION TEST 09:30 HRS.) | | | | | | | | | | | | | | | 3 |
| 165 | 184 | -67 | 16.1 | 22622 | 797.7 | .3814 | .3818 | | | | | | | | | | | | | | | | | 4 |
| 165 | 184 | -71 | 16.3 | 22589 | 796.8 | .3796 | .3799 | | | | | | | | | | | | | | | | | 5 |
| 165 | 183 | -72 | 16.1 | 22859 | 782.4 | .3783 | .3787 | | | | | | | | | | | | | | | | | 6 |
| 165 | 184 | -72 | 16.1 | 22556 | 798 | .3796 | .3799 | | | | | | | | | | | | | | | | | 7 |
| 165 | 184 | -73 | 16.0 | 22794 | 789.7 | .3784 | .3787 | | | | | | | | | | | | | | | | | 8 |
| 165 | 184 | -73 | 16.0 | 22681 | 793.6 | .3788 | .3791 | | | | | | | | | | | | | | | | | 9 |
| 165 | 184 | -73 | 16.0 | 22656 | 794.5 | .3797 | .3801 | | | | | | | | | | | | | | | | | 10 |
| 165 | 185 | -73 | 16.1 | 22527 | 799 | .3801 | .3805 | | | | | | | | | | | | | | | | | 11 |
| 166 | 185 | -74 | 16.0 | 22349 | 805.4 | .3795 | .3799 | | | | | | | | | | | | | | | | | 12 |
| 166 | 185 | -76 | 16.0 | 22422 | 802.8 | .3819 | .3823 | | | | | | | | | | | | | | | | | 13 |
| 166 | 185 | | 16.1 | 22348 | 805.4 | .3831 | .3835 | | | | | | | | | | | | | | | | | 14 |
| | | | | | | | | | | | | | | | | | | | | | | | | 15 |
| 166 | 185 | -76 | 16.0 | 22714 | 792.5 | .3777 | .3781 | | | | | | | | | | | | | | | | | 16 |
| 166 | 186 | -77 | 16.5 | 22546 | 798.4 | .379 | .3794 | | | | | | | | | | | | | | | | | 17 |
| 167 | 186 | -79 | 16.1 | 22826 | 799 | .3792 | .3796 | | | | | | | | | | | | | | | | | 18 |
| 166 | 185 | -80 | 16.2 | 22523 | 799.2 | .3797 | .3800 | | | | | | | | | | | | | | | | | 19 |
| | | | | | | | | | | | | | | | | | | | | | | | | 20 |
| 165 | 185 | -8 | 16.0 | 22586 | 797 | .3795 | .3799 | | | | | | | | | | | | | | | | | 21 |
| 166 | 185 | -8 | 16.0 | 22598 | 796.7 | .3796 | .3791 | | | | | | | | | | | | | | | | | 22 |
| 166 | 185 | -6 | 16.0 | 22623 | 795.7 | .3792 | .3796 | | | | | | | | | | | | | | | | | 23 |
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| Line No. | TURBO RPM C.S. | TURBO RPM O.C.S. | COMPRESSOR AIR Pressure To Comp. In PSI C.S. | COMPRESSOR AIR Pressure To Comp. In PSI O.C.S. | COMPRESSOR AIR Pressure From Comp. In PSI C.S. | COMPRESSOR AIR Pressure From Comp. In PSI O.C.S. | COMPRESSOR AIR Temp. °F Inlet | COMPRESSOR AIR Temp. °F From Comp. C.S. | COMPRESSOR AIR Temp. °F From Comp. O.C.S. | BLOWER Discharge PSI | BLOWER Suct °F | BLOWER Discharge °F | WATER Temps. °F From Turbo. C.S. | WATER Temps. °F From Turbo. O.C.S. | WATER Temps. °F Air Cooler In | WATER Temps. °F Air Cooler Out | LUBE OIL PSIG Turbo. Inlet | LUBE OIL Temp. °F From Turbo. C.S. | LUBE OIL Temp. °F From Turbo. O.C.S. | TURBINE EXHAUST Press. "HG To C.S. | TURBINE EXHAUST Press. "HG To O.C.S. | TURBINE EXHAUST Temp. °F To C.S. | TURBINE EXHAUST Temp. °F To O.C.S. | TURBINE EXHAUST Temp. °F From Turbine | TURBINE EXHAUST Temp. °F 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| ✗ 2 | 18325 | | 24.8 | | 23.62 | | 58 | 277 | | 25.69 | 127 | 150 | 163 | | 57 | 76 | 28 | 212 | | 20.18 | | | | 653 | 815 |
| 3 | 18300 | | 25.1 | | 23.55 | | 59 | 277 | | 25.59 | 127 | 149 | 162 | | 57 | 77 | 28 | 212 | | 20.06 | | | | 654 | 815 |
| 4 | 18300 | | 25.3 | | 23.61 | | 59 | 279 | | 25.65 | 127 | 150 | 163 | | 57 | 77 | 28 | 212 | | 20.15 | | | | 655 | 817 |
| 5 | 18250 | | 25.1 | | 23.45 | | 59 | 276 | | 25.45 | 126 | 149 | 163 | | 57 | 76 | 28 | 212 | | 20.0 | | | | 653 | 817 |
| 6 | 18350 | | 25.5 | | 23.76 | | 61 | 282 | | 25.86 | 129 | 151 | 163 | | 58 | 77 | 28 | 213 | | 20.35 | | | | 659 | 823 |
| 7 | 18350 | | 24.3 | | 23.59 | | 61 | 281 | | 25.64 | 128 | 151 | 163 | | 58 | 77 | 28 | 212 | | 20.16 | | | | 658 | 823 |
| 8 | 18350 | | 24.8 | | 23.51 | | 63 | 283 | | 26.1 | 128 | 151 | 163 | | 57 | 77 | 28 | 212 | | 20.14 | | | | 660 | 825 |
| 9 | 18350 | | 24.9 | | 23.5 | | 63 | 284 | | 25.57 | 128 | 151 | 163 | | 57 | 76 | 28 | 213 | | 20.1 | | | | 661 | 828 |
| 10 | 18350 | | 25.1 | | 23.55 | | 64 | 286 | | 25.61 | 129 | 152 | 163 | | 58 | 77 | 28 | 213 | | 20.15 | | | | 664 | 832 |
| 11 | 18500 | | 24.7 | | 23.52 | | 67 | 289 | | 26.4 | 130 | 153 | 163 | | 58 | 77 | 28 | 213 | | 20.16 | | | | 669 | 836 |
| 12 | 18500 | | 25.1 | | 23.63 | | 67 | 290 | | 25.85 | 131 | 154 | 164 | | 58 | 77 | 28 | 214 | | 20.39 | | | | 672 | 836 |
| 13 | 18450 | | 24.6 | | 23.38 | | 66 | 287 | | 25.5 | 130 | 153 | 163 | | 58 | 77 | 28 | 214 | | 20.06 | | | | 668 | 831 |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 18450 | | 24.8 | | 23.48 | | 66 | 287 | | 25.5 | 130 | 153 | 163 | | 58 | 77 | 28 | 214 | | 20.06 | | | | 667 | 830 |
| 16 | 18500 | | 24.6 | | 23.45 | | 66 | 288 | | 25.55 | 130 | 153 | 164 | | 58 | 77 | 28 | 214 | | 20.05 | | | | 667 | 830 |
| 17 | 18500 | | 24.9 | | 23.46 | | 66 | 288 | | 25.6 | 130 | 153 | 164 | | 58 | 77 | 28 | 214 | | 20.1 | | | | 668 | 830 |
| 18 | 18500 | | 24.7 | | 23.47 | | 66 | 287 | | 25.6 | 130 | 153 | 163 | | 58 | 77 | 28.3 | 214 | | 20.1 | | | | 668 | 830 |
| ~~19~~ | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 18500 | | 24.8 | | 23.4 | | 66 | 287 | | 25.5 | 130 | 153 | 163 | | 58 | 77 | 28.3 | 213 | | 20.07 | | | | 666 | 833 |
| 21 | 18450 | | 24.8 | | 23.5 | | 65 | 287 | | 25.6 | 130 | 153 | 164 | | 57 | 77 | 28.1 | 213 | | 20.12 | | | | 667 | 831 |
| 22 | 18450 | | 24.7 | | 23.55 | | 65 | 287 | | 25.63 | 130 | 153 | 164 | | 56 | 77 | 28.0 | 213 | | 20.15 | | | | 666 | 830 |
| 23 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 32 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | | | | | | | | | | | | | | |

SHIFT: 0700 - 1500 DATE: 4-23-80 TESTER: NIMSON HR. MTR 22494.1 K.W. MTR 2960 P.S. MTR. 272334

REMARKS:

SHIFT: 1500 2300 DATE: 4-23-80 TESTER: [illegible]

REMARKS:

| CYLINDER TEMP. °F 2 | 3 | 4 | 5 | 6 | 7 | SEA $H_2O$ PD 8 PSI | IN 9 °F | OUT 10 °F | 11 | 12 | 123 Combined Exhaust | 456 Combined Exhaust | ~~789~~ 1-6 Combined Exhaust | 10-11-12 Combined Exhaust | Back Press. | Color | Δ OSCH | | AIR FLOW DATA INLET °F | INLET $H_2O$ | Δp $H_2O$ | $m_s/m_w$ | F/A RATIO | FOLD Line No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 826 | 763 | 860 | 892 | 810 | | 32 | 66 | 78 | | | 863 | 901 | 882 | | 9.8 | | .8 | | 54 | 6.0 | 11.5 | 602.9 | .02203 | 2 |
| 825 | 762 | 862 | 896 | 812 | | 32 | 68 | 80 | | | 861 | 901 | 882 | | 10.4 | | .7 | | 55 | 6.0 | 11.5 | 602.3 | .02202 | 3 |
| 825 | 764 | 866 | 894 | 810 | | 32 | 69 | 81 | | | 863 | 903 | 884 | | 10.2 | | .6 | | 55 | 6.0 | 11.5 | 602.3 | .02205 | 4 |
| 827 | 762 | 857 | 887 | 805 | | 32 | 70 | 82 | | | 864 | 896 | 881 | | 9.9 | | .65 | | 55 | 5.9 | 11.5 | 602.3 | .02178 | 7 |
| 831 | 766 | 870 | 899 | 814 | | 32 | 71 | 83 | | | 870 | 908 | 890 | | 10.3 | | .70 | | 57 | 6.1 | 11.6 | 602.9 | .02304 | 6 |
| 830 | 767 | 866 | 895 | 812 | | 32 | 72 | 84 | | | 870 | 906 | 888 | | 10.3 | | .70 | | 58 | 6.0 | 11.5 | 600.3 | .02192 | 2 |
| 832 | 771 | 869 | 896 | 810 | | 32 | 72 | 84 | | | 872 | 908 | 890 | | 9.9 | | .65 | | 59 | 5.9 | 11.5 | 599.7 | .02206 | 8 |
| 834 | 768 | 865 | 897 | 811 | | 32 | 75 | 87 | | | 875 | 907 | 891 | | 10.3 | | .70 | | 60 | 5.5 | 11.5 | 599.1 | .02210 | 9 |
| 838 | 773 | 870 | 903 | 819 | | 32 | 75 | 87 | | | 880 | 912 | 896 | | 10.5 | | .80 | | 61 | 6.0 | 11.5 | 598.0 | .02222 | 04 |
| 844 | 777 | 878 | 910 | 828 | | 32 | 76 | 88 | | | 886 | 920 | 903 | | 10.3 | | .70 | | 64 | 6.0 | 11.6 | 598.5 | .02241 | 11 |
| 846 | 782 | 880 | 917 | 837 | | 32 | 77 | 89 | | | 886 | 924 | 906 | | 10.4 | | .70 | | 63 | 6.0 | 11.5 | 596.6 | .02242 | 2 |
| 841 | 779 | 877 | 911 | 835 | | 32 | 77 | 90 | | | 879 | 919 | 900 | | 10.0 | | .70 | | 63 | 5.9 | 11.5 | 596.5 | .02250 | 8 |
| | | | | | | | | | | | | | | | | | | | | | | | | 14 |
| 845 | 781 | 876 | 912 | 833 | | 32 | 77 | 90 | | | 881 | 918 | 900 | | 10.1 | | .60 | | 64 | 6.0 | 11.6 | 598.4 | .02207 | 15 |
| 844 | 779 | 877 | 912 | 833 | | 32 | 78 | 91 | | | 881 | 918 | 900 | | 10.3 | | .60 | | 64 | 6.0 | 11.5 | 595.9 | .02234 | 16 |
| 844 | 777 | 879 | 916 | 835 | | 32 | 79 | 91 | | | 881 | 920 | 901 | | 10.2 | | .60 | | 64 | 5.9 | 11.6 | 598.4 | .02236 | 17 |
| 843 | 776 | 877 | 920 | 839 | | 32 | 79 | 91 | | | 880 | 920 | 901 | | 10.7 | | .66 | | 63 | 6.0 | 11.5 | 596.3 | .02234 | 18 |
| | | | | | | | | | | | | | | | | | | | | | | | | 19 |
| 842 | 778 | 875 | 908 | 818 | | 32 | 80 | 92 | | | 882 | 915 | 899 | | 10.2 | | .60 | | 63 | 6.0 | 11.5 | 596.2 | .02258 | 20 |
| 842 | 779 | 877 | 917 | 835 | | 32 | 80 | 93 | | | 881 | 920 | 901 | | 10.2 | | .60 | | 63 | 6.0 | 11.5 | 596.07 | .02228 | 21 |
| 839 | 774 | 876 | 917 | 835 | | | 80 | 92 | | | 880 | 919 | 900 | | 10.6 | | .65 | | 63 | 5.6 | 11.6 | 599.0 | .02214 | 22 |
| | | | | | | | | | | | | | | | | | | | | | | | | 23 |
| | | | | | | | | | | | | | | | | | | | | | | | | 24 |
| | | | | | | | | | | | | | | | | | | | | | | | | 25 |
| | | | | | | | | | | | | | | | | | | | | | | | | 26 |
| | | | | | | | | | | | | | | | | | | | | | | | | 27 |
| | | | | | | | | | | | | | | | | | | | | | | | | 28 |
| | | | | | | | | | | | | | | | | | | | | | | | | 29 |
| | | | | | | | | | | | | | | | | | | | | | | | | 30 |
| | | | | | | | | | | | | | | | | | | | | | | | | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | 32 |
| | | | | | | | | | | | | | | | | | | | | | | | | 33 |
| | | | | | | | | | | | | | | | | | | | | | | | | 34 |

HR. MTR. 20501.6 K.W. MTR. 5969 F.O. MTR. 0079205

SHIFT: 2300 DATE: TESTER: HR. MTR. K.W. MTR. F.O. MTR.

REMARKS:

# SECTION 4

## SAMPLING DATA SHEETS

This section includes data sheets for continuous monitoring of gaseous emissions ($O_2$, $CO_2$, NO, $NO_x$, and TUHC), particulate mass emissions using EPA's Method 5 and the Source Assessment Sampling System, and sulfur emissions using the modified High Volume Stack Sampler according to EPA Method 8 procedure. The field data sheets are arranged in the following order:

4.1 -- Continuous Monitoring Emission Data

4.2 -- Particulate Mass Emissions - High Volume Stack Sampler (HVSS)

4.3 -- Sulfur Emissions - Modified HVSS, Method 8

4.4 -- Trace Elements and Organics - Source Assessment Sampling System (SASS)

## 4.1 CONTINUOUS MONITORING EMISSION DATA

# FIELD DATA SHEET

COMPRESSION IGNITION ENGINE - DIESEL

UREX Aerotherm

Plant: Fairbanks Morse - Colt Ind.

Location: Beloit, Wisconsin

Operator: Joe Smith of Colt Ind.

