OBSERVER'S REPORT:

COMPLIANCE TEST

for

VOC

Facility: CNG GAS TRANSMISSION LINES

Premise Number: 1483000144

Source: B007 & B008

Conducted On: 3-23-93

Test Firm: GALSON CORP.

Observed By: DAVID J. WILLBRAND, ET1

Prepared By: Trent Lewis, AQS
LeRoy Gruber, AQE

Date Prepared: JUNE 7, 1993

DEPARTMENT OF ENVIRONMENTAL SERVICES
AIR QUALITY PROGRAMS
1632 CENTRAL PARKWAY
CINCINNATI, OHIO 45210

OEPA COPY
IP FILE COPY
SA FILE COPY

APPENDIX K

OEPA STACK TEST REVIEW SUMMARY FORM

APPLICATION NUMBER PTI 14-2284 PN: 1483000144 B007 & B008

FACILITY NAME CNG Gas Transmission

SOURCE DESCRIPTION (OR SCC CODE) Two 4200 HP Gas-Fired (Compressor) Engines (36 MMBtu/hr)

CONTROL EQUIPMENT None **

DATE(S) OF TEST 3/23/93

FINAL TEST REPORT RECEIVED ON 4/28/93

POLLUTANT(S) TESTED NOx, CO, VOC

TEST METHOD U.S EPA Ref. Method 1-4, 7E, 10, 25.2 (SCAQMD)

TEST FIRM Galson Corporation

			(#5)	(#6)		
EMISSION RATES*:		CO -	23.0	23.6		CO - 25.9
	[ ] (lb(s)/MMBtu)	NOx -	15.7	16.5		NOx - 18.5
ACTUAL	[X] (lb(s)/hr)	VOC -	3.7	3.8	ALLOWABLE**	VOC - 8.3*

OPERATING RATES*:

DURING TEST** #5 - 4260 HP, #6 - 4180 HP

MAXIMUM** 4200 HP

EMISSION FACTOR***

COMMENTS: * Also, CO-2.8 gm/HP-hr; NOx-2.0 gm/HP-hr; VOC-.98 gm/HP-hr

** Fuel/Air ratio may affect complinace status

I HEREBY VERIFY THAT THE INFORMATION CONTAINED WITHIN THE STACK TEST REPORT HAS BEEN REVIEWED AND IT HAS BEEN DETERMINED THAT THE TEST PROCEDURES, ANALYSIS AND CALCULATIONS ARE:

[X] AN ACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

[ ] AN UNACCEPTABLE DEMONSTRATION OF CONFORMANCE WITH THE APPROVED TESTING METHODOLOGY.

6/3/93 PREPARED BY: Trent R. Lewis, AQS 1

DATE OF REVIEW REVIEWED BY: LeRoy R. Gruber, AQE

* BASED ON 3 RUN AVERAGE
** SPECIFY APPLICABLE UNITS
*** SPECIFY UNITS OF MASS/INPUT

Testing for NOx, Co, and Voc was conducted at the CNG Transmission Corporation, Lebanon Compressor Station on Units B007(ENGINE #5) and B008(ENGINE #6). Emission measurements were taken at B007 on March 23, 1993, while B008 was tested on March 24, 1993. All sampling was conducted by the Galson Corp. under the supervision of Mr. Craig A. Clapsaddle.

The permit limit for Co is 25.93 lbs./hr., 18.52 lbs./hr. for Nox, and 8.33 lbs./hr VOC. The sources are subject to PSD regulations (40 CFR 52.21), BAT 3715-31-05. Other limits are Co 2.8 gm/hp; 2.0 gm/hp Nox; and .98 gm/hp Voc. Engine # 5 was originally tested on Feb. 10, 1993 with emissions being determined at 9.3 lbs./hr Nox, 31.3 lbs./hr. Co, 5.3 lbs./hr. VOC (as CH4). Because testing was done in accordance with a permit to install, adjustments were made and retesting was allowed.