Date: 4-22-80 BASELINE

Load Range: 2100 Bhp

Ambient Temperature: 88 °F Average

Barometric Pressure: 28.82 in Hg average

~~Static Pressure Duct~~ Humidity = 37%

Fuel: No. 2 Oil

| Time | Sample Point | | | DRY UNCORRECTED $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | $NO_2$ ppm | CORRECTED TO 15% O2 DRY NO ppm | $NO_x$ ppm | $NO_2$ ppm | HYDROCARBONS (HC) Total HC | Methane | Non-Methane HC | $H_2O$ % | Stack Gas Temp °F | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10:00 | | | | 13.6 | 5.3 | 140 | | 965 | 1000 | 35 | | | | 30 | | | | | |
| 10:30 | | | | 13.75 | 5.35 | 140 | | 970 | 1010 | 40 | | | | 30 | | | | | |
| 11:30 | | | | 13.7 | 5.35 | 140 | | 980 | 1020 | 40 | | | | 25 | | | | | |
| 13:20 | | | | 13.6 | 5.4 | 140 | | 1000 | 1030 | 30 | | | | 25 | | | | | |
| 13:30 | | | | 13.75 | 5.3 | 130 | | 990 | 1025 | 35 | | | | 30 | | | | | |
| 14:00 | | | | 13.5 | 5.4 | 150 | | – | 1100 | – | | | | 35 | | | | | |
| 14:30 | | | | 13.6 | 5.35 | 140 | | 980 | 1000 | 20 | | | | 30 | | | | | |
| 15:00 | | | | 13.75 | 5.4 | 135 | | 1020 | 1150 | 130 | | | | 37 | | | | | Start of SASS & MS trains |
| 15:30 | | | | 13.5 | 5.4 | 150 | | – | – | – | | | | 37 | | | | | |
| 16:00 | | | | 13.7 | 5.4 | 140 | | 975 | 1000 | 25 | | | | 40 | | | | | |
| 17:00 | | | | 13.5 | 5.4 | 170 | | 978 | 1000 | 22 | | | | 37 | | | | | |
| 18:00 | | | | 13.5 | 5.4 | 140 | | 965 | 975 | 10 | | | | 35 | | | | | |
| 19:00 | | | | 13.7 | 5.3 | 130 | | 965 | 1000 | 35 | | | | 33 | | | | | |
| 19:30 | | | | 13.7 | 5.4 | 150 | | 965 | 990 | 25 | | | | 23 | | | | | |
| 20:00 | | | | 13.7 | 5.3 | 160 | | 1025 | 1050 | 25 | | | | 22 | | | | | |
| 20:30 | | | | 14.0 | 5.3 | 120 | | 950 | 955 | 5 | | | | 28 | | | | | |
| | | | | 13.7 | 5.3 | 145 | | 980 | 1015 | 35 | 805 | 834 | 29 | 32 | | | | | AVERAGE Over duration of SASS and MS tests |

EXHAUST AHEAD OF MUFFLER

Form EED-063 12/78

# FIELD DATA SHEET

COMPRESSION IGNITION ENGINE - DIESEL

Plant: Fairbanks Morse - Colt Ind.
Location: Beloit, Wisconsin
Operator: Joe Smith of Colt Industries
Date: 4-23-80 CONTROLLED NOx
Load Range: 2101 Bhp

Ambient Temperature: 46-66 °F (63 °F average)
Barometric Pressure: 29.08 in Hg average
~~Static Pressure Duct~~ Humidity = 45%
Fuel: No. 2 Fuel Oil

| Time | Sample Point | | | DRY UNCORRECTED $O_2$ % | $CO_2$ % | CO % ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | $NO_2$ ppm | CORRECTED TO 15% O2 DRY NO ppm | $NO_x$ ppm | $NO_2$ ppm | HYDROCARBONS (HC) Total HC | Methane | Non-Methane HC | $H_2O$ % | Stack Gas Temp °F | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9:30 | | | | 14.3 | 4.9 | 85 | – | 630 | 650 | 20 | | | | 42 | | | | | |
| 10:00 | | | | 14.35 | 4.9 | 80 | | 615 | 635 | 20 | | | | 32 | | | | | |
| 10:30 | | | | 14.4 | 4.86 | 70 | | 605 | 620 | 15 | | | | 27 | | | | | |
| 11:00 | EXHAUST OF MUFFLER | | | 14.3 | 4.9 | 85 | | 600 | 620 | 20 | | | | 30 | | | | | Start of tests |
| 11:30 | | | | 14.3 | 4.9 | 85 | | 580 | 610 | 30 | | | | 25 | | | | | ↓ |
| 12:00 | | | | 14.3 | 4.9 | 75 | | 580 | 610 | 30 | | | | 25 | | | | | |
| 12:30 | | | | 14.3 | 4.9 | 75 | | 590 | 610 | 20 | | | | 27 | | | | | |
| 13:00 | | | | 14.25 | 4.98 | 80 | | 610 | 630 | 20 | | | | 25 | | | | | |
| 13:30 | | | | 14.2 | 5.0 | 90 | | 630 | 640 | 10 | | | | 19 | | | | | |
| 14:00 | | | | 14.2 | 5.0 | 120 | | 650 | 670 | 20 | | | | 39 | | | | | |
| 14:30 | | | | 14.2 | 5.0 | 105 | | 640 | 660 | 20 | | | | 28 | | | | | |
| 15:00 | ENGINE AHEAD | | | 14.2 | 4.9 | 115 | | 630 | 650 | 20 | | | | 21 | | | | | |
| 15:30 | | | | 14.25 | 5.0 | 110 | | 650 | 677 | 27 | | | | 26 | | | | | |
| 16:00 | | | | 14.25 | 5.0 | 115 | | 640 | 670 | 30 | | | | 31 | | | | | |
| 16:30 | | | | 14.25 | 5.0 | 110 | | 650 | 670 | 20 | | | | 28 | | | | | |
| 17:00 | | | | 14.3 | 5.0 | 110 | | 650 | 670 | 20 | | | | 35 | | | | | |
| 17:30 | | | | 14.25 | 5.0 | 115 | | 640 | 660 | 20 | | | | 25 | | | | | |
| 18:00 | | | | 14.25 | 5.0 | 110 | | 640 | 660 | 20 | | | | 25 | | | | | |
| | | | | | | | | | | | | | | | | | | | AVERAGE |
| | | | | 14.3 | 4.95 | 100 | | 625 | 645 | 20 | 560 | 578 | 18 | 27 | | | | | Over duration of SASS and |
| | | | | | | | | | | | | | | | | | | | M5 test |

Form EED-063 12/78

## 4.2 PARTICULATE MASS EMISSIONS -- HVSS

# PARTICULATE TEST FIELD DATA SHEET

Plant: CONT INDUSTRIES
Date: 4/22/80
Test Location: DIESEL - BASELINE
Run Number: METHOD-5
Stack Diameter inches: 15.375
Duct Dimensions in. x in.: 185.66
Start Time: 1459
Operator: REHDER

Barometric Pressure: 28.30
Static Pressure: +3.0
Stack Pressure: 29.31
Probe Number: 5 FT. STAINLESS
Pitot Coefficient: .841
Pitot Number: 50 SIDE B
Meter Box Number: 0038
Orifice Coefficient: .741/.999

Nozzle Size & Number: .185"
Molecular Weight: 29.4 DRY
BWO: ASSUMED .03

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| A-31 | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| 400 | 513 | | | | |
| 400 | 455 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| 300 | 332.5 | | | | |

| | SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | INT LEAK CK 0.0 FT³/MIN @ 15 in Hg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-1 | INIT | 0 / 1459 | - | - | 794.828 | - | - | - | - | - | 94 | 94 | - | | |
| | 1 | 5 / 1504 | 5.4 | 3.4 | 800.18 | 600 | 275 | 104 | - | 253 | 97 | 95 | <.5 | | |
| | 2 | 10 / 1509 | 5.4 | 3.4 | 805.595 | 599 | 273 | 101 | - | 263 | 96 | 95 | <.5 | | |
| | STOP | | | | | | | | | | | | | | STOP IMPINGER |
| | START | 10 / 1557 | - | - | 805.595 | - | - | - | - | - | 96 | 96 | - | | H2O LEVEL |
| 4-9 | 3 | 15 / 1602 | 4.7 | 3.0 | 810.73 | 600 | 260 | 97 | - | 251 | 97 | 97 | <.5 | | TOO LOW FOR STEMS |
| | 4 | 20 / 1607 | 4.9 | 3.2 | 815.64 | 600 | 255 | 97 | - | 251 | 97 | 97 | <.5 | | LK CK .005 44 SEC. |
| | 5 | 25 / 1612 | 5.4 | 3.5 | 820.79 | 598 | 240 | 95 | - | 251 | 97 | 97 | <.5 | | @ 17 in Hg |
| | 6 | 30 / 1617 | 5.6 | 3.5 | 825.90 | 621 | 253 | 95 | - | 252 | 97 | 97 | <.5 | | .0037 FT³/min |
| | 7 | 35 / 1622 | 6.3 | 4.0 | 831.43 | 631 | 270 | 95 | - | 251 | 97 | 97 | <.5 | | |
| | 8 | 40 / 1627 | 6.5 | 4.0 | 837.00 | 633 | 280 | 95 | - | 252 | 97 | 97 | <.5 | | |
| | 9 | 45 / 1632 | 6.8 | 4.3 | 842.71 | 634 | 291 | 95 | - | 252 | 98 | 97 | <.5 | | |
| | 10 | 50 / 1637 | 7.0 | 4.35 | 848.45 | 639 | 296 | 95 | - | 254 | 98 | 97 | <.5 | | |
| | 11 | 55 / 1642 | 7.0 | 4.37 | 854.25 | 640 | 303 | 95 | - | 237 | 98 | 96 | <.5 | | |
| | 12 | 60 / 1647 | 6.7 | 4.2 | 859.90 | 640 | 313 | 94 | - | 246 | 98 | 96 | <.5 | | |
| | 13 | 65 / 1652 | 6.6 | 4.1 | 865.54 | 638 | 316 | 94 | - | 248 | 98 | 96 | <.5 | | |
| | 14 | 70 / 1657 | 6.1 | 3.8 | 871.20 | 637 | 317 | 94 | - | 246 | 98 | 96 | <.5 | | |
| | 15 | 75 / 1702 | 6.5 | 4.06 | 876.51 | 638 | 316 | 84 | - | 246 | 98 | 96 | <.5 | | |
| | 16 | 80 / 1707 | 6.4 | 4.0 | 882.05 | 639 | 318 | 85 | - | 247 | 97 | 96 | <.5 | | |
| | 17 | 85 / 1712 | 6.4 | 4.0 | 887.58 | 636 | 320 | 85 | - | 247 | 98 | 96 | <.5 | | |
| | AVG/TOTAL | | | | | | | | | | | | | | |

Form EED-021 1 79

Corporation

# PARTICULATE TEST FIELD DATA SHEET

Plant: COLT INDUSTRIES

Date: 4/22/80

Test Location: DIESEL - BASELINE

Run Number: METHOD -5

Stack Diameter inches

Duct Dimensions in. x in.

Start Time

Operator

Barometric Pressure

Static Pressure

Stack Pressure

Probe Number

Pitot Coefficient

Pitot Number

Meter Box Number

Orifice Coefficient

Nozzle Size & Number

Molecular Weight

BWO

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| | | | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 90 / 1717 | 6.4 | 4.0 | 893.142 | 636 | 320 | 87 | – | 248 | 97 | 96 | <.5 | | |
| START | 90 / 1750 | | | | | | | | | | | | | CHANGE PORTS |
| 1 | 95 / 1755 | 4.1 | 2.63 | 897.90 | 601 | 220 | 70 | – | 246 | 93 | 93 | <.5 | | |
| 2 | 100 / 1800 | 4.1 | 2.64 | 902.81 | 598 | 220 | 70 | – | 243 | 93 | 93 | <.5 | | |
| 3 | 105 / 1805 | 4.3 | 2.75 | 907.76 | 600 | 221 | 71 | – | 246 | 92 | 93 | <.5 | | HIT PUMP VALVE – VOL SPOT UP |
| 4 | 110 / 1810 | 4.5 | 2.9 | 912.48 | 596 | 245 | 71 | – | 246 | 92 | 92 | <.5 | | |
| 5 | 115 / 1815 | 4.8 | 3.0 | 917.25 | 610 | 252 | 71 | – | 231 | 92 | 92 | <.5 | | |
| 6 | 120 / 1820 | 5.3 | 3.3 | 922.29 | 621 | 261 | 68 | – | 246 | 92 | 92 | <.5 | | |
| 7 | 125 / 1825 | 5.5 | 3.5 | 927.39 | 623 | 271 | 66 | – | 243 | 92 | 91 | <.5 | | |
| 8 | 130 / 1830 | 6.0 | 3.75 | 932.79 | 625 | 277 | 67 | – | 251 | 91 | 91 | <.5 | | |
| 9 | 135 / 1835 | 6.3 | 3.9 | 938.23 | 628 | 285 | 68 | – | 251 | 90 | 90 | <.5 | | |
| 10 | 140 / 1840 | 7.3 | 4.5 | 944.01 | 628 | 291 | 70 | – | 251 | 90 | 90 | <.5 | | |
| 11 | 145 / 1845 | 7.4 | 4.6 | 949.90 | 633 | 305 | 69 | – | 251 | 89 | 89 | <.5 | | |
| 12 | 150 / 1850 | 7.5 | 4.6 | 955.95 | 635 | 314 | 68 | – | 249 | 89 | 89 | 1.0 | | |
| 13 | 155 / 1855 | 7.4 | 4.56 | 961.88 | 635 | 317 | 68 | – | 250 | 89 | 88 | 1.0 | | |
| 14 | 160 / 1900 | 7.3 | 4.5 | 967.63 | 635 | 316 | 68 | – | 251 | 88 | 88 | 1.0 | | |
| 15 | 165 / 1905 | 7.4 | 4.55 | 973.62 | 635 | 318 | 67 | – | 253 | 88 | 87 | 1.0 | | |
| 16 | 170 / 1910 | 7.1 | 4.4 | 979.40 | 634 | 318 | 67 | – | 241 | 88 | 87 | 1.0 | | |
| 17 | 175 / 1915 | 7.2 | 4.4 | 985.18 | 634 | 322 | 67 | – | 237 | 87 | 86 | 1.0 | | FINAL LK CK. 0.0 FT³/MIN |
| 18 | 180 / 1920 | 7.0 | 4.3 | 990.947 | 319 | 319 | 67 | – | 256 | 87 | 86 | 1.0 | | @ 15 in Hg |
| STOP AVG/TOTAL | | $\sqrt{}$=2.47 | 3.83 | 196.119 | 623 | | | | | 94 | 93 | | | |

Form EED-021 1 79

# PARTICULATE TEST FIELD DATA SHEET

Corporation

Plant: COAT INDUSTRIES
Date: 4/23/80
Test Location: DIESEL-CONTROL
Run Number: 2-METHOD 5
Stack Diameter inches: 15.375
Duct Dimensions in. x in.: 185.66
Start Time: 1058 HRS
Operator: RENDER

Barometric Pressure: 29.18
Static Pressure: + 3.2
Stack Pressure: 29.42
Probe Number: 5 FT STAINLESS
Pitot Coefficient: .841
Pitot Number: 50 SIDE B
Meter Box Number: 0038
Orifice Coefficient K: .741/.999

Nozzle Size & Number: (.185")
Molecular Weight: 29.4 DRY
BWO: ASSUMED .03

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| A-21 | | |
| | | |
| | | |

| | IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|---|
| 1 | 400 | 587 | | | | |
| 2 | 400 | 430 | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | SILICA GEL | | | | | |
| | 600 | 27.8 | NET | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | LK. CHECK .011/MIN @ 15 in Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-1 INIT | 0 / 1058 | – | – | 994.184 | – | – | – | – | – | 70 | 70 | – | | |
| 1 | 5 / 1103 | 4.9 | 3.0 | 998.68 | 585 | 245 | 67 | – | 231 | 67 | 69 | 2.5 | | IMPINGER T.C. |
| 2 | 12 / 1108 | 6.4 | 3.9 | 1003.47 | 590 | 245 | 85 | – | 285 | 67 | 69 | 4.0 | | SHORTED OUT |
| 3 | 15 / 1113 | 5.3 | 3.2 | 1008.85 | 595 | 232 | 87 | – | 258 | 67 | 69 | 3.0 | | SOME VALUES HIGH |
| 4 | 20 / 1118 | 6.5 | 3.9 | 1013.86 | 595 | 242 | 68 | – | 229 | 66 | 69 | 4.0 | | |
| 5 | 25 / 1123 | 7.3 | 4.5 | 1019.28 | 590 | 256 | 68 | – | 225 | 68 | 69 | 4.5 | | |
| 6 | 30 / 1128 | 7.5 | 4.6 | 1025.06 | 590 | 275 | 62 | – | 273 | 68 | 69 | 5.0 | | |
| 7 | 35 / 1133 | 7.6 | 4.6 | 1030.98 | 608 | 284 | 72 | – | 259 | 69 | 69 | 5.0 | | |
| 8 | 40 / 1138 | 8.4 | 5.07 | 1036.86 | 610 | 285 | 76 | – | 227 | 69 | 70 | 5.5 | | FIXED TC |
| 9 | 45 / 1143 | 8.5 | 5.1 | 1043.04 | 612 | 292 | 67 | – | 252 | 68 | 69 | 5.5 | | |
| 10 | 50 / 1148 | 9.0 | 5.4 | 1049.29 | 615 | 298 | 68 | – | 229 | 69 | 68 | 6.0 | | |
| 11 | 55 / 1153 | 8.8 | 5.3 | 1055.69 | 615 | 306 | 68 | – | 238 | 69 | 68 | 6.0 | | |
| 12 | 60 / 1158 | 8.6 | 5.1 | 1062.06 | 614 | 311 | 68 | – | 238 | 69 | 68 | 6.0 | | |
| 13 | 65 / 1203 | 8.5 | 5.1 | 1068.30 | 616 | 315 | 68 | – | 253 | 69 | 68 | 6.0 | | |
| 14 | 70 / 1208 | 8.4 | 5.0 | 1074.48 | 614 | 315 | 65 | – | 245 | 69 | 68 | 6.0 | | |
| 15 | 75 / 1213 | 8.3 | 5.0 | 1080.78 | 617 | 317 | 66 | – | 255 | 70 | 67 | 6.0 | | |
| 16 | 80 / 1218 | 8.4 | 5.0 | 1086.91 | 614 | 317 | 63 | – | 255 | 71 | 67 | 6.0 | | |
| 17 | 85 / 1223 | 8.2 | 4.9 | 1093.06 | 614 | 317 | 63 | – | 256 | 71 | 67 | 6.0 | | |
| 18 | 90 / 1228 | 8.0 | 4.8 | 1099.15 | 614 | 316 | 62 | – | 255 | 71 | 67 | 6.0 | | |
| STOP | 93 / 1233 | – | – | 1103.214 | | | | | | | | | | CHANGE PORTS |
| AVG/TOTAL | | | | | | | | | | | | | | |

Form EED-021 1 79

Corporation

# PARTICULATE TEST FIELD DATA SHEET

Plant: COLT INDUSTRIES

Date: 4/23/80

Test Location: DIESEL - CONTROL

Run Number: 2 - METHOD 5

Stack Diameter inches:

Duct Dimensions in. x in.:

Start Time:

Operator:

Barometric Pressure:

Static Pressure:

Stack Pressure:

Probe Number:

Pitot Coefficient:

Pitot Number:

Meter Box Number:

Orifice Coefficient:

Nozzle Size & Number:

Molecular Weight:

BWO:

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| | | | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93 / 1241 | — | — | — | — | — | — | — | — | 67 | 67 | — | | |
| 1 | 95 / 1243 | 4.9 | 3.0 | 1105.35 | 586 | 228 | 58 | — | 229 | 67 | 67 | 4.0 | | |
| 2 | 100 / 1248 | 4.9 | 3.0 | 1110.12 | 590 | 234 | 56 | — | 224 | 67 | 66 | 4.0 | | |
| 3 | 105 / 1253 | 5.0 | 3.1 | 1114.92 | 590 | 246 | 57 | — | 275 | 67 | 66 | 4.0 | | |
| 4 | 110 / 1258 | 5.1 | 3.6 | 1119.76 | 593 | 244 | 57 | — | 290 | 68 | 66 | 4.0 | | |
| 5 | 115 / 1303 | 5.9 | 4.0 | 1124.97 | 612 | 258 | 58 | — | 290 | 69 | 66 | 4.5 | | |
| 6 | 120 / 1308 | 6.7 | 3.9 | 1130.39 | 603 | 267 | 59 | — | 267 | 68 | 66 | 5.0 | | |
| 7 | 125 / 1313 | 6.5 | 4.15 | 1135.84 | 610 | 275 | 59 | — | 250 | 70 | 66 | 5.0 | | |
| 8 | 130 / 1318 | 6.9 | 5.0 | 1141.39 | 620 | 281 | 59 | — | 268 | 69 | 66 | 5.0 | | |
| 9 | 135 / 1323 | 8.4 | 5.3 | 1147.44 | 617 | 297 | 60 | — | 246 | 70 | 66 | 6.5 | | |
| 10 | 140 / 1328 | 8.9 | 5.25 | 1153.66 | 620 | 303 | 60 | — | 260 | 70 | 66 | 7.0 | | |
| 11 | 145 / 1333 | 8.8 | 5.3 | 1159.98 | 621 | 308 | 60 | — | 243 | 70 | 66 | 7.0 | | |
| 12 | 150 / 1338 | 8.9 | 5.4 | 1166.27 | 621 | 324 | 61 | — | 244 | 70 | 66 | 7.0 | | |
| 13 | 155 / 1343 | 9.1 | 5.2 | 1172.66 | 622 | 329 | 61 | — | 246 | 71 | 65 | 7.5 | | |
| 14 | 160 / 1348 | 8.7 | 5.1 | 1178.91 | 622 | 329 | 61 | — | 247 | 71 | 66 | 7.5 | | |
| 15 | 165 / 1353 | 8.6 | 5.1 | 1185.11 | 620 | 327 | 61 | — | 248 | 70 | 66 | 7.0 | | |
| 16 | 170 / 1358 | 8.6 | 5.1 | 1191.27 | 622 | 330 | 62 | — | 251 | 70 | 66 | 7.0 | | |
| 17 | 175 / 1403 | 8.0 | 4.8 | 1197.25 | 620 | 331 | 63 | — | 248 | 71 | 65 | 7.0 | | |
| 18 | 180 / 1408 | 7.8 | 4.7 | 1202.86 | 621 | 328 | 63 | — | 250 | 71 | 66 | 7.0 | | |
| | | | | | | | | | | 68 | | | | FINAL LK. CK. 0.0 FT³/MIN @ 10 in Hg |
| AVG/TOTAL | | $\sqrt{}$ = 2.73 | 4.56 | 208.676 | 609 | | | | | 69 | 67 | | | |

Form EED-021 1 79

## 4.3 SULFUR EMISSION DATA -- MODIFIED HVSS, METHOD 8

Corporation

# PARTICULATE TEST FIELD DATA SHEET

Plant: COLT INDUSTRIES
Date: 4/24/80
Test Location: DIESEL - BASELINE
Run Number: 1 - METHOD 8
Stack Diameter inches: 15.375 AVG.
Duct Dimensions in. x in.: 185.66
Start Time: 0931
Operator: RENDER

Barometric Pressure: 27.10 @ 09.00
Static Pressure: +3.0 "H2O
Stack Pressure: 29.32 in Hg
Probe Number: 3FT GLASS
Pitot Coefficient: -
Pitot Number: -
Meter Box Number: 0038
Orifice Coefficient: .714

Nozzle Size & Number: (.185")
Molecular Weight: 29.4 DRY
BWO: ASSUMED (.03)

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| 200 | IPA | | | | |
| 200 | $H_2O_2$ | | | | |
| 200 | $H_2O_2$ | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| 300 | | | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PORT 1 | | | | | | | | | | | | | | |
| INIT | 0 / 0931 | | 2.85 | 354.154 | | | | | | 46 | 48 | - | - | START |
| 5 | 15 / 0946 | 4.9 | 2.85 | 367.85 | 605 | | 40 | | 321 | 43 | 44 | 9.0 | 1.69 | |
| 5 | 30 / 1001 | 4.9 | 2.85 | 381.40 | 600 | | 43 | | 310 | 47 | 45 | 9.5 | 1.69 | SILICA IMPINGER |
| 5 | 60 / 1031 | 4.9 | 2.85 | 403.61 | 600 | | 42 | | 320 | 46 | 48 | 10.0 | 1.69 | BROKEN AT AN UNKNOWN |
| 5 | 75 / 1046 | 4.9 | | | | | | | | | | | 1.69 | TIME |
| 5 | 91 / 1117 | 4.9 | 2.85 | 449.86 | 600 | | 49 | | 319 | 47 | 48 | 12.0 | 1.69 | |
| 5 | 152 / 1218 | 4.9 | 2.85 | 507.337 | 602 | | 51 | | 318 | 54 | 51 | 12.0 | 1.69 | STOP |
| | | | | | | | | | | | | | | |
| PURGE | 1332 | | | 519.001 | | | | | | | | | | |
| 19 MIN. | 1351 | | | 530.000 | | | | | | | | | | FINAL LK. |
| | | | | | | | | | | | | | | CHECK WAS |
| | | | | | | | | | | | | | | CONDUCTED |
| | | | | | | | | | | | | | | FROM THE |
| | | | | | | | | | | | | | | THIRD |
| | | | | | | | | | | | | | | IMPINGER |
| | | | | | | | | | | | | | | 0.0 FT³/MIN |
| | | | | | | | | | | | | | | @ 15 IN Hg. |
| | | | | 16.999 FT³/PURGE | | | | | | | | | | |
| | | | | | | | | | | (47.25) | | | | |
| AVG/TOTAL | 152.0 | 4.9 | 2.85 | 153.183 | 601.0 | | 45 | | | 47.2 | 47.3 | | 1.69 | |

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# PARTICULATE TEST FIELD DATA SHEET

Corporation

Plant: COLT INDUSTRIES
Date: 4/23/80
Test Location: DIESEL - CONTROL
Run Number: 1 METHOD 8
Stack Diameter inches: 16.375
Duct Dimensions in. x in.: 186.66
Start Time: 1536
Operator: RENDER

Barometric Pressure: 29.18
Static Pressure: +3.2
Stack Pressure: 29.42
Probe Number: 3FT GLASS
Pitot Coefficient:
Pitot Number: N/A
Meter Box Number: 0038
Orifice Coefficient: .714

Nozzle Size & Number: (.186")
Molecular Weight: 29.4 DRY
BWO: IPA, $H_2O_2$, $H_2O_2$

| FILTER DATA | | |
|---|---|---|
| NUMBER | TARE | FINAL WT. |
| | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| 200 | | | | | |
| 200 | | | | | |
| 200 | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| 300 | | | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F 300 STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART 9-1 | | | | | | | | | | | | | | |
| 5 | 0 / 1536 | 4.9 | – | 203.787 | – | – | – | – | – | 80 | 69 | – | 2.21 | INITIAL |
| 5 | 15 / 1556 | 4.9 | 3.0 | 218.15 | 612 | 245 | 62 | – | 308 | 75 | 70 | 13.5 | 2.21 | LEAK CHECK .09 cfm |
| 5 | 30 / 1606 | 4.9 | 3.0 | 231.90 | 613 | 255 | 63 | – | 310 | 73 | 69 | 13.5 | 2.21 | @ 15" Hg |
| 5 | 45 / 1621 | 4.9 | 3.0 | 246.83 | 612 | 249 | 67 | – | 311 | 74 | 69 | 13.5 | 2.21 | |
| 5 | 60 / 1636 | 4.9 | 3.0 | 260.95 | 612 | 251 | 70 | – | 311 | 74 | 69 | 14.0 | 2.21 | |
| 5 | 75 / 1641 | 4.9 | 3.0 | 274.38 | 611 | 257 | 67 | – | 312 | 72 | 68 | 14.0 | 2.21 | |
| 5 | 105 / 1709 | 4.9 | 3.0 | 292.01 | 612 | 260 | 64 | – | 310 | 71 | 68 | 14.0 | 2.21 | |
| 5 | 120 / 1724 | 4.9 | 3.0 | 306.08 | 613 | 247 | 64 | – | 309 | 70 | 67 | 15.0 | 2.21 | |
| 5 | 135 / 1739 | 4.9 | 3.0 | 320.22 | 612 | 246 | 60 | – | 309 | 69 | 67 | 15.0 | 2.21 | |
| 5 | 155 / 1759 | 4.9 | 3.0 | 338.90 | 611 | 244 | 55 | – | 312 | 70 | 66 | 16.0 | 2.21 | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | FINAL LEAK |
| | | | | | | | | | | | | | | CHECK .025/ |
| | | PURGE | | | | | | | | | | | | MIN @ |
| | | 1828 | | 339.4 | | | | | | | | | | 15 in Hg. |
| | | 1844 | | 351.602 | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | 12.202 FT³ | PURGE | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | 70.5 | | | | |
| AVG/TOTAL | | 4.9 | 3.0 | 135.114 | 612 | | | | | 72.8 | 68.2 | | 2.21 | |

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## 4.4 TRACE ELEMENTS AND ORGANICS -- SASS

Corporation

# PARTICULATE TEST FIELD DATA SHEET

Plant: COLT INDUSTRIES
Date: 4/22/80
Test Location: DIESEL-UNCONTROLLED
Run Number: SASS #01
Stack Diameter inches: 15.375
Duct Dimensions in. x in.:
Start Time: 1558
Operator: KAUFMANN

Barometric Pressure: 28.80
Static Pressure: +3.0" H2O
Stack Pressure:
Probe Number: 3 ft GLASS
Pitot Coefficient: .84
Pitot Number: 10
Meter Box Number: 088
Orifice Coefficient: 3.589/1.166

Nozzle Size & Number: 369
Molecular Weight: 29.4 (DRY)
BWO:

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| A56 | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| 500 | 510 | INSTRUMENT | | | DATA |
| 500 | 440 | | 5.22 | 13.9 | 80.88 |
| 500 | 475 | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| 750 | 862 | | | | |

| | SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | LEAK RATE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N-1 | 5 | 0 | 5.7 | 2.1 | 802.598 | 626 | 407 | 93 | 59 | 406 | 97 | 97 | 20/20 | 2.39 | .023/10" |
| | 5 | 20 | 5.7 | 1.9 | 884.9 | 624 | 422 | 93 | 63 | 405 | 103 | 98 | 20/20 | 2.39 | |
| | STOP | 40 | | | 962.378 | | | | | | | | | | CHANGE FILTER |
| | 1646 | 40 | 5.7 | 2.2 | 962.378 | 626 | 410 | 93 | 58 | 378 | 96 | 95 | 17/17 | 2.39 | A-10 |
| 4-19 | 5 | 60 | 5.7 | 1.9 | 1045.30 | 633 | 427 | 92 | 56 | 406 | 105 | 96 | 20/20 | 2.39 | MOVE TO PORT S-1 |
| | STOP | 80 | | | 1122.818 | | | | | | | | | | CHANGE FILTER |
| S-1 | 1752 | 80 | 5.2 | 2.2 | 1122.818 | 624 | 398 | 90 | 57 | 372 | 93 | 92 | 17/17 | 2.38 | A-25 |
| | 5 | 100 | 5.2 | 1.8 | 1204.30 | 623 | 427 | 87 | 56 | 407 | 101 | 93 | 20/20 | 2.38 | |
| | OFF | 120 | | | 1281.875 | | | | | | | | | | |
| | 1852 | 120 | 5.2 | 2.2 | 1281.875 | 623 | 425 | 86 | 60 | 337 | 86 | 85 | 17/17 | 2.39 | CHANGE FILTER |
| | 5 | 140 | 5.2 | 1.8 | 1372.4 | 623 | 425 | 83 | 64 | 400 | 95 | 87 | 20/20 | 2.39 | A-3 |
| | OFF | 150 | | | 1411.137 | | | | | | | | | | |
| | 1940 | 150 | 5.2 | 2.2 | 1411.137 | 616 | 393 | 80 | 67 | 338 | 83 | 85 | 17/17 | 2.28 | CHANGE FILTER |
| | 5 | 160 | 5.2 | 2.0 | 1456.8 | 617 | 423 | 79 | 72 | 404 | 95 | 95 | 20/20 | 2.28 | A-6 |
| | OFF | 180 | | | 1534.311 | | | | | | | | | | FUEL LEAK |
| | | | | | | | | | | | | | FROM PROBE | | .055/10" |
| | | | | | | | | | | | | | FROM ORG MOD | | .008/20" |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | AVG/TOTAL | 180 | 5.4 | 2.03 | 731.713 | 624 | | | | | 93 | | | 2.32 | |

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# PARTICULATE TEST FIELD DATA SHEET

Corporation

Plant: COLT INDUSTRIES
Date: 4/23/80
Test Location: DIESEL CONTROLLED
Run Number: BASS #2
Stack Diameter inches: 15.375
Duct Dimensions in. x in.:
Start Time: 1110
Operator: P. KAUFMANN

Barometric Pressure: 29.18
Static Pressure: +3.2" H2O
Stack Pressure: 29.42
Probe Number:
Pitot Coefficient: .84
Pitot Number: 10
Meter Box Number: 088
Orifice Coefficient: 3.589 / 1.66

Nozzle Size & Number: .369
Molecular Weight:
BWO:

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| A-6 | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| 510 | 601 | | INSTRUMENT | DATA | |
| 500 | 468 | | 4.95 | 14.27 | 80.78 |
| 500 | 452 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| 831.9 | 1052.8 | | | | |

COND 448

| | SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | √ΔP | LEAK RATE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 5.2 | 2.2 | 537.121 | 605 | 406 | 57 | 67 | 407 | 65 | 64 | 20/20 | 2.28 | 037/10" |
| N-1 | | 10 | 5.2 | 2.1 | 578.0 | 604 | 421 | 61 | 54 | 410 | 73 | 67 | 20/20 | 2.28 | |
| | | 20 | 5.2 | 1.9 | 617.6 | 604 | 424 | 64 | 50 | 415 | 80 | 70 | 20/20 | 2.28 | CHANGE FILTER |
| | OFF | 30 | | | 655.278 | | | | | | | | | | A-68 |
| 4-20 | 1150 | 30 | 5.2 | 2.2 | 655.278 | 602 | 417 | 59 | 53 | 383 | 72 | 72 | 17/17 | 2.28 | |
| | | 40 | 5.2 | 2.0 | 695. | 609 | 425 | 64 | 50 | 410 | 77 | 70 | 20/20 | 2.28 | |
| | | 50 | 5.2 | 1.8 | 735.7 | 607 | 422 | 55 | 52 | 410 | 78 | 73 | 20/20 | 2.28 | |
| | OFF | 60 | | | 774.044 | | | | | | | | | | |
| | 1237 | 60 | 6.2 | 2.2 | 774.044 | 606 | 407 | 61 | 56 | 372 | 76 | 76 | 17/17 | 2.49 | CHANGE PORT CHANGE FILTER |
| 8.1 | | 70 | 6.2 | 2.1 | 815 | 609 | 425 | 66 | 53 | 413 | 79 | 74 | 20/20 | 2.49 | A-30 |
| | | 80 | 6.2 | 1.8 | 856 | 610 | 418 | 63 | 52 | 409 | 82 | 78 | 20/20 | 2.49 | |
| | OFF | 90 | | | 892.818 | | | | | | | | | | CHANGE FILTER |
| | 1333 | 90 | 6.2 | 2.2 | 892.818 | 616 | 415 | 65 | 55 | 327 | 72 | 75 | 17/17 | 2.49 | A-38 |
| | | 100 | 6.2 | 2.1 | | 617 | 421 | 65 | 54 | 408 | 81 | 77 | 20/20 | 2.49 | |
| | | 110 | 6.2 | 1.8 | 974.5 | 617 | 417 | 63 | 49 | 408 | 80 | 77 | 20/20 | 2.49 | |
| | OFF | 120 | | | 1012.805 | | | | | | | | | | CHANGE FILTER |
| | 1417 | 120 | 6.2 | 2.2 | 1012.805 | 612 | 407 | 65 | 51 | 357 | 75 | 76 | 17/17 | 2.49 | A-36 |
| | OFF | 150 | | | 1130.254 | | | | | | | | | | |
| | 1500 | 150 | 6.2 | 2.2 | 1130.254 | 609 | 428 | 66 | 53 | 308 | 76 | 78 | 17/17 | 2.49 | CHANGE FILTER |
| | | 160 | 6.2 | 2.1 | 1174. | 611 | 425 | 66 | 51 | 405 | 85 | 79 | 20/20 | 2.49 | A-23 |
| | AVG/TOTAL | | | | | | | | | | | | | | |

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Corporation

# PARTICULATE TEST FIELD DATA SHEET

Plant: COLT INDUSTRIES

Date: 4/23/80

Test Location: DIESEL-CONTROLLED

Run Number: SASS #2

Stack Diameter inches

Duct Dimensions in. x in.

Start Time

Operator

Barometric Pressure

Static Pressure

Stack Pressure

Probe Number

Pitot Coefficient

Pitot Number

Meter Box Number

Orifice Coefficient

Nozzle Size & Number

Molecular Weight

BWO

FILTER DATA

| NUMBER | TARE | FINAL WT. |
|---|---|---|
| | | |
| | | |
| | | |

| IMPINGER VOLUMES | | TIME | $CO_2$ | $O_2$ | CO |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| SILICA GEL | | | | | |
| | | | | | |

| SAMPLE POINT | CLOCK TIME | VELOCITY HEAD ΔP in. wg. | ORIFICE METER ΔH in. wg. | GAS METER VOLUME FT³ | TEMPERATURES °F STACK | PROBE | IMPINGER | ORGANIC MODULE | OVEN | GAS METER IN | GAS METER OUT | PUMP VACUUM in. Hg | $\sqrt{\Delta P}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 173 | 6.2 | 1.8 | 1223.7 | 611 | 421 | 67 | 48 | 400 | 83 | 80 | 20/20 | 2.49 | |
| OFF | 180 | | | 1250.965 | | | | | | | | | | CHANGE FILTER |
| 1543 | 180 | 6.2 | 2.2 | 1250.965 | 611 | 420 | 62 | 52 | 347 | 76 | 78 | 17/17 | 2.49 | A-52 |
| | 191 | 6.2 | 2.1 | 1296.7 | 612 | 426 | 74 | 53 | 409 | 84 | 79 | 20/20 | 2.49 | |
| | 200 | 6.2 | 1.9 | 1333.1 | 613 | 423 | 58 | 51 | 460 | 81 | 79 | 20/20 | 2.49 | |
| OFF | 210 | | | 1372.048 | | | | | | | | | | CHANGE FILTER |
| 1622 | 210 | 6.2 | 2.2 | 1372.048 | 612 | 406 | 64 | 54 | 318 | 79 | 78 | 17/17 | 2.49 | A-1 |
| | 220 | 6.2 | 2.0 | 1420.2 | 611 | 421 | 66 | 52 | 408 | 82 | 77 | 20/20 | 2.49 | |
| | 232 | 6.2 | 1.8 | 1460.1 | 612 | 420 | 64 | 62 | 412 | 83 | 78 | 20/20 | 2.49 | |
| OFF | 240 | | | 1491.212 | | | | | | | | | | FINAL LEAK |
| | | | | | | | | | | | | THROUGH CYCLONES | | .105/11" |
| | | | | | | | | | | | | THROUGH ORG MOD | | .009/21" |
| AVG/TOTAL | 240 | | 2.04 | 954.091 | 610 | | | | | 78 | | | 2.43 | |

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# SECTION 5

## ANALYTICAL LABORATORY RESULTS

This section contains laboratory reports and calculations of analytical results for fuel and exhaust gas emissions samples collected from the compression ignition engine during baseline and controlled $NO_x$ tests. The reports are presented in the following order:

5.1 -- Fuel and Lube Oil Analyses

5.2 -- Particulate Mass Samples and Data Reduction

5.3 -- Sulfur Emissions Data Reduction

5.4 -- Trace Elements

5.5 -- TCO, GRAV, and GC/MS Results, and Infrared Spectra of Total Sample Extracts

5.6 -- Gas Chromatography Data Reduction

5.7 -- LC Fractionation of Selected Extract Samples with TCO, GRAV, and IR Results on LC Fractions

5.8 -- LRMS Analyses of Selected LC Fractions and Total Sample Extracts

5.9 -- Bioassay Analysis Report

LABORATORY CERTIFICATE

# CURTIS & TOMPKINS, LTD.

ESTABLISHED 1878

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290 DIVISION STREET
SAN FRANCISCO, CALIF. 94103
U.S.A.

CABLE ADDRESS ANALYST

REFEREE ANALYSES
RESEARCH — INVESTIGATIONS
VITAMIN ASSAYS — BIOCHEMISTRY

SPECIALISTS IN BULK COMMODITIES

*Laboratory No.* 80k10
*Preliminary No.* 4132

*Reported* 10/6/80
*Sampled* -------
*Received* 9/8/80

*For* ACUREX CORPORATION

| | Diesel oil -- baseline | | | Diesel oil -- low $NO_x$ | | | Lube oil | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1st test | 2nd test | 3rd test | 1st test | 2nd test | 3rd test | 1st test | 2nd test | 3rd test |
| Carbon (C), % | 86.55 | -- | -- | 86.72 | -- | -- | 83.84 | -- | -- |
| Hydrogen (H), % | 12.28 | -- | -- | 12.42 | -- | -- | 12.80 | -- | -- |
| Oxygen (O), by difference, % | 0.93 | -- | -- | 0.63 | -- | -- | 2.34 | -- | -- |
| Nitrogen (N), % | 0.05 | 0.05 | 0.05 | 0.03 | 0.04 | 0.03 | 0.05 | 0.08 | 0.07 |
| Sulfur (S), % | 0.18 | 0.19 | 0.20 | 0.19 | 0.20 | 0.20 | 0.96 | 0.96 | 0.96 |
| Heating Value: Btu/Pound | 18,925 | -- | -- | 18,938 | -- | -- | 18,687 | -- | -- |
| Gravity, °API @ 60°F | 33.60 | -- | -- | 33.60 | -- | -- | 24.10 | -- | -- |

Compression Ignition Engine, Grams

| Test | SASS train | | | | | Method 5 train | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Solids | | Condensables | |
| | Probe & nozzle rinse | 10μ cyclone catch & rinse | 3μ cyclone catch & rinse | 1μ cyclone catch & rinse | Filter | Probe & nozzle rinse | Filter | Impinger inorganic | Impinger organics |
| Baseline | 0.0913 | 0.0280 | 0.0163 | 0.0011 | 0.4597 | 0.0518 | 0.1461 | 0.0099 | 0.0123 |
| Controlled $NO_x$ | 0.4115 | 0.0103 | 0.0152 | 0.0005 | 0.7923 | 0.0411 | 0.2152 | --[a] | --[a] |

[a]Impinger samples were lost during shipping

SASS BASELINE DIESEL

ACUREX Corporation

# PARTICULATE CALCULATIONS

1. Volume of dry gas sampled at standard conditions, 68°F, 29.92 inch Hg (scf)

$$Vm_{std} = 17.64 \frac{Vm}{\alpha} \left( \frac{P_b + \frac{\Delta H}{13.6}}{T_{m,avg} + 460} \right) =$$

$$\text{or} \quad Vm_{stack} = \left( \frac{Vm}{\alpha} + Vw_{std} \right) \left( \frac{T_{s,avg} + 460}{T_{m,avg} + 460} \right) \left( \frac{P_m}{P_s} \right) \quad \text{(acf at stack conditions)}$$

$$= 17.64 \frac{731.713}{1.166} \left( \frac{28.8 + \frac{2.03}{13.6}}{83 + 460} \right) = 579.5 \quad \text{dscf}$$

2. Stack gas moisture condensed at standard conditions (scf)

$$Vw_{std} = 0.04707 \, Vl_c = 0.04707 \; 357)$$

$$= 16.804$$

3. Stack gas proportion of water vapor, by volume

$$B_{wo} = \frac{Vw_{std}}{Vw_{std} + Vm_{std}}$$

$$= \frac{16.804}{16.804 + 579.5} = 0.028$$

4. Stack gas dry molecular weight (lb/lb-mole)

$$MW_d = 0.44 \, (\%CO_2) + 0.32 \, (\%O_2) + 0.28 \, (\%N_2 + \%CO)$$

$$= 0.44 \, (5.3) + 0.32 (13.7) + 0.28 ( \; ) = 29.356$$

5. Stack gas molecular weight (lb/lb-mole)

$$MW_s = MW_d \, (1 - B_{wo}) + 18 \, (B_{wo})$$

$$= 29.356 \, (1 - 0.028) + 18 (0.028) = 29.077$$

6. Pressure stack, in. Hg

$$P_s = P_b + \frac{P_{st}}{13.6}$$

$$= 29.077$$

7. Stack gas velocity at stack conditions (ft/sec)

$$V_s = 85.49\ (C_p)\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_{s,avg} + 460}{P_s\ MW_s}}$$

$$= 85.49(0.84)(2.32)\sqrt{\frac{624+460}{29.02\ (29.077)}} = 188.83$$

8. Stack gas volume at standard conditions (scfm)

$$Q_s = 60\ (1 - B_{wo})\ Vs_{avg}\ A_s \left(\frac{528}{T_{s,avg} + 460}\right)\left(\frac{P_s}{29.92}\right) = 60(1-0.028)(188.83)(1.2873)\left(\frac{528}{1284}\right)\left(\frac{29.02}{29.92}\right)$$

or $Q_a = 60\ Vs_{avg}\ A_s$ (acfm) = $= 6707.8$

9. Test percent isokinetic

$$\%I = \frac{17.33\ (T_{s,avg} + 460)\ \ [0.04707\ (W_{lc}) + Vm_{std}]}{\theta\ V_s\ P_s\ D_n^2}$$

$= 83\%$

10. Particulate matter concentration, gr/scf

$$C_s = 15.432 \frac{M_p}{Vm_{std}} = \frac{15.432}{579.5} \qquad (M_p) = 0.0266\ M_p$$

$M_p$ [illegible]

or $C_a = 15.432 \dfrac{M_p}{Vm_{stack}}$ (gr/acf) =

11. Emission rate of particulate matter, lb/hr

$$ER = 0.00857\ (Q_s')\ C_s'$$

$$= 0.00857(6707.8)(0.0266)\ M_p = 1.5308\ M_p$$

12. Percent excess air at sampling point

$$\%\ EA = \frac{100\ [\%O_2 - 0.5\ (\%CO)]}{0.264\ \ \%N_2 - (\%O_2 - 0.5 \times \%CO)} =$$

| | Probe + 13μ | 3μ | 1μ | filter | total |
|---|---|---|---|---|---|
| catch $M_p$ | 0.1173 | 0.0163 | 0.0011 | 0.4517 | 0.5964 |
| EA lb/hr | 0.1826 | 0.0250 | 0.0017 | 0.7037 | |
| Eg/lb/μm | 0.0375 | 0.0054 | 0.0004 | 0.1521 | 0.1974 |

13. Emission rate of particulate matter, lb/10⁶ Btu

$$E = 2.679 \times 10^6 \left(\frac{M_p}{Vm_{std}}\right) F \left(\frac{20.9}{20.9 - \%O_2}\right)$$

=

ACUREX Corporation

SASS - CONTROLLED NOx - DIESEL

## PARTICULATE CALCULATIONS

1. Volume of dry gas sampled at standard conditions, 68°F, 29.92 inch Hg (scf)

$$Vm_{std} = 17.64 \frac{Vm}{\alpha}\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_{m,avg} + 460}\right) = 17.64 \frac{954.091}{1.166}\left(\frac{29.18 + \frac{2.24}{13.6}}{78 + 460}\right) = 736.9$$

$$\text{or } Vm_{stack} = \left(\frac{Vm}{\alpha} + Vw_{std}\right)\left(\frac{T_{s,avg} + 460}{T_{m,avg} + 460}\right)\left(\frac{P_m}{P_s}\right) \quad \text{(acf at stack conditions)}$$

$$=$$

2. Stack gas moisture condensed at standard conditions (scf)

$$Vw_{std} = 0.04707\ Vl_c$$

$$= 0.04707\,(679.9) = 32.003$$

3. Stack gas proportion of water vapor, by volume

$$B_{wo} = \frac{Vw_{std}}{Vw_{std} + Vm_{std}}$$

$$= \frac{32.003}{32.003 + 736.9} = 0.039$$

4. Stack gas dry molecular weight (lb/lb-mole)

$$MW_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$$

$$= 0.44\,(4.95) + 0.32\,(14.27) + 0.28\,(80.78) = 29.363$$

5. Stack gas molecular weight (lb/lb-mole)

$$MW_s = MW_d\ (1 - B_{wo}) + 18\ (B_{wo})$$

$$= 29.92$$

6. Pressure stack, in. Hg

$$P_s = P_b + \frac{P_{st}}{13.6}$$

$$= 29.415$$

7. Stack gas velocity at stack conditions (ft/sec)

$$V_s = 85.49\ (C_p)\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_{s,avg} + 460}{P_s\ MW_s}}$$

$$= 85.49\ (0.84)(2.43) \sqrt{\frac{610 + 460}{(29.415)(28.92)}} = 195.71$$

8. Stack gas volume at standard conditions (scfm)

$$Q_s = 60\ (1 - B_{wo})\ Vs_{avg}\ A_s \left(\frac{528}{T_{s,avg} + 460}\right)\left(\frac{P_s}{29.92}\right) = 60(1-0.039)(195.71)(1.2843)\left(\frac{528}{1070}\right)\left(\frac{29.415}{29.92}\right)$$

or $Q_a = 60\ Vs_{avg}\ A_s$ (acfm) = $= 7058.28$

9. Test percent isokinetic

$$\%I = \frac{17.33\ (T_{s,avg} + 460)\ \ [0.04707\ (W_{lc}) + Vm_{std}]}{\theta\ V_s\ P_s\ D_n^2}$$

$= 80.7\ \%$

10. Particulate matter concentration, gr/scf

$$C_s = 15.432 \frac{M_p}{Vm_{std}} = \frac{15.432}{786.9} M_p = 0.0196 (M_p)$$ $M_p$ = grams

or $C_a = 15.432 \dfrac{M_p}{Vm_{stack}}$ (gr/acf) =

11. Emission rate of particulate matter, lb/hr

$$ER = 0.00857\ (Q_s)\ C_s$$

$$= 0.00857 (7058.28)(0.0196)\ M_p = 1.18627 (M_p)$$

12. Percent excess air at sampling point

$$\%\ EA = \frac{100\ [\%O_2 - 0.5\ (\%CO)]}{0.264\ \ \%N_2 - (\%O_2 - 0.5 \times \%CO)}$$

13. Emission rate of particulate matter, lb/10⁶ Btu

$$E = 2.679 \times 10^6 \left(\frac{M_p}{Vm_{std}}\right) F \left(\frac{20.9}{20.9 - \%O_2}\right)$$

=

| | Probe + 10μ | 3μ | 1μ | filter | Total |
|---|---|---|---|---|---|
| Catch (Mp) grams | 0.4218 | 0.0152 | <0.001 | 0.7923 | 1.2303 |
| ER lb/hr. | 0.5004 | 0.0180 | <0.0012 | 0.9399 | 1.4595 |
| ER g/Bhp-h. | 0.1081 | 0.0039 | <0.0003 | 0.2031 | 0.3154 |

METHOD 5 - BASELINE - DIESEL

ACUREX Corporation

## PARTICULATE CALCULATIONS

1. Volume of dry gas sampled at standard conditions, 68°F, 29.92 inch Hg (scf)

$$Vm_{std} = 17.64 \frac{Vm}{\alpha}\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_{m,avg} + 460}\right) = 17.64 \frac{196.119}{0.999}\left(\frac{28.8 + \frac{3.83}{13.6}}{93.5 + 460}\right) = 181.95$$

$$\text{or } Vm_{stack} = \left(\frac{Vm}{\alpha} + Vw_{std}\right)\left(\frac{T_{s,avg} + 460}{T_{m,avg} + 460}\right)\left(\frac{P_m}{P_s}\right) \quad \text{(acf at stack conditions)}$$

=

2. Stack gas moisture condensed at standard conditions (scf)

$$Vw_{std} = 0.04707\ Vl_c$$

$$= 0.04707\ (200.5) = 9.4375$$

3. Stack gas proportion of water vapor, by volume

$$B_{wo} = \frac{Vw_{std}}{Vw_{std} + Vm_{std}}$$

$$= \frac{9.4375}{9.4375 + 181.95} = 0.05$$

4. Stack gas dry molecular weight (lb/lb-mole)

$$MW_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$$

$$= 0.44(5.3) + 0.32(13.7) + 0.28(81) = 29.376$$

5. Stack gas molecular weight (lb/lb-mole)

$$MW_s = MW_d\ (1 - B_{wo}) + 18\ (B_{wo})$$

$$= 29.376(1 - 0.05) + 18(0.05) = 28.83$$

6. Pressure stack, in. Hg

$$P_s = P_b + \frac{P_{st}}{13.6}$$

$$= 28.8 + \frac{3}{13.6} = 29.02$$

7. Stack gas velocity at stack conditions (ft/sec)

$$V_s = 85.49\ (C_p)\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_{s,avg} + 460}{P_s\ MW_s}}$$

$$= 85.49(0.841)(2.47)\sqrt{\frac{623+460}{29.02\ (28.83)}} = 202.05$$

8. Stack gas volume at standard conditions (scfm)

$$Q_s = 60\ (1 - B_{wo})\ Vs_{avg}\ A_s \left(\frac{528}{T_{s,avg} + 460}\right)\left(\frac{P_s}{29.92}\right) = 60(1-0.05)(202.05)(1.2093)\left(\frac{528}{1083}\right)\frac{29.02}{29.92}$$

or $Q_a = 60\ Vs_{avg}\ A_s$ (acfm) = $= 7021.48$

9. Test percent isokinetic

$$\%I = \frac{17.33\ (T_{s,avg} + 460)\ \ [0.04707\ (W_{lc}) + Vm_{std}]}{\theta\ V_s\ P_s\ D_n^2}$$

$$= \frac{17.33(1083)[0.04707(200.5) + 181.95]}{(183)(202.05)(29.02)(.185)^2} = 99.44\ \%$$

10. Particulate matter concentration, gr/scf

$$C_s = 15.432\ \frac{M_p}{Vm_{std}} = \frac{15.432}{181.95}\ M_p = 0.0848\ M_p$$

or $C_a = 15.432\ \dfrac{M_p}{Vm_{stack}}$ (gr/acf) =

11. Emission rate of particulate matter, lb/hr

$$ER = 0.00857\ (Q_s)\ C_s$$

$$= 0.00857(7021.48)(0.0848)\ M_p = 5.1036\ M_p$$

12. Percent excess air at sampling point

$$\%\ EA = \frac{100\ [\%O_2 - 0.5\ (\%CO)]}{0.264\ \ \%N_2 - (\%O_2 - 0.5 \times \%CO)} =$$

13. Emission rate of particulate matter, lb/10⁶ Btu

$$E = 2.679 \times 10^{-6} \left(\frac{M_p}{Vm_{std}}\right) F \left(\frac{20.9}{20.9 - \%O_2}\right)$$

=

| | probe + filter | Condensibles |
|---|---|---|
| $M_p$ grams | 0.1979 | 0.0222 |
| lb/hr | 1.0100 | 0.1133 |
| $/Mp-hr | 0.2184 | 0.0245 |

ACUREX Corporation

METHOD 5- CONTROLLED NOx - DIESEL

## PARTICULATE CALCULATIONS

1. Volume of dry gas sampled at standard conditions, 68°F, 29.92 inch Hg (scf)

$$Vm_{std} = 17.64 \frac{Vm}{\alpha}\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_{m,avg} + 460}\right) = 17.64 \frac{209.676}{0.999}\left(\frac{29.4 + \frac{4.56}{13.6}}{68 + 460}\right) = 207.51$$

or $Vm_{stack} = \left(\frac{Vm}{\alpha} + Vw_{std}\right)\left(\frac{T_{s,avg} + 460}{T_{m,avg} + 460}\right)\left(\frac{P_m}{P_s}\right)$ (acf at stack conditions)

=

2. Stack gas moisture condensed at standard conditions (scf)

$$Vw_{std} = 0.04707\ Vl_c$$

$$= 0.04707\,(244.8) = 11.52$$

3. Stack gas proportion of water vapor, by volume

$$B_{wo} = \frac{Vw_{std}}{Vw_{std} + Vm_{std}}$$

$$= \frac{11.52}{11.52 + 207.51} = 0.05$$

4. Stack gas dry molecular weight (lb/lb-mole)

$$MW_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$$

$$= 0.44\,(4.95) + 0.32\,(14.27) + 0.28\,(80.78) = 27.363$$

5. Stack gas molecular weight (lb/lb-mole)

$$MW_s = MW_d\ (1 - B_{wo}) + 18\ (B_{wo})$$

$$= 27.363\,(1 - 0.05) + 18\,(0.05) = 28.77$$

6. Pressure stack, in. Hg

$$P_s = P_b + \frac{P_{st}}{13.6}$$

$$= 29.4 + \frac{3.2}{13.6} = 29.64$$

7. Stack gas velocity at stack conditions (ft/sec)

$$V_s = 85.49\ (C_p)\ (\sqrt{\Delta P})_{avg} \sqrt{\frac{T_{s,avg} + 460}{P_s\ MW_s}}$$

$$= 85.49\ (0.841)(2.73)\sqrt{\frac{609 + 460}{(29.64)28.79}} = 219.69$$

8. Stack gas volume at standard conditions (scfm)

$$Q_s = 60\ (1 - B_{wo})\ Vs_{avg}\ A_s \left(\frac{528}{T_{s,avg} + 460}\right)\left(\frac{P_s}{29.92}\right) =$$

or $Q_a = 60\ Vs_{avg}\ A_s$ (acfm) $= 60(1-0.05)(219.69)(1.2893)\left(\frac{528}{1069}\right)\frac{29.64}{29.92} = 7899.7$