USEPA Ref. Test Methods 1&2, 3a, 4, 7e, 10 and 25.2 were used to determine emission levels from both sources. The emission averages for both engines are demonstrated below in the following table:

	ALL EMISSION RATES ARE IN LBS./HR.	
	ENGINE #5	ENGINE #6
Co	22.95 (2.44 gm./hp-hr.)	23.61 (2.56 gm./hp-hr)
Nox	15.74 (1.68 gm./hp-hr.)	16.5 (1.79 gm./hp-hr)
Voc (as CH4)	3.68 (.39 gm./hp-hr.)	3.84 (.42 gm./hp-hr)

THESE EMISSION RATES WERE CALCULATED BY DES PERSONNEL. THE TEST FIRMS EMISSION RATES WERE SLIGHTLY DIFFERENT, BUT THE CAUSE OF THE DIFFERENCE COULD NOT BE DETERMINED BECAUSE OF A LACK OF CALCULATION INFORMATION. DES CALCULATIONS WERE CONDUCTED THROUGH THE USE OF FIELD DATA.

Stack conditions for ENGINE #5 (B007) during testing were:

STACK GAS FLOW: 20274 dscfm
STACK TEMP.: 505.4 degrees F.
% MOIST.: 6.74%
% O2: 15.6%
% CO2: 3.1%

Stack conditions for ENGINE #6 (B008) during testing were:
STACK GAS FLOW: 19353 dscfm
STACK TEMP.: 501.3 degrees F.
% MOIST.: 5.77%
% O2: 15.63%
% CO2: 3.1%

Operating parameters for both engines are demonstrated on the following page:

CNG TRANSPORT
PTI # 14-2284
PAGE 2 of 2

	ENGINE # 5	ENGINE # 6
CALC. HORSE POWER	4259.7	4180
FUEL FLOW (MCFH)	333	331.4
FUEL FEED (PSI)	76	74.9
FUEL FLOW DELTA P (IN " WATER)	71.5	71.5

BOTH IDENTICAL ENGINES ARE RATED AT 4200 HP/HR.

Reasonable quality assurance measures were demonstrated during testing included: calibration of field sampling equipment, proper documentation, nozzle diameter measurements, on site leak checks of equipment, and use of designated analytical equipment and sampling reagents. Calculations of flow rate, isokinetic ratio, and mass emission rate were checked and found to be correct.

To assure continuing compliance, the following is recommended: An air-fuel ratio setting between .45 -.50 (at > 70% operating capacity) be maintained; and engine timing to be kept within close tolerance of 5° BTDC.

In conclusion, the proper testing protocol was followed and the source was operating at near worst case conditions. The data is of sufficient accuracy and precision to be used in the determination of compliance. **PTI conditions requiring the addition of an oxidation catalytic converter cannot be addressed until results of the pennsylvania test are received.** Testing at Permit renewal is recommended.

EPA METHOD 5 STACK TEST ANALYSIS

FACILITY NAME: CNG TRANSPORT ENGINE #6
PREMISE #:
SOURCE DESCRIPTION: ENGINE #6

REVIEWER: TRL
TEST DATE: 3-24-93
PRINTED: 05-24-1993

INPUT DATA:

	RUN #1	RUN #2	RUN #3
METER VOLUME (ACF)	22.125	23.37	23.257
METER CORRECTION	1.014	1.014	1.014
BAROMETRIC PRESSURE (IN HG)	29.76	29.76	29.76
ORIFICE PRESSURE (IN H20)	2	2	2
METER TEMPERATURE (F)	64.51	76.1	76.17
VOLUME WATER (ML H20)	34.4	21	34.4
CO2 IN STACK GAS (%)	3.1	3.1	3.1
O2 IN STACK GAS (%)	15.7	15.6	15.6
N2 IN STACK GAS (%)	81.2	81.3	81.3
CO IN STACK GAS (%)	0	0	0
PITOT COEFFICIENT	.84	.84	.84
AVERAGE SQUARE ROOT VELOCITY PRESS	.839	.843	.874
STACK TEMPERATURE (F)	500.9	503.9	499
STACK PRESSURE (IN HG)	29.727	29.727	29.727
STACK DIAMETER (IN)	42	42	42
STACK AREA (SQ FT)	9.621128	9.621128	9.621128
PARTICULATE CATCH (MG)	0	0	0
NOZZLE DIAMETER (IN)	.5	.5	.5
NOZZLE AREA (SQ FT)	0.001364	0.001364	0.001364
TEST LENGTH (MIN)	30	30	30

TEST RESULTS:

METER VOLUME @STP (DSCF)	22.5652	23.3197	23.2039
VOLUME OF WATER VAPOR @STP (CF)	1.619208	0.988470	1.619208
MOLE FRACTION OF WATER IN STACK GAS	0.066952	0.040664	0.065230
DRY MOLECULAR WEIGHT OF STACK GAS	29.1240	29.1200	29.1200
MOLECULAR WEIGHT OF STACK GAS	28.3792	28.6678	28.3946
STACK GAS VELOCITY (FT/SEC)	64.3013	64.3821	66.8993
STACK GAS FLOW (DRY STD CF/HR)	%1134481.0	%1164276.0	%1184840.0
PARTICULATE CONCENTRATION (GR/DSCF)	0.000000	0.000000	0.000000
ISOKINETIC RATIO	28.0809	28.2770	27.6484
MASS RATE OF EMISSION (LB/HR)	0.0000	0.0000	0.0000

STACK TEST COMMENTS:

PROGRAM USED TO DETERMINE FLOWS ONLY!!

RECEIVED APR 20 1993

Source Test Report

Source Emission Testing

of

Two Natural Gas-Fired Reciprocating Engines

at the

CNG Lebanon Compressor Station

Lebanon, Ohio

Galson Project No. GE-282

April 1993

Submitted by:

FOR:
Craig A. Clapsaddle

Approved by:

William Chatterton

Galson Corporation
6601 Kirkville Road
East Syracuse, New York 13057

Project Background

Name of Source Owner:	CNG Transmission Corporation
Address of Owner:	Clarksburg, West Virginia
Source Identification:	Reciprocating Engines
Location of Source:	Lebanon, Ohio
Type of Operation:	Natural Gas Transmission
Tests Performed:	Sample and Velocity Traverses - EPA Method 1 Stack Gas Velocity - EPA Method 2 Oxygen/Carbon Dioxide - EPA Method 3A Stack Gas Moisture Content - EPA Method 4 Carbon Monoxide - EPA Method 10 Nitrogen Oxides - EPA Method 7E Volatile Organic Compounds - EPA Method 18 SCAQMD 25.2
Test Supervisor:	Mr. Craig Clapsaddle
Owner's Representative:	Mr. Joseph Estanich

Test Personnel

Emission Measurement Manager:	Mr. Mark Distler
Project Manager:	Mr. Craig Clapsaddle
Environmental Specialist:	Mr. Robert Hart
Environmental Technician:	Mr. Ed McGaffick
Word Processing Operator:	Ms. Tammy Crossman

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Section 1.0
Introduction

Galson Corporation was retained by Consolidated Natural Gas (CNG) Transmission Corporation to perform source emission testing at the CNG Lebanon Compressor Station in Lebanon, Ohio. Testing was conducted on the exhaust of two natural gas fired reciprocating engines. Testing was conducted to determine emissions of nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC). The primary purpose of this test program was to evaluate the compliance status of these sources with respect to Ohio Environmental Protection Agency (OhioEPA) permit conditions.

Mr. Joseph Estanich of CNG coordinated engine operations with the testing. Ms. Denise Bien and Mr. Lee Gruber of OhioEPA were present to observe portions of the testing.

Results of the test program indicate that emissions of NO_x, CO, and VOC from both engines were below the permit limits. Emissions from Engine 5 averaged 1.6 grams per horsepower hour (g/Hp-hr) and 15.52 pounds per hour (lb/hr) for NO_x (80 percent and 84 percent, respectively of the emission limits), 2.4 g/Hp-hr and 22.65 lb/hr for CO (86 percent and 87 percent, respectively of the emission limits), and 0.39 g/Hp-hr and 3.63 lb/hr for VOC (40 percent and 43 percent, respectively of the emission limits).

Emissions from Engine 6 averaged 1.8 g/Hp-hr and 16.42 lb/hr for NO_x (90 percent and 89 percent, respectively of the emission limits), 2.5 g/Hp-hr and 23.51 lb/hr for CO (89 percent and 91 percent, respectively of the emission limits), and 0.41 g/Hp-hr and 3.82 lb/hr for VOC (42 percent and 46 percent, respectively of the emission limits).