9. Test percent isokinetic

$$\%I = \frac{17.33\ (T_{s,avg} + 460)\ \ [0.04707\ (W_{lc}) + Vm_{std}]}{\theta\ V_s\ P_s\ D_n^2}$$

$$= \frac{17.33\ (1069)\ [11.52 + 207.51]}{180(219.69)(29.64)(0.185)^2} = 101\ \%$$

10. Particulate matter concentration, gr/scf

$$C_s = 15.432\ \frac{M_p}{Vm_{std}} = \frac{15.432}{207.51} M_p = 0.0744\ M_p$$

or $C_a = 15.432\ \frac{M_p}{Vm_{stack}}$ (gr/acf) =

11. Emission rate of particulate matter, lb/hr

$$ER = 0.00857\ (Q_s)\ C_s$$

$$= 0.00857(7899.7)(0.0744)M_p = 5.0369$$

| | Probe + filter | condensible | total |
|---|---|---|---|
| $M_p$ grams | 0.2563 | – | – |
| ER lb/hr | 1.2910 | – | – |
| #/Btu-hr | 0.2790 | – | – |

12. Percent excess air at sampling point

$$\%\ EA = \frac{100\ [\%O_2 - 0.5\ (\%CO)]}{0.264\ \ \%N_2 - (\%O_2 - 0.5 \times \%CO)} =$$

13. Emission rate of particulate matter, lb/$10^6$ Btu

$$E = 2.679 \times 10^6 \left(\frac{M_p}{Vm_{std}}\right) F \left(\frac{20.9}{20.9 - \%O_2}\right)$$

=

## 5.3 SULFUR EMISSIONS DATA REDUCTION

## $H_2SO_4$ Mist and $SO_2$ Clean-Up and Analysis

Plant Colt Ind - Beloit  Date 6-24-80

Project No. CMEA  Recorded by Gregg Nicholl

BASELINE DIESEL

### $H_2SO_4$ Mist and $SO_2$ Train Description and Recovery Data

| Impinger Sequence | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Impinger Number | | | | | | |
| G-S Standard ( ) | ✓ | | ✓ | | | |
| G-S Modified ( ) | | ✓ | | ✓ | | |
| Contents | IPA | $H_2O_2$ | $H_2O_2$ | $SiO_2$ | | |
| Concentration (%) | 80% | 3% | 3% | | | |
| Initial Volume (ml) | | | | | | |
| Final Volume (ml) | | | | | | |
| Dilution Volume (ml) | 409 | 325 | | | | |
| Container Number | 062 | 061A | 061B | | | |

Location of glass wool in train Filter between probe + 1st IPA impinger

Location and type of filter in train Glass Fiber Filter between Impingers 1 & 2

Total Condensate (No. 8-7) _____

$$C_{SO_2} = \frac{7.05\times10^{-5}(42.03-0.14)(0.0148)\left(\frac{325}{25}\right)}{159.26} = 3.57\times10^{-6}\ lb/ft^3\ dry$$

$H_2O_2$ Sample Blank No. Yes

IPA Sample Blank No. Yes

$$C_{H_2SO_4} = \frac{1.08\times10^{-4}(2.95-0.08)(0.011)\left(\frac{400}{10}\right)}{159.26} = 8.56\times10^{-7}\ lb/ft^3\ dry$$

### $H_2SO_4$ and $SO_2$ Analysis

| Sample Number | 062 | 062 | 061A&B | | | |
|---|---|---|---|---|---|---|
| Volume of Titrant for Sample (ml) | 3.0 | 2.9 | 42.03 | | | |
| Volume of Titrant for Blank (ml) | 0.08 | 0.08 | 0.14 | | | |
| Normality of Titrant | 0.011 | 0.011 | 0.0148 | | | |
| Ttl. Vol. of Soln. (ml) | 400 | 400 | 325 | | | |
| Volume of Sample Aliquot Titrated (ml) | 10 | 10 | 25 | | | |
| Performed by | Gregg | Gregg | Gregg | | | |

## $H_2SO_4$ Mist and $SO_2$ Clean-Up and Analysis

Plant Colt Ind. - Beloit

Date 6-23-80

Project No. CMEA

Recorded by Cregg Nicholl

CONTROLLED NOx TEST - DIESEL

### $H_2SO_4$ Mist and $SO_2$ Train Description and Recovery Data

| Impinger Sequence | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Impinger Number | | | | | | |
| G-S Standard ( ) | ✓ | | ✓ | | | |
| G-S Modified ( ) | | ✓ | | ✓ | | |
| Contents | IPA | $H_2O_2$ | $H_2O_2$ | $SiO_2$ | | |
| Concentration (%) | 80% | 3% | 3% | | | |
| Initial Volume (ml) | | | | | | |
| Final Volume (ml) | | | | | | |
| Dilution Volume (ml) | | 1027 | | | | |
| Container Number | 057 | 058A&B | 058C&A | | | |

Location of glass wool in train Filter between probe and 1st IPA Impinger

Location and type of filter in train Glass fiber filters between impingers 1&2

Total Condensate (No. 8-7) _____

$$C_{SO_2} = \frac{7.05\times10^{-5}(22.23-0.14)(0.0148)\left(\frac{1027}{25}\right)}{133.82} = 7.07\times10^{-6}\ lb/ft^3\ dry$$

$H_2O_2$ Sample Blank No. Yes

IPA Sample Blank No. Yes

$$C_{H_2SO_4} = \frac{1.08\times10^{-4}(3.9-0.08)(0.011)\left(\frac{409}{10}\right)}{133.82} = 1.39\times10^{-6}\ lb/ft^3\ dry$$

### $H_2SO_4$ and $SO_2$ Analysis

| Sample Number | 057 | 057 | 058 A&B | | | |
|---|---|---|---|---|---|---|
| Volume of Titrant for Sample (ml) | 4.0 | 3.8 | 22.23 | | | |
| Volume of Titrant for Blank (ml) | 0.08 | 0.08 | 0.14 | | | |
| Normality of Titrant | 0.011 | 0.011 | 0.0148 | | | |
| Ttl. Vol. of Soln. (ml) | 409 | 409 | 1027 | | | |
| Volume of Sample Aliquot Titrated (ml) | 10 | 10 | 25 | | | |
| Performed by | Cregg | Cregg | Cregg | | | |

## 5.4 TRACE ELEMENTS

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-0434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14235 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-279-9521


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 23, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: 80-1535

XAD - BLANK

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.3 |
| Thorium | | Gadolinium | | Molybdenum | 0.4 | Titanium | 2 |
| Bismuth | <0.1 | Europium | | Niobium | | Scandium | <0.1 |
| Lead | 0.6 | Samarium | | Zirconium | 1 | Calcium | 170 |
| Thallium | | Neodymium | | Yttrium | <0.1 | Potassium | 24 |
| Mercury | NR | Praseodymium | 0.2 | Strontium | 0.2 | Chlorine | 1 |
| Gold | | Cerium | 0.9 | Rubidium | <0.1 | Sulfur | 9 |
| Platinum | | Lanthanum | 2 | Bromine | 0.4 | Phosphorus | 26 |
| Iridium | | Barium | 1 | Selenium | 0.2 | Silicon | *MC |
| Osmium | | Cesium | | Arsenic | <0.1 | Aluminum | 13 |
| Rhenium | | Iodine | <0.1 | Germanium | 0.2 | Magnesium | 17 |
| Tungsten | | Tellurium | | Gallium | 0.1 | Sodium | 98 |
| Tantalum | ≤0.6 | Antimony | 0.2 | Zinc | 6 | Fluorine | ≈3 |
| Hafnium | | Tin | 0.1 | Copper | 13 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | MC | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | 3 | Carbon | NR |
| Thulium | | Silver | | Iron | 120 | Boron | <0.1 |
| Erbium | | Palladium | | Manganese | 39 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 29 | Lithium | 0.1 |
| Dysprosium | | | | | | Hydrogen | NR |

• Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1 ppm
MC — Major Component
INT — Interference

Approved: 5-19

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 330 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: L. Jacobs

P. O. No.:

Sample No.: 80-1544
First Impinger Blank

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN µg/ml

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.001 |
| Thorium | | Gadolinium | | Molybdenum | 0.01 | Titanium | 0.09 |
| Bismuth | | Europium | | Niobium | | Scandium | |
| Lead | 0.07 | Samarium | | Zirconium | | Calcium | 2 |
| Thallium | | Neodymium | | Yttrium | | Potassium | 0.5 |
| Mercury | NR | Praseodymium | | Strontium | | Chlorine | 0.1 |
| Gold | | Cerium | | Rubidium | <0.001 | Sulfur | 0.2 |
| Platinum | | Lanthanum | | Bromine | 0.003 | Phosphorus | 0.9 |
| Iridium | | Barium | 0.04 | Selenium | | Silicon | 2 |
| Osmium | | Cesium | | Arsenic | | Aluminum | MC |
| Rhenium | | Iodine | | Germanium | | Magnesium | *0.9 |
| Tungsten | | Tellurium | | Gallium | | Sodium | 0.5 |
| Tantalium | | Antimony | | Zinc | 0.03 | Fluorine | |
| Hafnium | | Tin | | Copper | <0.001 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.03 | Nitrogen | NR |
| Ytterbium | | Cadmium | ≤0.01 | Cobalt | 0.007 | Carbon | NR |
| Thulium | | Silver | | Iron | 1 | Boron | <0.001 |
| Erbium | | Palladium | | Manganese | 0.02 | Beryllium | <0.001 |
| Holmium | | Rhodium | | Chromium | 0.001 | Lithium | <0.001 |
| Dysprosium | | | | | | Hydrogen | NR |

* Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.002 µg/ml
MC — Major Component >10 µg/ml
INT — Interference

Approved: 5-20

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

Reply to


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 25, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: A-45 Blank

IAD No.: 97-E697-116-28

FILTER BLANK

## SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

CONCENTRATION IN $\mu g/cm^2$

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | ≤0.008 | Terbium | | Ruthenium | | Vanadium | 0.02 |
| Thorium | 0.01 | Gadolinium | | Molybdenum | 0.005 | Titanium | 0.9 |
| Bismuth | | Europium | | Niobium | 0.01 | Scandium | 0.002 |
| Lead | 0.007 | Samarium | | Zirconium | 0.05 | Calcium | MC |
| Thallium | | Neodymium | 0.004 | Yttrium | 0.003 | Potassium | 0.5 |
| Mercury | NR | Praseodymium | 0.003 | Strontium | 0.04 | Chlorine | 0.4 |
| Gold | <0.001 | Cerium | 0.01 | Rubidium | <0.001 | Sulfur | 0.8 |
| Platinum | | Lanthanum | 0.02 | Bromine | 0.03 | Phosphorus | 0.07 |
| Iridium | | Barium | 0.2 | Selenium | 0.005 | Silicon | MC |
| Osmium | | Cesium | | Arsenic | 0.001 | Aluminum | MC |
| Rhenium | | Iodine | 0.001 | Germanium | | Magnesium | 1 |
| Tungsten | 0.01 | Tellurium | | Gallium | 0.008 | Sodium | >2 |
| Tantalum | | Antimony | | Zinc | 0.01 | Fluorine | ≈0.005 |
| Hafnium | | Tin | | Copper | 0.01 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.01 | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | <0.001 | Carbon | NR |
| Thulium | | Silver | 0.001 | Iron | 0.2 | Boron | 0.9 |
| Erbium | | Palladium | | Manganese | 0.003 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 0.02 | Lithium | <0.001 |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected <0.001 $\mu g/cm^2$
MC — Major Component > 10 $\mu g/cm^2$
INT — Interference

Approved: M Jacobs
5-21

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Avenue
Mountain View, California 94042

Date: September 26, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: 1508
DIESEL ENGINE - GASOLINE FILTER

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS

IAD No.: 97-E697-116-28

CONCENTRATION IN $\mu g/cm^2$

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.01 |
| Thorium | 0.005 | Gadolinium | | Molybdenum | 0.009 | Titanium | 0.8 |
| Bismuth | <0.001 | Europium | | Niobium | 0.004 | Scandium | 0.002 |
| Lead | 0.1 | Samarium | 0.001 | Zirconium | 0.08 | Calcium | MC |
| Thallium | | Neodymium | 0.002 | Yttrium | 0.002 | Potassium | 0.4 |
| Mercury | NR | Praseodymium | 0.002 | Strontium | 0.04 | Chlorine | 0.1 |
| Gold | | Cerium | 0.006 | Rubidium | <0.001 | Sulfur | MC |
| Platinum | | Lanthanum | 0.008 | Bromine | 0.03 | Phosphorus | 0.2 |
| Iridium | | Barium | 0.1 | Selenium | 0.004 | Silicon | MC |
| Osmium | | Cesium | <0.001 | Arsenic | 0.002 | Aluminum | MC |
| Rhenium | | Iodine | 0.003 | Germanium | <0.001 | Magnesium | 3 |
| Tungsten | 0.003 | Tellurium | 0.005 | Gallium | 0.006 | Sodium | MC |
| Tantalum | | Antimony | | Zinc | 0.1 | Fluorine | ≈0.4 |
| Hafnium | | Tin | 0.006 | Copper | 0.09 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.02 | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | <0.001 | Carbon | NR |
| Thulium | | Silver | <0.001 | Iron | 0.5 | Boron | 2 |
| Erbium | | Palladium | | Manganese | 0.007 | Beryllium | <0.001 |
| Holmium | | Rhodium | | Chromium | 0.03 | Lithium | 0.009 |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.001 $\mu g/cm^2$
MC — Major Component >10$\mu g/cm^2$
INT — Interference

Approved: 5-22

M G Jacobs

**COMMERCIAL TESTING & ENGINEERING CO.**
GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 25, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: 80-1516
DIESEL ENGINE - LOW NOx FILTER

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN $\mu g/cm^2$

IAD No.: 97-E697-116-28

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | ≤0.002 | Terbium | | Ruthenium | | Vanadium | 0.007 |
| Thorium | 0.004 | Gadolinium | | Molybdenum | 0.009 | Titanium | 0.3 |
| Bismuth | <0.001 | Europium | | Niobium | 0.004 | Scandium | <0.001 |
| Lead | 0.09 | Samarium | 0.001 | Zirconium | 0.06 | Calcium | MC |
| Thallium | | Neodymium | 0.001 | Yttrium | 0.002 | Potassium | 0.8 |
| Mercury | NR | Praseodymium | <0.001 | Strontium | 0.08 | Chlorine | 0.06 |
| Gold | | Cerium | 0.006 | Rubidium | <0.001 | Sulfur | 2 |
| Platinum | | Lanthanum | 0.01 | Bromine | 0.02 | Phosphorus | 0.09 |
| Iridium | | Barium | 0.2 | Selenium | 0.001 | Silicon | 6 |
| Osmium | | Cesium | | Arsenic | 0.002 | Aluminum | MC |
| Rhenium | | Iodine | 0.002 | Germanium | <0.001 | Magnesium | 0.5 |
| Tungsten | | Tellurium | | Gallium | 0.003 | Sodium | >0.06 |
| Tantalum | | Antimony | <0.001 | Zinc | 0.07 | Fluorine | INT |
| Hafnium | | Tin | 0.002 | Copper | 0.04 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.01 | Nitrogen | NR |
| Ytterbium | | Cadmium | <0.001 | Cobalt | <0.001 | Carbon | NR |
| Thulium | | Silver | <0.001 | Iron | 0.2 | Boron | INT |
| Erbium | | Palladium | | Manganese | 0.006 | Beryllium | INT |
| Holmium | | Rhodium | | Chromium | 0.02 | Lithium | INT |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected <0.001 $\mu g/cm^2$
MC — Major Component >10 $\mu g/cm^2$
INT — Interference

Approved: 5-23

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: C. Wilson

P. O. No.:

Sample No.: 80-1556

DIESEL BASELINE
FUEL OIL

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.04 |
| Thorium | | Gadolinium | | Molybdenum | 2 | Titanium | 2 |
| Bismuth | | Europium | | Niobium | | Scandium | 0.02 |
| Lead | 0.2 | Samarium | | Zirconium | 0.09 | Calcium | 51 |
| Thallium | | Neodymium | | Yttrium | | Potassium | 44 |
| Mercury | | Praseodymium | | Strontium | 0.1 | Chlorine | 0.7 |
| Gold | | Cerium | | Rubidium | | Sulfur | MC |
| Platinum | | Lanthanum | | Bromine | 0.4 | Phosphorus | 7 |
| Iridium | | Barium | 0.8 | Selenium | | Silicon | *15 |
| Osmium | | Cesium | | Arsenic | | Aluminum | >21 |
| Rhenium | | Iodine | ≤0.03 | Germanium | | Magnesium | 2 |
| Tungsten | ≤0.1 | Tellurium | | Gallium | | Sodium | 1 |
| Tantalium | | Antimony | | Zinc | 0.9 | Fluorine | ≈0.2 |
| Hafnium | | Tin | | Copper | 0.6 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.7 | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | 0.08 | Carbon | NR |
| Thulium | | Silver | | Iron | 10 | Boron | 0.02 |
| Erbium | | Palladium | | Manganese | *0.2 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 0.05 | Lithium | 0.06 |
| Dysprosium | | | | | | Hydrogen | NR |

• Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.02 ppm
MC — Major Component > 100 ppm
INT — Interference

Approved: 5-24

M Y[illegible]

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 330 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521