Section 2.0
Source Description

The CNG Transmission Corporation uses compressors to transport natural gas. The gas is sold and distributed to other wholesale and gas distribution companies. The Lebanon Compressor Station is an important location that supplies the northeastern United States with natural gas. The station began operation of the newly installed gas-fired engines in October 1992.

Lebanon uses two 4,200 horsepower Dresser-Rand TCV-10 natural gas-fired reciprocating engines identified as Engines 5 and 6. Each engine exhausts directly to atmosphere through separate 42-inch inside diameter (ID) exhaust stacks. The Engine 5 stack is identified as OhioEPA source number B007 and the Engine 6 stack is identified as OhioEPA source number B008.

Permitted allowable emissions from each engine are as follows:

NO_x: 2.0 gr/HP-hr and 18.52 lb/hr
CO: 2.8 gr/HP-hr and 25.93 lb/hr
VOC: 0.98 gr/HP-hr and 8.33 lb/hr.

Section 3.0
Test Program/Operating Conditions

Engines 5 and 6 (OhioEPA source numbers B007 and B008) were tested for emissions of NO_x, CO, and VOC. Testing was conducted in triplicate for each parameter with emissions presented as grams per horsepower-hour and pounds per hour. All testing was performed under normal operating conditions. All testing on Engine 5 was performed on March 23, 1993; Engine 6 testing was performed on March 24, 1993. During the test periods, Engine 5 was operating at 102 percent of rated horsepower capacity, and Engine 6 was operating at 100 percent of rated horsepower capacity.

During each test run CNG plant personnel recorded engine operating data; these data included natural gas fuel flow, engine RPM, and engine horsepower. Copies of these data are presented in Appendix A.

Section 4.0
Test Methods

All testing was performed using EPA Reference Methods. Exhaust gas concentrations of NO_x and CO were determined using the continuous monitoring procedures specified by EPA Reference Methods 7E and 10. Instrumentation included a Thermo Environmental Instruments Inc. (TECO) Model 10S chemiluminescent analyzer to monitor NO_x concentrations. CO concentrations were determined using a TECO Model 48 gas correlation filter non-dispersive infrared (NDIR) analyzer. Exhaust gas O_2 and CO_2 levels were determined in accordance with EPA Method 3A using Infrared Industries, Inc. Model IR-2200 electro chemical and Model IR-703D NDIR analyzers, respectively. The analyzers were calibrated using the ranges and calibration gases outlined below.

Reference Method Analyzer Ranges
Lebanon Station
Lebanon, Ohio

Analyzer	Test Location	Range	Calibration Gases[a]
TECO M10S (NO_x)	Engines 5 and 6	0-250 ppm	138 ppm in N_2 208 ppm in N_2
TECO M48 (CO)	Engines 5 and 6	0-400 ppm	121 ppm in N_2 302 ppm in N_2
IR 2200 (O_2)	Engines 5 and 6	0-25%	13.8% in N_2 23.5% in N_2
IR 703D (CO_2)	Engines 5 and 6	0-20%	11.4% in N_2 17.3% in N_2

[a] All analyzers were zeroed with zero grade nitrogen (N_2).

Instrument outputs were monitored continuously with an Odessa Engineering DSM-3260 data logger and MacIntosh computer and recorded as five-minute averages. A written log of NO_x, O_2, CO, and CO_2 concentrations were also recorded during each test run. Sampling was performed at a single point near the stack centroids for a total duration of 60 minutes per test.

Emissions of VOC were determined in accordance with EPA Method 18. Samples were collected during each test run in pre-evacuated summa canisters and analyzed for total gaseous nonmethane hydrocarbons (TGNMHC) in accordance with Southern California Air Quality Management District (SCAQMD) Method 25.2 using gas chromatography/total combustion/flame ionization detection analysis.

In conjunction with each test run, exhaust gas moisture content was determined using EPA Method 4. This data was used to determine the exhaust gas molecular weight and to relate measured pollutant concentrations to mass emission rates.

Reference method sample ports in each 42-inch ID stack are located approximately 100 inches (2.40 diameters) downstream of a transition and approximately 51 inches (1.20 diameters) upstream of the stack exhaust. In accordance with EPA Method 1, a sixteen (16) point velocity traverse was performed in conjunction with each test run.

Sketches of the test location and traverse point locations are presented in Appendix B. More detailed descriptions of the sampling procedures can be found in Appendix C.

4.1 Quality Assurance/Quality Control (QA/QC) Procedures

All sampling, analytical and QA/QC procedures outlined in the above referenced methods were followed. All test equipment was calibrated before or during use in the field. Interference checks, response time checks, and NO_2 to NO converter checks were performed on each monitor (as applicable) and the entire monitoring system. In the field, each monitor was calibrated before and after each test run using EPA Protocol 1 gas standards traceable to National Bureau of Standards Reference Materials. The dry gas meter/orifice modules were calibrated immediately before this test program, with a post-test calibration check also performed. Nozzles and pitots were also calibrated before field use and visually inspected for damage during the test program. Thermometers, thermocouples, and temperature readouts are routinely calibrated or immediately following any damage/repair; post-test QA checks of this instrumentation were also performed and found to be correct.

4.2 Sample Marking, Chain of Custody, Sample Storage Procedures

During mobilization, all pre-weighed sampling media including filters, evaporating dishes, and silica gel containers are identified with a unique number. During sample retrieval, containers are labeled with a code identifying the source, test number, and date. Upon return from the field, samples are transferred to laboratory personnel with an accompanying chain-of-custody form; each sample is then assigned a second unique number which is used to denote the sample during its subsequent analysis and storage. Sample blanks were analyzed as a quality control measure to ensure that significant sample contamination did not occur. Collected samples are routinely stored in a protected environment at Galson's laboratory facilities for a period of six months following submission of the test report.

Section 5.0
Results and Discussion

Results of the test program are summarized in Tables 1 and 2. Supporting field data and calculations are presented in Appendix E. Laboratory data can be found in Appendix F.

5.1 Engine 5 - NO_x, CO, VOC Emissions - (Table 1)

As shown in Table 1, emissions of NO_x averaged approximately 1.6 g/Hp-hr and 15.52 lb/hr. CO emissions averaged approximately 2.4 g/Hp-hr and 22.65 lb/hr. VOC emissions averaged approximately 0.39 g/Hp-hr and 3.63 lb/hr. All pollutant emissions averaged well below the permitted emission limits.

5.2 Engine 6 - NO_x, CO, VOC Emissions - (Table 2)

As shown in Table 2, emissions of NO_x averaged approximately 1.8 g/Hp-hr and 16.42 lb/hr. CO emissions averaged approximately 2.5 g/Hp-hr and 23.51 lb/hr. VOC emissions averaged approximately 0.41 g/Hp-hr and 3.82 lb/hr. All pollutant emissions averaged well below the permitted emission limits.

In general, all testing ran smoothly with no sampling or process related problems. All pre-test and post test system bias and drift checks were within the acceptable limits.

Table 1
Engine 5 - NO_x, CO, VOC Emission Results
CNG Lebanon Compressor Station
Lebanon, Ohio

Run No.	Date (Time)	NO_x Emissions		CO Emissions		VOC Emissions	
		g/Hp-hr	lb/hr	g/Hp-hr	lb/hr	g/Hp-hr	lb/hr
1	03/23/93 (0915 - 1015)	1.7	16.31	2.4	22.37	0.38	3.57
2	03/23/93 (1040 - 1140)	1.7	15.82	2.5	23.20	0.41	3.87
3	03/23/93 (1205 - 1305)	1.5	14.44	2.4	22.38	0.37	3.45
Average		1.6	15.52	2.4	22.65	0.39	3.63
Permit Limits		2.0	18.52	2.8	25.93	0.98	8.33

Table 2
Engine 6 - NO_x, CO, VOC Emission Results
CNG Lebanon Compressor Station
Lebanon, Ohio

Run No.	Date (Time)	NO_x Emissions		CO Emissions		VOC Emissions	
		g/Hp-hr	lb/hr	g/Hp-hr	lb/hr	g/Hp-hr	lb/hr
1	03/24/93 (1000 - 1100)	1.7	15.89	2.5	23.30	0.39	3.64
2	03/24/93 (1230 - 1330)	1.9	17.69	2.5	22.94	0.42	3.93
3	03/24/93 (1345 - 1445)	1.7	15.68	2.6	24.28	0.42	3.88
Average		1.8	16.42	2.5	23.51	0.41	3.82
Permit Limits		2.0	18.52	2.8	25.93	0.98	8.33