Reply to

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: C. Wilson

P. O. No.:

Sample No.: 80-1558
DIESEL CONTROLLED
FUEL OIL

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.02 |
| Thorium | | Gadolinium | | Molybdenum | 0.2 | Titanium | 2 |
| Bismuth | | Europium | | Niobium | | Scandium | <0.01 |
| Lead | 0.3 | Samarium | | Zirconium | | Calcium | 19 |
| Thallium | | Neodymium | | Yttrium | | Potassium | 58 |
| Mercury | | Praseodymium | | Strontium | 0.2 | Chlorine | 0.3 |
| Gold | | Cerium | 0.02 | Rubidium | 0.01 | Sulfur | 1 |
| Platinum | | Lanthanum | 0.02 | Bromine | 0.08 | Phosphorus | 0.5 |
| Iridium | | Barium | 0.3 | Selenium | | Silicon | 5 |
| Osmium | | Cesium | | Arsenic | | Aluminum | 5 |
| Rhenium | | Iodine | | Germanium | | Magnesium | 1 |
| Tungsten | | Tellurium | | Gallium | | Sodium | 4 |
| Tantalium | | Antimony | 0.07 | Zinc | 0.6 | Fluorine | ≈3 |
| Hafnium | | Tin | | Copper | 0.2 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.4 | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | 0.04 | Carbon | NR |
| Thulium | | Silver | 0.2 | Iron | 0.04 | Boron | <0.01 |
| Erbium | | Palladium | | Manganese | 0.05 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 0.1 | Lithium | 0.04 |
| Dysprosium | | | | | | Hydrogen | NR |

STD – Internal Standard
NR – Not Reported
All elements not detected <0.01 ppm
MC – Major Component >100 ppm
INT – Interference

Approved: 5-25

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: L. Jacobs

P. O. No.:

Sample No.: 80-1560

DIESEL LUBE OIL

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.04 |
| Thorium | | Gadolinium | | Molybdenum | 0.4 | Titanium | 7 |
| Bismuth | | Europium | | Niobium | | Scandium | ≤0.02 |
| Lead | 1 | Samarium | | Zirconium | | Calcium | MC |
| Thallium | | Neodymium | | Yttrium | | Potassium | MC |
| Mercury | | Praseodymium | | Strontium | 23 | Chlorine | 53 |
| Gold | | Cerium | | Rubidium | 0.04 | Sulfur | MC |
| Platinum | | Lanthanum | 0.03 | Bromine | 0.7 | Phosphorus | 6 |
| Iridium | | Barium | 50 | Selenium | 0.3 | Silicon | 96 |
| Osmium | | Cesium | 0.01 | Arsenic | 1 | Aluminum | 0.7 |
| Rhenium | | Iodine | | Germanium | | Magnesium | 3 |
| Tungsten | | Tellurium | | Gallium | 0.05 | Sodium | MC |
| Tantalium | | Antimony | 0.02 | Zinc | 18 | Fluorine | ≈0.2 |
| Hafnium | | Tin | 0.2 | Copper | 5 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 2 | Nitrogen | NR |
| Ytterbium | | Cadmium | 0.07 | Cobalt | 0.7 | Carbon | NR |
| Thulium | | Silver | 0.01 | Iron | 85 | Boron | <0.01 |
| Erbium | | Palladium | | Manganese | 0.5 | Beryllium | <0.01 |
| Holmium | | Rhodium | | Chromium | 7 | Lithium | 0.07 |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.01 ppm
MC — Major Component > 100 ppm
INT — Interference

Approved: 5-26

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

Reply to

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 23, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: 80-1533

DIESEL BASELINE

XAD

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | <0.1 |
| Thorium | | Gadolinium | | Molybdenum | *0.3 | Titanium | 1 |
| Bismuth | | Europium | | Niobium | | Scandium | <0.1 |
| Lead | 0.3 | Samarium | | Zirconium | 0.3 | Calcium | 130 |
| Thallium | | Neodymium | | Yttrium | | Potassium | MC |
| Mercury | NR | Praseodymium | <0.1 | Strontium | 0.4 | Chlorine | 0.9 |
| Gold | | Cerium | 0.5 | Rubidium | <0.1 | Sulfur | 48 |
| Platinum | | Lanthanum | 0.6 | Bromine | 0.9 | Phosphorus | 9 |
| Iridium | | Barium | 1 | Selenium | <0.1 | Silicon | 270 |
| Osmium | | Cesium | | Arsenic | <0.1 | Aluminum | MC |
| Rhenium | | Iodine | | Germanium | <0.1 | Magnesium | 9 |
| Tungsten | | Tellurium | | Gallium | <0.1 | Sodium | >59 |
| Tantalum | ≤0.4 | Antimony | | Zinc | 5 | Fluorine | ≈2 |
| Hafnium | | Tin | <0.1 | Copper | 21 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | MC | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | 2 | Carbon | NR |
| Thulium | | Silver | 0.3 | Iron | 110 | Boron | *<0.1 |
| Erbium | | Palladium | | Manganese | 3 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 13 | Lithium | <0.1 |
| Dysprosium | | | | | | Hydrogen | NR |

• Heterogeneous

STD — Internal Standard
NR — Not Reported
All elements not detected <0.1 ppm
MC — Major Component
INT — Interference

Approved: 5-27

M Jacobs

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 23, 1980

Analyst: T. Bouts

P. O. No.:

Sample No.: 80-1534
DIESEL CONTROLLED
XAD

IAD No.: 97-E697-116-28

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN PPM WEIGHT

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.2 |
| Thorium | | Gadolinium | | Molybdenum | 0.9 | Titanium | 2 |
| Bismuth | | Europium | | Niobium | | Scandium | <0.1 |
| Lead | 2 | Samarium | | Zirconium | 0.4 | Calcium | 130 |
| Thallium | | Neodymium | | Yttrium | | Potassium | 36 |
| Mercury | NR | Praseodymium | 0.2 | Strontium | 0.4 | Chlorine | 1 |
| Gold | | Cerium | 0.7 | Rubidium | <0.1 | Sulfur | 22 |
| Platinum | | Lanthanum | 1 | Bromine | 0.4 | Phosphorus | 34 |
| Iridium | | Barium | 4 | Selenium | ≤0.2 | Silicon | 200 |
| Osmium | | Cesium | | Arsenic | <0.1 | Aluminum | 15 |
| Rhenium | | Iodine | | Germanium | <0.1 | Magnesium | 9 |
| Tungsten | | Tellurium | | Gallium | 0.2 | Sodium | 25 |
| Tantalum | ≤1 | Antimony | | Zinc | 17 | Fluorine | |
| Hafnium | | Tin | | Copper | 35 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | MC | Nitrogen | NR |
| Ytterbium | | Cadmium | | Cobalt | 4 | Carbon | NR |
| Thulium | | Silver | <0.1 | Iron | 310 | Boron | 0.2 |
| Erbium | | Palladium | | Manganese | 30 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 30 | Lithium | 0.3 |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.1 ppm
MC — Major Component
INT — Interference

Approved: 5-28

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521


To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: L. Jacobs

P. O. No.:

Sample No.: 80-1545

IAD No.: 97-E697-116-28

DIESEL BASELINE
1st IMPINGER & ORGANIC MODULE CONDENSATE

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN µg/ml

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.002 |
| Thorium | | Gadolinium | | Molybdenum | 0.02 | Titanium | 0.4 |
| Bismuth | | Europium | | Niobium | <0.001 | Scandium | 0.1 |
| Lead | 0.03 | Samarium | | Zirconium | 0.009 | Calcium | 10 |
| Thallium | | Neodymium | 0.003 | Yttrium | <0.001 | Potassium | MC |
| Mercury | NR | Praseodymium | | Strontium | 0.002 | Chlorine | 0.2 |
| Gold | | Cerium | 0.001 | Rubidium | 0.01 | Sulfur | MC |
| Platinum | | Lanthanum | 0.003 | Bromine | 0.01 | Phosphorus | MC |
| Iridium | | Barium | 0.05 | Selenium | 0.3 | Silicon | 6 |
| Osmium | | Cesium | <0.001 | Arsenic | 0.001 | Aluminum | MC |
| Rhenium | | Iodine | | Germanium | <0.001 | Magnesium | 1 |
| Tungsten | | Tellurium | | Gallium | 0.005 | Sodium | MC |
| Tantalium | | Antimony | 0.002 | Zinc | 1 | Fluorine | ≈0.009 |
| Hafnium | | Tin | 0.07 | Copper | 0.2 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.2 | Nitrogen | NR |
| Ytterbium | | Cadmium | 0.02 | Cobalt | 0.01 | Carbon | NR |
| Thulium | | Silver | 0.1 | Iron | 4 | Boron | 0.005 |
| Erbium | | Palladium | | Manganese | 0.1 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 0.03 | Lithium | |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected <0.001 µg/ml
MC — Major Component >10 µg/ml
INT — Interference

Approved: M Y Jacobs
5-29

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434
Reply to INSTRUMENTAL ANALYSIS DIVISION, 14335 WEST 44TH AVENUE, GOLDEN, COLORADO 80401, PHONE: 303-278-9521

To: Mr. Brent Higginbotham
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042

Date: September 22, 1980

Analyst: L. Jacobs

P. O. No.:

Sample No.: 80-1546

IAD No.: 97-E697-116-28

DIESEL CONTROLLED
+ INORGANIC & ORGANIC MODULE CONDENSATE

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSIS
CONCENTRATION IN µg/ml

| ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. | ELEMENT | CONC. |
|---|---|---|---|---|---|---|---|
| Uranium | | Terbium | | Ruthenium | | Vanadium | 0.002 |
| Thorium | | Gadolinium | | Molybdenum | 0.01 | Titanium | 0.1 |
| Bismuth | | Europium | | Niobium | 0.002 | Scandium | ≤0.002 |
| Lead | 0.05 | Samarium | | Zirconium | 0.006 | Calcium | 2 |
| Thallium | | Neodymium | | Yttrium | 0.001 | Potassium | MC |
| Mercury | NR | Praseodymium | | Strontium | 0.009 | Chlorine | 0.1 |
| Gold | | Cerium | | Rubidium | 0.001 | Sulfur | MC |
| Platinum | | Lanthanum | | Bromine | 0.02 | Phosphorus | 1 |
| Iridium | | Barium | 0.05 | Selenium | 0.4 | Silicon | 11 |
| Osmium | | Cesium | <0.001 | Arsenic | <0.001 | Aluminum | MC |
| Rhenium | | Iodine | | Germanium | <0.001 | Magnesium | 0.4 |
| Tungsten | | Tellurium | 0.002 | Gallium | 0.01 | Sodium | MC |
| Tantalium | | Antimony | 0.007 | Zinc | 3 | Fluorine | ≈0.9 |
| Hafnium | | Tin | 0.08 | Copper | 4 | Oxygen | NR |
| Lutetium | | Indium | STD | Nickel | 0.09 | Nitrogen | NR |
| Ytterbium | | Cadmium | 0.006 | Cobalt | 0.02 | Carbon | NR |
| Thulium | | Silver | 0.02 | Iron | 1 | Boron | 0.001 |
| Erbium | | Palladium | | Manganese | 0.04 | Beryllium | |
| Holmium | | Rhodium | | Chromium | 0.1 | Lithium | 0.004 |
| Dysprosium | | | | | | Hydrogen | NR |

STD — Internal Standard
NR — Not Reported
All elements not detected < 0.001 µg/ml
MC — Major Component > 10 µg/ml
INT — Interference

Approved: 5-30

# AAS ANALYSIS SHEET

Contractor Acurex

Sample Site COLT INDUSTRIES Sample Acquisition Date 4-22/23-80

Type of Source COMPRESSION IGNITION ENGINE

Test Number _____ Sample ID Number _____

Sample Description _____

Original Sample Volume or Mass _____

Analyst Responsible G. Nicoll Date Analyzed 7-9-80 Time _____

Calculations and Report Reviewed By G. Nicoll Report Date _____

| | As | Hg | Sb |
|---|---|---|---|
| Instrument Used | PE 460 | PE 460 | PE 460 |
| Wavelength Setting (nm) | 193.7 | 253.7 | 217.6 |
| Lamp Current (ma) | 8 watts | 6 | 20 |
| Fuel/Oxidizer Pressures (psi) | | | |
| PM Voltage (volts) | | | |
| Detection Limit ug/L | 10 | 1 | 3 |
| Sensitivity (abs. units/ppm/ sample volume) | | | |
| High/Low Calibration Standards (ppm) | 0.050 | 0.050 | 0.100 |
| Sample Aliquot Volume (mL) | 0.02 | 25. | 0.02 |
| Dilution Factor | | | |
| Uncorrected Sample Aliquot Value (ppm) | | | |
| Blank Value (ppm) | | | |
| Corrected Sample Aliquot Value (ppm) | | | |
| Assigned Concentration* | | | |
| At Source Mass/Volume, $mg/m^3$ or $\mu g/L$ | | | |

*Results: PPM value (in original sample) or I - interference; NC - not computed; NG - sample value below blank; ND - not detectable (<2σ blank or baseline).

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA
DATE July 10, 1980
CUSTOMER CONTRACT NO. 307605.22
ACUREX CONTRACT NO.
RESULTS REPORT TO
TELEPHONE
ADDRESS
Beloit Test 1 DIESEL BASELINE

| SAMPLE ID (CUSTOMER) | Fuel Hg | Lube Hg | Filter Hg | XAD Hg | 1 Imp Hg | 2 & 3 Hg | 2&3 As | 2&3 Sb | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| Blank | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Sample Aliquot | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Total Sample | | | | | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Total Sample | Less 0.1 | Less 0.1 | Less 2 | Less 0.1 | | | | | | ug/g |
| Total Sample | | | Less 1 | Less 10 | Less 0.9 | Less 1 | Less 10 | Less 3 | | ug |
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ANALYST G. Nicoll
REVIEWER Greg Nicoll

Form EED-057 4/80

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA DATE July 10, 1980

CUSTOMER CONTRACT NO. 307605.22 ACUREX CONTRACT NO.

RESULTS REPORT TO TELEPHONE

ADDRESS

Beloit Test 2 DIESEL CONTROLLED NOx

| SAMPLE ID (CUSTOMER) | Fuel Hg | Lube Hg | Filter Hg | XAD Hg | 1 Imp Hg | 2&3 Hg | 2&3 As | 2&3 Sb | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| Blank | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Sample Aliquot | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Total Sample | | | | | Less 1 | Less 1 | Less 10 | Less 3 | | ug/L |
| Total Sample | Less 0.1 | Less 0.1 | Less 2 | Less 0.1 | | | | | | ug/g |
| Total Sample | | | Less 2 | Less 10 | Less 1 | Less 1 | Less 10 | Less 3 | | ug |
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ANALYST C. Nicoll

REVIEWER Greg Hoff

Form EED-057 4.80

## 5.5 TCO, GRAV, AND GC/MS RESULTS AND INFRARED SPECTRA OF TOTAL SAMPLE EXTRACTS

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA
DATE July 15, 1980
CUSTOMER CONTRACT NO. 307605.22
ACUREX CONTRACT NO.
RESULTS REPORT TO
TELEPHONE
ADDRESS
Beloit Test 1 Diesel Baseline

| SAMPLE ID (CUSTOMER) | Filter | XAD | OMC | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| TCO Blank | | 0.07 | Less 0.02 | | | | | | | mg |
| TCO Sample | | 24 | 0.26 | | | | | | | mg |
| TCO Sample, Corrected | | 24 | 0.26 | | | | | | | mg |
| Grav Blank | Less 2 | 4 | Less 2 | | | | | | | mg |
| GRAV Sample | 11 | 69 | Less 2 | | | | | | | mg |
| GRAV, Corrected | 11 | 65 | Less 2 | | | | | | | mg |
| TCO & GRAV | 11 | 89 | Less 2 | | | | | | | mg |
| TCO & GRAV | 0.67 | 5.4 | Less 0.1 | | | | | | | mg/dscm |
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ANALYST M. Gardner, G. Nicoll
REVIEWER Greg Nicoll

Form EED-057 4/80

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA
DATE July 15, 1980
CUSTOMER CONTRACT NO. 307605.22
ACUREX CONTRACT NO.
RESULTS REPORT TO
TELEPHONE
ADDRESS
Beloit Test 2 Diesel - Low. $NO_x$

| SAMPLE ID (CUSTOMER) | Filter | XAD | OMC | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| TCO Blank | | 0.07 | Less 0.02 | | | | | | | mg |
| TCO Sample | | 31 | 0.56 | | | | | | | mg |
| TCO, Corrected | | 31 | 0.56 | | | | | | | mg |
| GRAV Blank | Less 2 | 4 | Less 2 | | | | | | | mg |
| GRAV Sample | 226 | 102 | Less 2 | | | | | | | mg |
| GRAV, Corrected | 226 | 98 | Less 2 | | | | | | | mg |
| TCO & GRAV | 226 | 129 | Less 2 | | | | | | | mg |
| TCO & GRAV | 10.1 | 5.8 | Less 0.1 | | | | | | | mg/dscm |
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ANALYST M. Gardner, G. Nicoll
REVIEWER Greg Nicoll

Form EED-057 4/80

COMPOUNDS SOUGHT

Detection Limit in nanograms

| | |
|---|---|
| 8 | • 4-bromophenyl phenyl ether |
| 1 | * bis (2-chloroisopropyl) ether |
| 2 | • bis (2-chloroethoxy) methane |
| 8 | * hexachlorobutadiene |
| 40 | • hexachlorocyclopentadiene |
| 1 | * isophorone |
| 1 | * naphthalene |
| 8 | • nitrobenzene |
| 4 | * N-nitrosodiphenylamine |
| 40 | • N-nitrosodi-n-propylamine |
| 3 | * bis (2-ethylhexyl) phthalate |
| 3 | • butyl benzyl phthalate |
| 1 | • di-n-butyl phthalate |
| 2 | * di-n-octyl phthalate |
| 2 | • diethyl phthalate |
| 2 | * dimethyl phthalate |
| 5 | • benzo(a)anthracene |
| 7 | • benzo(a)pyrene |
| 8 | • 3,4-benzofluoranthene |
| 8 | • benzo(k)fluoranthene |
| 5 | • chrysene |
| 1 | • acenaphthylene |
| 1 | • anthracene |
| 40 | * benzo(ghi)perylene |
| 2 | * fluorene |
| 1 | * phenanthrene |
| 40 | • dibenzo(a,h)anthracene |
| 40 | • indeno(1,2,3-cd)pyrene |
| 2 | • pyrene |
| 2 | • acenaphthene |
| 100 | • benzidine |
| 8 | • 1,2,4-trichlorobenzene |
| 8 | * hexachlorobenzene |
| 8 | • hexachloroethane |
| 3 | * bis(2-chloroethyl)ether |
| 2 | • 2-chloronaphthalene |
| 4 | • 1,2-dichlorobenzene |
| 8 | • 1,3-dichlorobenzene |
| 4 | • 1,4-dichlorobenzene |
| 20 | • 3,3-dichlorobenzindine |
| 10 | * 2,4-dinitrotoluene |
| 10 | • 2,6-dinitrotoluene |
| 1 | • 1,2-diphenylhydrazine (as azobenzene) |
| 2 | * fluoranthene |
| 4 | • 4-chlorophenyl phenyl ether |
| 40 | anthanthrene |
| 40 | benzo(e)pyrene |
| @ | dibenzo(a,H)pyrene |
| @ | dibenzo(a,i)pyrene |
| 40 | dibenzo(c,g)carbozole |
| 40 | 7,12 dimethyl benz(a)anthracene |
| 40 | 3-methyl cholanthrene |
| 40 | perylene |
| 40 | Benzo(c)phenanthrene |