ENGINE #5 - RUN # 1-1

Engine Operation Page - Engine #5 03/23/93 09:13:21

ENGINE OPERATION STATUS
AUTO
Engine Online

MAIN GAS	Header Number	Temp (OF)	Press (PSI)
Suction	1	45	618
Discharge	1	90	802
Pump Cap. (Actual)	272.4	MMCFD	

ENGINE PERFORMANCE	
Present Load Step	14
Calc. Horsepower	4246 HP
Engr. Efficiency	92.9 %
Engine Speed	333 RPM
Turbine Speed	12943 RPM
Fuel Flowrate	36.0 MCFH

ENGINE TORQUE	ACTUAL	OPER SP	MAX ALLOW	CNTRL SP
Calculated Torque *	100.5	100	99.6	99.6
Fuel Torque	108.1			
* - Indicates controlling value				

Engine Wait Timer	
Start:	0 Sec
Stop:	0 Sec

Manual Mode
Speed SP
330 RPM

Start Command OFF	Stop Command OFF
Start Step # 0	Stop Step # 0

PLOT PLAN | SETPOINTS | OVERVIEW | MISCDATA | COOLERS | SHUTDOWNS | ENGINE 6

HELP SYSTEM

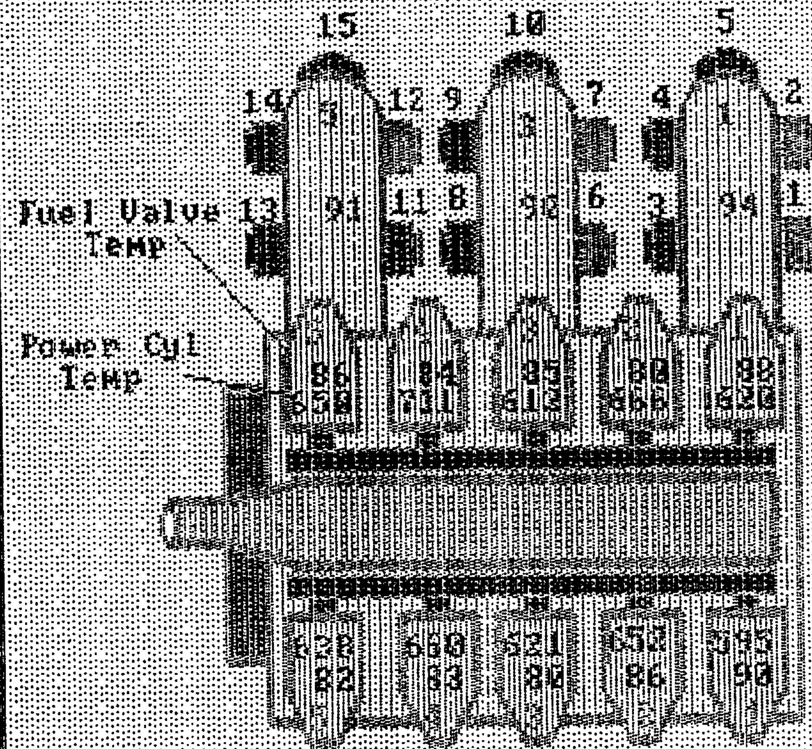
Page 1

:F1: Station Plot Plan
:Alt-P: Password Security
:Alt-A: Alarm Summary
:Ctrl-Prt: Print Screen
:F2: Main Menu
:?: Help System
:ALT-W: [illegible]
:PGDN: Next Help Screen

ENGINE # 5 - RUN # 1-1

Engine Data Page - Engine #5 03/23/93 09:21:24

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	45	609
Discharge #1	90	805
Air Manifold	119	20.5
Jacket Water In	148	----
Jacket Water Out	156	----
PCC Fuel Manifold	---	42.7
Engine Oil IN	145	----
Engine Oil OUT	159	55
Fuel Manifold	---	42
Fuel Flow	61	76
Fuel Flow DP ("H2O)	---	71.0
Pre-Turbine Exhaust	725	----
Post-Turbine Exhst	531	----
Turbo Oil	134	19
Engine Vibration ("/sec)		23.07
Turbine Vibration ("/sec)		26.21