*Authenic standard ran

@Molecular weight too high for direct analysis by Base/Neutral run

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA DATE July 21, 1980
CUSTOMER CONTRACT NO. 307605.22 ACUREX CONTRACT NO.
RESULTS REPORT TO TELEPHONE
ADDRESS
Beloit Test 1 16.4 dscm Diesel Baseline

| SAMPLE ID (CUSTOMER) | Filter Bk | Filter | XAD Blk | XAD | OMC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| Amount injected | 2 | 1 | 2 | 1 | 2 | | | | | uL |
| Bis eth/hex phthalate* | Less 2 | 390 | 13 | 1700 | 61 | | | | | mg/L |
| Fluoranthene* | Less 1 | Less 2 | Less 1 | 36 | 12 | | | | | mg/L |
| Naphthalene* | Less 0.5 | 22 | Less 0.5 | 100 | Less 0.5 | | | | | mg/L |
| Phenan/Anthracene* | Less 0.5 | Less 1 | Less 0.5 | 16 | 0.8 | | | | | mg/L |
| Pyrene* | Less 1 | Less 2 | Less 1 | 10 | 4 | | | | | mg/L |
| Bis eth/hex phthalate | | 32 | | 1100 | 4.1 | | | | | ug/dscm |
| Fluoranthene | | Less 0.2 | | 24 | 0.81 | | | | | ug/dscm |
| Naphthalene | | 1.8 | | 67 | Less 0.03 | | | | | ug/dscm |
| Phenanthr/Anthracene | | Less 0.08 | | 11 | 0.05 | | | | | ug/dscm |
| Pyrene | | Less 0.2 | | 7 | 0.3 | | | | | ug/dscm |
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*Sample Aliquot

ANALYST
REVIEWER Greg Nicoll

Form EED-057 4:80

ACUREX Corporation
ANALYSIS LABORATORIES

# DATA REPORTING FORM

CUSTOMER CMEA
DATE July 21, 1980
CUSTOMER CONTRACT NO. 307605.22
ACUREX CONTRACT NO.
RESULTS REPORT TO
TELEPHONE
ADDRESS
Beloit Test 2 22.3 dscm Diesel - Low-$NO_x$

| SAMPLE ID (CUSTOMER) | Filter Bk | Filter | XAD Blank | XAD | OMC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID (LAB) | | | | | | | | | | |
| PARAMETER | | | | | | | | | | UNITS |
| Amount injected | 2 | 1 | 2 | 1 | 2 | | | | | uL |
| Bis eth/hex phthalate* | Less 2 | 170 | 13 | 1100 | 420 | | | | | mg/L |
| Fluoranthene* | Less 1 | Less 2 | Less 1 | Less 2 | Less 1 | | | | | mg/L |
| Naphthalene* | Less 0.5 | Less 1 | Less 0.5 | 100 | Less 0.5 | | | | | mg/L |
| Phenanthr/Anthracene* | Less 0.5 | Less 1 | Less 0.5 | 8 | 1 | | | | | mg/L |
| Pyrene* | Less 1 | Less 2 | Less 1 | Less 2 | Less 1 | | | | | mg/L |
| Bis eth/hex phthalate | | 83 | | 540 | 21 | | | | | ug/dscm |
| Fluoranthene | | Less 1 | | Less 1 | Less 0.05 | | | | | ug/dscm |
| Naphthalene | | Less 0.5 | | 49 | Less 0.02 | | | | | ug/dscm |
| Phenanthr/Anthracene | | Less 0.5 | | 4 | 0.05 | | | | | ug/dscm |
| Pyrene | | Less 1 | | Less 1 | Less 0.05 | | | | | ug/dscm |
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*Sample Aliquot

ANALYST
REVIEWER Greg Nicoll

Form EED-057 4/80

IR REPORT

SAMPLE: Filter Blank

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
| 2750 - 2450 | W | O-H (COOH) | |

GN 7/20/80

IR REPORT

SAMPLE: Filter Beloit Test 1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |

IR REPORT

SAMPLE: Filter Beloit Test 2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
| 1725 | W | C=O | |
| 1445 | W | C-H Alkane | |
| 1375 | W | C-H Alkane | |
| 725 | W | Not Assigned | |
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IR REPORT

SAMPLE: XAD Blank

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
| 2750 - 2450 | W | O-H (COOH) | |



GN/7/20/80

IR REPORT

SAMPLE: XAD Beloit Test 1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 3575-3070 | W | O-H (COOH) | |
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
| 2750-2450 | W | O-H (COOH) | |
| 1725 | S | C=O (COOH) | |
| 1445 | W | C-H Alkane | |
| 1265 | W | C-O (COOH) | |
| 1095 | W | C-O (COOH) | |
| 805 | W | Not Assigned | |
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IR REPORT

SAMPLE: XAD Beloit Test 2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 3575-3070 | W | O-H (COOH) | |
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
| 2750-2450 | W | O-H (COOH) | |
| 1725 | S | C=O (COOH) | |
| 1445 | W | C-H Alkane | |
| 1265 | W | C-O (COOH) | |
| 805 | W | Not Assigned | |
| 705 | W | Not Assigned | |

IR REPORT

SAMPLE: OMC Beloit Test 2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2905 | S | C-H Alkane | |
| 2845 | S | C-H Alkane | |
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IR REPORT

SAMPLE: OMC Beloit Test 1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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| Hydrocarbon | Baseline | | | | Controlled $NO_x$ | | | | | Average percent change from baseline |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sample 1 | Sample 2 | Sample 3 | Average | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Average | |
| $C_1$ | 35.7±3.6 | 27.3±2.7 | 7.7±1.5 | 23.6±2.6 | 3.5±1.5 | 6.3±1.5 | 5.6±1.5 | 7.0±1.5 | 5.6±1.5 | -76 |
| $C_2$ | 18.7±1.9 | 10.5±1.5 | 8.2±1.5 | 12.5±1.6 | 14.6±1.5 | 13.7±1.5 | 14.6±1.5 | 22.0±2.2 | 16.2±1.7 | +30 |
| $C_3$ | 5.7±1.5 | 1.2±1.6 | 1.5±1.6 | 2.8±1.6 | 2.0±1.6 | 2.4±1.6 | 5.4±1.6 | 4.4±1.6 | 3.6±1.6 | +29 |
| $C_4$ | 4.0±1.5 | 3.3±1.5 | 6.8±1.5 | 4.7±1.5 | 2.2±1.5 | 1.7±1.5 | 12.8±1.5 | 5.0±1.5 | 5.4±1.5 | +15 |
| $C_5$ | 4.8±1.6 | 4.5±1.6 | 6.1±1.6 | 5.1±1.6 | --[a] | --[a] | 9.1±1.6 | 5.0±1.6 | 7.0±1.6 | +37 |
| $C_6$ | --[a] | --[a] | --[a] | -- | --[a] | --[a] | --[a] | --[a] | -- | -- |
| Total $C_1$-$C_6$ | 69±10 | 47±9 | 30±8 | 49±9 | 22±6 | 24±6 | 47±8 | 43±8 | 38±8 | -22[b] |

[a]Undetectable
[b]Weighted average percent change in total ($C_1$-$C_6$) hydrocarbon emissions

100003

# ORGANIC COMPOUNDS (bp < 100° C)

Contractor: Colt-Ind. Beloit Wisconsin

Sample Site: — Sample Acquisition Date: N/A Time:

Type of Source: Cal Gas

Test Number: Calib. Gas Sample ID Number: 100003

Sample Description: Calibration gas $C_1 - C_6$

Analyst Responsible: DaRos Date Analyzed: 4-23-80 Time: 1555

Calculations and Report Reviewed By: Costaldini Report Date: 7-9-80

## Workup

1. Column Flow Rate (mL/min):
2. Recorder Speed:
3. Full Scale (mV): 1.0 MV
4. Column Pressure (psi):
5. Electrometer Set (A/mV):
6. Calibration Date: 4-23-80
7. Sample Size (mL): 600 µl
8. Oven Temperature (°C):
9. Flame Flow Rates (mL/min): $H_2$ Air
10. Attenuation: X1
11. Range: X1
12. Observations: Column Temp 112°F

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (< 2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 21.6 | | 1.1 | | | | | 15.1 | ± 1.5 |
| $IC_2$ | 32 | | 1.8 | | | | | 14.6 | ± 1.5 |
| $IC_3$ | 54.9 | | 3.6 | | | | | 15.6 | ± 1.6 |
| $IC_4$ | 69 | | 9.4 | | | | | 15.2 | ± 1.5 |
| $IC_5$ | 84.5 | | 26.7 | | | | | 15.6 | ± 1.6 |
| $IC_6$ | 90 | | 78.0 | | | | | 15.9 | ± 1.6 |
| $IC_7$ | | | | | | | | | |

10000 2

# ORGANIC COMPOUNDS (bp < 100° C)

Contractor: COIT - BELOIT, WS.

Sample Site: DIESEL - BASELINE  Sample Acquisition Date: 4-22-80  Time: 1858

Type of Source: COMPRESSION IGNITION ENGINE

Test Number: 1 - BASELINE  Sample ID Number: 100002

Sample Description: STACK GAS

Analyst Responsible: DaRos  Date Analyzed: 4-23-80  Time: 0541

Calculations and Report Reviewed By: Castaldini  Report Date:

Sample Temp 130°F 1000 µl

## Workup

1. Column Flow Rate (mL/min): 
2. Recorder Speed: 1cm/m
3. Full Scale (mV): 1.0
4. Column Pressure (psi): 
5. Electrometer Set (A/mV): 
6. Calibration Date: 4-23-80
7. Sample Size (mL): 1.0
8. Oven Temperature (°C): 
9. Flame Flow Rates (mL/min): $H_2$ ____ Air ____
10. Attenuation: X1
11. Range: 10'
12. Observations:

Air 10psi $H_2$ 18psi $H_2$ 14psi Column Temp 112°F

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (< 2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 51.1 | | 1.2 min | | | | | 35.7 | $C_1$ |
| $IC_2$ | 26 | | 1.6 min | | | | | 11.9 | $C_2$ |
| $IC_3$ | 15 | | 1.9 min | | | | | 6.8 | $C_2$ |
| $IC_4$ | 18.9 | | 3.5 | | | | | 5.7 | $C_3$ |
| $IC_5$ | 18.2 | | 5.2 | | | | | 4.0 | $C_4$ |
| $IC_6$ | 25.9 | | 15.0 | | | | | 4.8 | $C_5$ |
| $IC_7$ | | | | | | | | | |

Note: Had to make electrometer adjustments, therefore calibration may be incorrect. However this chromatogram indicates No $C_6$ or $C_5$ Present in sample

100004

ORGANIC COMPOUNDS (bp < 100° C)

Contractor: COLT -- BELOIT, WS.

Sample Site: DIESEL CONTROLLED  Sample Acquisition Date: 4-23-80  Time: 1720 (A)

Type of Source: Compression Ignition Engine

Test Number: 2 - Controlled NOx  Sample ID Number: 100004

Sample Description: STACK GAS

Analyst Responsible: DaRos  Date Analyzed: 4-24-80  Time:

Calculations and Report Reviewed By: Pastaldin  Report Date:

Gas Sample Temp 180 °F

Workup

1. Column Flow Rate (mL/min):  2. Recorder Speed:
3. Full Scale (mV): 1mV  4. Column Pressure (psi):
5. Electrometer Set (A/mV):  6. Calibration Date:
7. Sample Size (mL): 1000 µl  8. Oven Temperature (°C):
9. Flame Flow Rates (mL/min): $H_2$:  Air:
10. Attenuation: X1  11. Range: X1
12. Observations:

Column Temp 112°F

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (< 2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 5 | | 1.0 | | | | | 3.5 | $C_1$ |
| $IC_2$ | 18 | | 1.6 | | | | | 8.2 | $C_2$ |
| $IC_3$ | 14 | | 1.8 | | | | | 6.4 | |
| $IC_4$ | 7 | | 3.3 | | | | | 2.0 | $C_3$ |
| $IC_5$ | 5 | | 4.1 | | | | | 1.1 | $C_4$ |
| $IC_6$ | 5 | | 7.4 | | | | | 1.1 | |
| $IC_7$ | | | | | | | | | |

1000005

# ORGANIC COMPOUNDS (bp <100° C)

Contractor: COLT -- BELOIT, WS.

Sample Site: DIESEL CONTROLLED  Sample Acquisition Date: 4-23-80  Time: 12:29

Type of Source: Compression Ignition Engine

Test Number: 2 - Controlled NOx  Sample ID Number: 100005

Sample Description: STACK GAS

Analyst Responsible: DaRos  Date Analyzed: 4-23-80  Time: 1248

Calculations and Report Reviewed By: Pavtaldini  Report Date:

Sample Temp 270°F

## Workup

1. Column Flow Rate (mL/min):
2. Recorder Speed:
3. Full Scale (mV): 1.0 mv
4. Column Pressure (psi):
5. Electrometer Set (A/mV):
6. Calibration Date:
7. Sample Size (mL): 1000 µl
8. Oven Temperature (°C):
9. Flame Flow Rates (mL/min): $H_2$  Air:
10. Attenuation: X1
11. Range: X1
12. Observations:

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (<2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time min | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 9 | | 1.0 | | | | | 6.3 | $C_1$ |
| $IC_2$ | 18 | | 1.6 | | | | | 8.2 | $C_2$ |
| $IC_3$ | 12 | | 1.9 (8) | | | | | 5.5 | $C_2$ |
| $IC_4$ | 8 | | 3.3 | | | | | 2.4 | $C_3$ |
| $IC_5$ | 2 | | 5.1 | | | | | 0.4 | $C_4$ |
| $IC_6$ | 6 | | 8.4 | | | | | 1.3 | $C_4$ |
| $IC_7$ | | | | | | | | | |

100006

# ORGANIC COMPOUNDS (bp <100° C)

Contractor: Colt Ind. Beloit Wisconsin

Sample Site: DIESEL BASELINE  Sample Acquisition Date: 4-22-80  Time: 1858

Type of Source: Compression Ignition Engine

Test Number: 1 Baseline  Sample ID Number: 100006

Sample Description: STACK GAS

Analyst Responsible: DaRos  Date Analyzed: 4-23-80  Time: 1219

Calculations and Report Reviewed By: Pastaldini  Report Date:

Sample Temp 280°F

## Workup

1. Column Flow Rate (mL/min):
2. Recorder Speed: 1cm/m
3. Full Scale (mV): LOW
4. Column Pressure (psi):
5. Electrometer Set (A/mV):
6. Calibration Date:
7. Sample Size (mL): 1.0
8. Oven Temperature (°C):
9. Flame Flow Rates (mL/min): $H_2$ ____ Air ____
10. Attenuation: X1
11. Range: 10'
12. Observations:

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (<2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 39 | | 1.0 | | | | | 27.3 | $C_1$ |
| $IC_2$ | 12 | | 1.4 | | | | | 5.5 | $C_2$ |
| $IC_3$ | 11 | | 1.8 | | | | | 5.0 | |
| $IC_4$ | 4 | | 3.5 | | | | | 1.2 | $C_3$ |
| $IC_5$ | 4 | | 5.1 | | | | | 0.9 | $C_4$ |
| $IC_6$ | 11 | | 8.3 | | | | | 2.4 | |
| $IC_7$ | 16 | | 14.8 | | | | | 3.0 | $C_5$ |
| | 8 | | 19.0 | | | | | 1.5 | |

100007

# ORGANIC COMPOUNDS (bp < 100° C)

Contractor: CMT -- BELOIT, WS

Sample Site: DIESEL BASELINE  Sample Acquisition Date: 4-22-80  Time: 1641

Type of Source: Compression Ignition Engine

Test Number: 1 Baseline  Sample ID Number: 100007

Sample Description: STACK GAS

Analyst Responsible: DM Ros  Date Analyzed: _____  Time: _____

Calculations and Report Reviewed By: _____  Report Date: _____

Sample Temp 300°F 1000µl

## Workup

1. Column Flow Rate (mL/min): _____
2. Recorder Speed: 1cm/m
3. Full Scale (mV): 1.0mv
4. Column Pressure (psi): _____
5. Electrometer Set (A/mV): _____
6. Calibration Date: _____
7. Sample Size (mL): 1.0
8. Oven Temperature (°C): _____
9. Flame Flow Rates (mL/min): $H_2$ _____ Air _____
10. Attenuation: X1
11. Range: 10¹
12. Observations: _____

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (< 2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 11 | | 1.0 | | | | | 7.7 | $C_1$ |
| $IC_2$ | 6 | | 1.4 | | | | | 2.7 | $C_2$ |
| $IC_3$ | 12 | | 1.8 | | | | | 5.5 | |
| $IC_4$ | 5 | | 3.5 | | | | | 1.5 | $C_3$ |
| $IC_5$ | 24 | | 5.1 | | | | | 5.3 | $C_4$ |
| $IC_6$ | 7 | | 8.4 | | | | | 1.5 | |
| $IC_7$ | 6 | | 13.6 | | | | | 1.1 | $C_5$ |
| | 27 | | 15.3 | | | | | 5.0 | |

100008

# ORGANIC COMPOUNDS (bp <100° C)

Contractor: COLT IND. Beloit Wisconsin

Sample Site: DIESEL CONTROLLED  Sample Acquisition Date: 4-23-80  Time: 1229

Type of Source: Compression ignition engine

Test Number: 2 Controlled NOx  Sample ID Number: 100008

Sample Description: STACK GAS

Analyst Responsible: DaRos  Date Analyzed: 4-23-80  Time: ~~4-23-80~~ 2:44P

Calculations and Report Reviewed By: Costaldini  Report Date:

Sample Temp 330°F

## Workup

1. Column Flow Rate (mL/min) ____
2. Recorder Speed ____
3. Full Scale (mV) ____
4. Column Pressure (psi) ____
5. Electrometer Set (A/mV) ____
6. Calibration Date ____
7. Sample Size (mL) 1000 µl
8. Oven Temperature (°C) ____
9. Flame Flow Rates (mL/min): $H_2$ ____ Air ____
10. Attenuation ~~X1~~
11. Range ~~X1~~
12. Observations ____

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (<2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| $IC_1$ | 8 | | 1.0 | | | | | 5.6 | $C_1$ |
| $IC_2$ | 19 | | 1.5 | | | | | 8.7 | $C_2$ |
| $IC_3$ | 13 | | 1.8 | | | | | 5.9 | |
| $IC_4$ | 18 | | 3.3 | | | | | 5.4 | $C_3$ |
| $IC_5$ | 38 | | 5.0 | | | | | 8.4 | $C_4$ |
| $IC_6$ | 20 | | 8.2 | | | | | 4.4 | |
| $IC_7$ | 7 | | 12.9 | | | | | 1.3 | $C_5$ |
| | 42 | | 14.5 | | | | | 7.2 | |

100009

# ORGANIC COMPOUNDS (bp < 100° C)

Contractor CORT -- BELOIT, WS

Sample Site DIESEL CONTROLLED Sample Acquisition Date 4-23-80 Time 1720B

Type of Source Compression Ignition Engine

Test Number 2- Controlled NOx Sample ID Number 100009

Sample Description STACK GAS

Analyst Responsible DMRos Date Analyzed _____ Time _____

Calculations and Report Reviewed By Costaldini Report Date _____

Gas Temp 180°F

## Workup

1. Column Flow Rate (mL/min) _____
2. Recorder Speed _____
3. Full Scale (mV) 1.0 mV
4. Column Pressure (psi) _____
5. Electrometer Set (A/mV) _____
6. Calibration Date _____
7. Sample Size (mL) 100 µl
8. Oven Temperature (°C) _____
9. Flame Flow Rates (mL/min): $H_2$ _____ Air _____
10. Attenuation _____
11. Range _____
12. Observations _____

Results: PPM value (in original sample) or I – interference; NC – not computed; NG – sample value below blank; ND – not detectable (< 2 σ blank or baseline).

| | Uncorrected Sum of Peak Areas | Blank Value | Retention Time | Corrected Sum of Peak Areas | Conc. (%) | Sensitivity | High/Low Calibration Standards | Conc. (ppm) | |
|---|---|---|---|---|---|---|---|---|---|
| iC1 | 11 / 9 | | 1.0 / 1.0 | | | | | 7.7/6.3 | C1 |
| iC2 | 24 / 28 | | 1.5 / 1.5 | | | | | 11.0/12.8 | C2 |
| iC3 | 22 / 23 | | 1.8 / 1.9 | | | | | 10.0/10.5 | C2 |
| iC4 | 13 / 16 | | 3.3 / 3.4 | | | | | 3.9/4.8 | C3 |
| iC5 | 12 / 10 | | 5.1 / 5.3 | | | | | 2.6/2.2 | C4 |
| iC6 | 8 / 15 | | 8.5 / 8.9 | | | | | 1.8/3.3 | C4 |
| iC7 | 3 / 17 | | 13.4 / 14.4 | | | | | 0.6/3.1 | C5 |
| | 12 / 22 | | 15.2 / 16.3 | | | | | 2.2/4.1 | C5 |

initial report

## 5.7 LC FRACTIONATION OF SELECTED EXTRACT SAMPLES WITH TCO, GRAV, AND IR RESULTS ON LC FRACTIONS

SAMPLE: Beloit 1 XAD #1533

| | TCO mg | GRAV mg | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|
| Total Sample[1] | 24 | 65 | 89 | 5.4 |
| Taken for LC[2] | 12 | 31 | 43 | 2.6 |
| Recovered[3] | 9.5 | 24 | 34 | 2.1 |

| Fraction | TCO in mg | | | | GRAV in mg | | | | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|---|---|---|---|---|---|
| | Found in Fraction | Blank | Corrected | Total[4] | Found in Fraction | Blank | Corrected | Total[4] | | |
| 1 | 9.1 | <0.02 | 9.1 | 19 | 12 | <1 | 12 | 25 | 44 | 2.7 |
| 2 | 0.14 | <0.01 | 0.14 | 0.29 | <0.8 | <0.8 | 0.8 | <2 | <2 | <0.1 |
| 3 | 0.06 | <0.01 | 0.06 | 0.1 | 1.8 | <0.8 | 1.8 | 4 | 4 | 0.2 |
| 4 | 0.08 | <0.01 | 0.08 | 0.2 | 2.6 | 1.2 | 1.4 | 3 | 3 | 0.2 |
| 5 | 0.03 | <0.01 | 0.03 | 0.06 | 1.6 | <0.8 | 1.6 | 3 | 3 | 0.2 |
| 6 | 0.06 | <0.01 | 0.06 | 0.1 | 4.8 | <0.8 | 4.8 | 10 | 10 | 0.6 |
| 7 | <0.01 | <0.01 | <0.01 | <0.02 | 2.2 | <0.8 | 2.2 | 5 | 5 | 0.3 |
| Sum | 9.5 | <0.08 | 9.5 | 20 | 25 | <6 | 24 | 50 | 70 | 4.3 |

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

**IR REPORT**

**SAMPLE:** Beloit XAD Blank 1535 F1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit XAD Blank 1535 F2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit XAD Blank 1535 F3

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit XAD Blank 1535 F4

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit XAD Blank 1535 F5

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

**IR REPORT**

**SAMPLE:** Beloit XAD Blank 1535 F6

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit XAD Blank 1535 F7

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit 1 XAD 1533 F1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 1 XAD 1533 F2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 1 XAD 1533 F3

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 1 XAD 1533 F4

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 1 XAD 1533 F5

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 1 XAD 1533 F6

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit 1 XAD 1533 F7

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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SAMPLE: Beloit 2 XAD #1534

| | TCO mg | GRAV mg | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|
| Total Sample[1] | 31 | 100 | 130 | 5.8 |
| Taken for LC[2] | 12 | 38 | 50 | 2.2 |
| Recovered[3] | 15 | 43 | 58 | 2.6 |

| Fraction | TCO in mg | | | | GRAV in mg | | | | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|---|---|---|---|---|---|
| | Found in Fraction | Blank | Corrected | Total[4] | Found in Fraction | Blank | Corrected | Total[4] | | |
| 1 | 14 | <0.02 | 14 | 37 | 22 | <1 | 22 | 58 | 95 | 4.3 |
| 2 | 0.25 | <0.01 | 0.25 | 0.66 | 1.4 | <0.8 | 1.4 | 4 | 5 | 0.2 |
| 3 | 0.22 | <0.01 | 0.22 | 0.58 | 2.6 | <0.8 | 2.6 | 7 | 8 | 0.4 |
| 4 | 0.06 | <0.01 | 0.06 | 0.2 | 8.0 | 1.2 | 6.8 | 18 | 18 | 0.8 |
| 5 | 0.05 | <0.01 | 0.05 | 0.1 | 2.2 | <0.8 | 2.2 | 6 | 6 | 0.3 |
| 6 | 0.09 | <0.01 | 0.09 | 0.2 | 4.6 | <0.8 | 4.6 | 12 | 12 | 0.5 |
| 7 | <0.01 | <0.01 | <0.01 | <0.02 | 3.0 | <0.8 | 3.0 | 8 | 8 | 0.4 |
| Sum | 15 | <0.08 | 15 | 39 | 44 | <6 | 43 | 110 | 150 | 6.9 |

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

**IR REPORT**

**SAMPLE:** Beloit 2 XAD 1534 F1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2920 | s | CH Aliphatic hydrocarbons | |
| 2840 | s | CH Aliphatic hydrocarbons | |
| 1450 | w | CH Aliphatic hydrocarbons | |
| 1270 | w | CO Aliphatic hydrocarbons | |

IR REPORT

SAMPLE: Beloit 2 XAD 1534 F2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

**IR REPORT**

**SAMPLE:** Beloit 2 XAD 1534 F3

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit 2 XAD 1534 F4

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit 2 XAD 1534 F5

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 3620-3140 | s | OH Alcohol, ACID | |
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IR REPORT

SAMPLE: Beloit 2 XAD 1534 F6

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |

IR REPORT

SAMPLE: Beloit 2 XAD 1534 F7

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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SAMPLE: Beloit 2 Front Half #1513

| | TCO mg | GRAV mg | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|
| Total Sample[1] | NA | 226 | 226 | 10.1 |
| Taken for LC[2] | - | 86 | 86 | 3.9 |
| Recovered[3] | - | 81 | 81 | 3.6 |

| Fraction | TCO in mg | | | | GRAV in mg | | | | TCO + GRAV Total mg | Concentration mg/dscm |
|---|---|---|---|---|---|---|---|---|---|---|
| | Found in Fraction | Blank | Corrected | Total[4] | Found in Fraction | Blank | Corrected | Total[4] | | |
| 1 | | | | | 74 | <1 | 74 | 190 | 190 | 8.5 |
| 2 | | | | | 1.6 | <0.8 | 1.6 | 4 | 4 | 0.2 |
| 3 | | | | | 3.2 | <0.8 | 3.2 | 8 | 8 | 0.4 |
| 4 | | | | | 2.2 | <0.8 | 2.2 | 6 | 6 | 0.3 |
| 5 | | | | | < 0.8 | <0.8 | <0.8 | < 2 | <2 | < 0.09 |
| 6 | | | | | 5.2 | <0.8 | 5.2 | 14 | 14 | 0.6 |
| 7 | | | | | 2.6 | <0.8 | 2.6 | 7 | 7 | 0.3 |
| Sum | | | | | 89 | <6 | 89 | 130 | 230 | 10 |

1. Quantity in entire sample, determined before LC
2. Portion of whole sample used for LC, actual mg
3. Quantity recovered from LC column, actual mg
4. Total mg computed back to total sample

IR REPORT

SAMPLE: Beloit Filter Blank 1521 F1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit Filter Blank 1521 F2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit Filter Blank 1521 F3

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit Filter Blank 1521 F4

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit Filter Blank 1521 F5

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit Filter Blank 1521 F6

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit Filter Blank 1521 F7

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 2 Front Half 1513 F1

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2920 | s | CH Aliphatic hydrocarbons | |
| 2860 | s | CH Aliphatic hydrocarbons | |
| 1470 | w | CH Aliphatic hydrocarbons | |
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IR REPORT

SAMPLE: Beloit 2 Front Half 1513 F2

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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IR REPORT

SAMPLE: Beloit 2 Front Half 1513 F3

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2920 | s | CH Heterocyclic oxygen compounds | |
| 2840 | s | CH Heterocyclic oxygen compounds | |

IR REPORT

SAMPLE: Beloit 2 Front Half 1513 F4

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| | | No Peaks | |
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**IR REPORT**

**SAMPLE:** Beloit 2 Front Half 1513 F5

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 3520-3420 | s | NH Amine, OH ALCOHOL | |
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**IR REPORT**

**SAMPLE:** Beloit 2 Front Half 1513 F6

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2920 | s | CH ~~Carboxylic acids~~ ALIPHATIC | |
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IR REPORT

SAMPLE: Beloit 2 Front Half 1513 F7

| Wave Number ($cm^{-1}$) | Intensity | Assignment | Comments |
|---|---|---|---|
| 2920 | s | CH Carboxylic acids | |
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## 5.8 LRMS ANALYSES OF SELECTED LC FRACTIONS AND TOTAL SAMPLE EXTRACTS

ACUREX Corporation

Energy & Environmental Division

CMEA/ACUREX

October 8, 1981
Acurex ID#: A81-08-022
Client P.O. #: 307605

Samples: 45 extracts from previous work

The above reference samples were analyzed by direct probe mass spectrometry. Searches have been made for classes of compounds most likely to be found in the various LC fractions, according to procedures described in the "IERL-RTP Procedures Manual: Level 1 Environmental Assessment". The following fragment ions used for search are given below:

| Compound Class | Fragment ions (m/e⁻) |
|---|---|
| Aliphatic hydrocarbons | 57,71,85 |
| Halogenated aliphatics | 63,65 |
| Polycyclic aromatics | 178,202,228,252 |
| Halogenated ethers | 63,65,73 |
| Alcohols | 75,89,103 |
| Phenols | 51,77,94 |
| Halogenated phenols | 162,196 |
| Nitrophenols | 139 |
| Phthalate esters | 149,167 |
| Amines | 84,98 |
| Nitrosamines | 44,58 |
| N-heterocyclics | 167,193 |
| Mercaptans | 47,61 |
| Sulfides | 75,89,103 |
| Benzothiophenes | 134 |
| Carboxylic acids | 60,73 |
| Carboxylic acids esters | 74,87 |

The various classes of compounds identified in each fraction are given on the attached data sheets. Classes of compounds identified include phenols, carboxylic acids, mercaptans, and esters (include phthalates). There was a background of aliphatic hydrocarbons throughout the analyses.

To test the analysis procedure, a standard mixture containing ethers, amines, polycyclic aromatic hydrocarbons, nitrosamines, phenols, etc., was analysed under identical conditions as the samples. Losses of the very volatile compounds such as naphthalene, bis-chloro ethyl ether, low molecular weight nitrosamines were observed, however the higher molecular weight compounds in a particular class were recovered.

Prepared by: Greg Nicoll
Greg Nicoll
Program Director

Approved by: Viorica Lopez-Avila
Viorica Lopez-Avila, Ph.D.
Technical Director

GN/VLA:es



485 CLYDE AVENUE, MOUNTAIN VIEW, CA 94042 PHONE (415) 964-3200 TELEX: 34-6391 TWX: 910-3796593

LRMS REPORT

SAMPLE: 1507 Beloit 1 Front half

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 1 | Aliphatic hydrocarbons | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1513 F1 Beloit 2 Front half

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 1 | Aliphatic hydrocarbons | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1513 F2+3 Beloit 2 Front half

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| | None found | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1513 F4+5 Beloit 2 Front half

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| | None found | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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LRMS REPORT

SAMPLE: 1513 F6+7 Beloit 2 Front half

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 10 | Phenols | |
| 10 | Mercaptans | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1533 F1 Beloit 1 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 1 | Aliphatic hydrocarbons ✓ | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1533 F2+3 Beloit 1 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| | None found | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1533 F4+5 Beloit 1 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 10 | Esters | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1533 F6+7 Beloit 1 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 10 | Phenols | |
| 10 | Carboxylic acids | |
| 10 | Mercaptans | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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LRMS REPORT

SAMPLE: 1534 F1 Beloit 2 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 1 | Aliphatic hydrocarbons | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
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Other

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LRMS REPORT

SAMPLE: 1534 F2+3 Beloit 2 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| | None found | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
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Other

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**LRMS REPORT**

**SAMPLE:** 1534 F4+5 Beloit 2 XAD

**Major Categories**

| Intensity | Category | MW Range |
|---|---|---|
| 10 | Esters | |
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**Sub-Categories, Specific Compounds**

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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**Other**

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LRMS REPORT

SAMPLE: 1534 F6+7 Beloit 2 XAD

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 10 | Phenols | |
| 10 | Mercaptans | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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Acorn Park
Cambridge, Massachusetts 02140
617 864-5770 Telex 921436

Arthur D. Little, Inc.

July 8, 1982

Dr. Larry Waterland
M2S-2260
Accurex Corporation
485 Clyde Avenue
Mountain View, CA 94042

Dear Larry: 1-7641

We have completed the batch inlet LRMS analysis of your ten Level 1 samples. The data obtained in the analysis of these samples is reported on the enclosed, standard EPA Level 1 LRMS report forms. The intensity levels are reported for this (batch) analysis only, as though it were the complete LRMS analysis. Presumably you will integrate the data from these analyses with your own direct probe LRMS analysis of the same samples.

We have reported the "sample" content of the samples as though the solvent(s) were not present; a component reported as intensity 100 is a major component of the non-solvent portion of the spectrum; one as intensity 10 when it is present and identifiable in the non-solvent portion of the spectrum, and so on. Intensity level 1 components appeared to be present in some of the samples, but were not specifically identifiable. When they occur they are included in the unclassified category.

All samples were analyzed by direct injection of 4 μL of sample into the three liter glass inlet of the mass spectrometer. The mass spectrometer was operated in the electron impact ionization mode, at 70 eV. Low energy ionization was not used due to the low level of sample material as compared to the solvent content of the sample. Instrument blanks were obtained by direct injection of 4 μL of spectra grade methylene chloride. One sample (AC009) was



Brussels Paris Tokyo
Houston Rio de Janeiro Toronto
London San Francisco Washington
Madrid São Paulo Wiesbaden

concentrated 3X and given an additional direct injection analysis. This was done only to clarify some spectral ambiguities. The reported data is from the unconcentrated initial analysis.

If you have any questions about any of this work, please feel free to call me.

Yours Truly,

James L. Stauffer

/laf

enclosures

LRMS REPORT

SAMPLE: Beloit 1 XAD 1533 LC1 (AC001)

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| 100 | Aromatic Hydrocarbons | - - |
| 100 | Fused alternate/nonalternate hydrocarbons | < 216 |
| 100 | Aliphatic Hydrocarbons | — |
| 100 | Unclassified | 94, 98 |
| | | |
| | | |

Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
| 100 | Naphthalene + alkyls | 128-170 | $C_{10}H_8$ - $C_{13}H_{14}$ |
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Other

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LRMS REPORT

SAMPLE: Beloit 2 XAD 1534 LCI (AC007)

Major Categories

| Intensity | Category | MW Range |
|---|---|---|
| | Nothing reliably present above the background level. | |
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Sub-Categories, Specific Compounds

| Intensity | Category | m/e | Composition |
|---|---|---|---|
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Other

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## 5.9 BIOASSAY ANALYSIS REPORT

**AP42 Section:** 3.4 Large Stationary Diesel And All Stationary Dual-fuel Engines

**Title:** Comments and Correspondence from 1980's and early 1990's