Average Fuel Valve Temp 84.3

Average Power Cyl Temp 641.6

PLOTPLAN SETPOINT OVERVIEW OPERATE COOLERS [illegible] [illegible] ENGINE 6

HELP SYSTEM

:F1:	Station Plot Plan	:F2:	Main Menu
:Alt-P:	Password Security	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-W:	Reset Workline
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

ENGINE # 5 - RUN # 1-2

ENGINE # 5 - RUN # 1-2

Misc. Temp & Press	45	91	1.6
Suction M1	603	306	20.6
Discharge M1	45	91	131
Air Manifold	603	306	----
Jacket Water In	45	91	142
Jacket Water Out	----	----	156
PCC Fuel Manifold	----	45.1	----
Engine Oil In	----	----	145
Engine Oil Out	54	54	159
Fuel Manifold	52	52	----
Fuel Flow	74	74	62
Fuel Flow Dp (mH2O)	----	71.7	----
Pre-Turbine Exhaust	727	727	301
Post-Turbine Exhaust	----	----	306
Turbo Oil	15	15	136
Engine Ultrasonic (m/sec)	21.24	19.89	
Turbine Ultrasonic (m/sec)			

EI: Cyl-Pst:
DI-D:
DI-P:
ALI-H:
PCSN:

ENGINE # 5 - RUN # 1 - 3

ENGINE #5 - Run # 1-3

Turbine Vibration (in/sec)	22.14		
Turbo Oil	133	16	
Post-Turbine Exhaust	528	----	
Pre-Turbine Exhaust	725	----	
Fuel Flow DP (inH2O)	---	71.9	
Fuel Flow	51	72	
Fuel Manifold	---	42	
Engine Oil Out	159	54	
Engine Oil In	146	----	
Engine Fuel Manifold	---	43.2	
PCC Fuel Water Out	155	----	
Jacket Water In	147	----	
Air Manifold	120	20.3	
Discharge #1	91	800	
Suction #1	45	600	
Misc. Temp & Press	Temp (°F)	Press (PSI)	

ENGINE # 5 - RUN # 2-1

ENGINE # 5 - ルバン # 2-1

Engine # 5 — Page 1

03/23/93 10:50:00

	Press (PSI)	Temp (°F)	Value
Misc. Temp & Press	425	16	
Section #1	425	16	
Discharge #1	906	16	
Air Manifold	29.5	121	
Jacket Water In	----	143	
Jacket Water Out	----	133	
PCC Fuel Manifold	42.2	---	
Engine Oil IN	----	148	
Engine Oil OUT	----	159	
Fuel Manifold	31	92	
Fuel Flow	32	72	
Fuel Flow DP (MA20)	28.2	---	
Pre-Turbine Exhaust	125	125	
Post-Turbine Exhaust	----	531	
Turbo Oil	19	101	
Engine Operation (°/sec)	29.73	29.63	
Turbine Operation (°/sec)			

HELP SYSTEM

F1: F2: ALT-N: PGUP: PGDN:
ALT-P: ALT-B: Ctrl-Pgdn: Ctrl-Pgup:

ENGINE # 5 - RUN # 2-2

ENGINE 6
SUMMARY
SENSORS
CONTROLS
OPERATION
MONITOR
SUBSYSTEMS
HELP SYSTEM
Page 1
Engine Data - Engine # 5
03/23/93 11:14:25
Average Power Cyl Temp
85.3
Average Fuel Valve Temp
85.3
Power Cyl Temp
Fuel Valve Temp
Turbo Oil 19 132
Engine Oil Temp 21.91 (°/sec) 21.90
Post-Turbine Exhaust 1 ---- 329
Pre-Turbine Exhaust ---- 724
Fuel Flow Dp (mH2O) 69.3 ---
Fuel Flow 76 62
Fuel Manifold 26 ---
Engine Oil IN 34 (S) ---
Engine Oil OUT ---- 148
PSC Fuel Manifold 42.7 ---
Jacket Water Out ---- 158
Jacket Water In ---- 158
Air Manifold 208.5 120
Displacement 304 26
Suction Oil 303 45
Misc. Temp & Press (PSI) Press (°F) Temp
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Fuel Valve Temp

ENGINE # 5 - RUN # 2-3

Engine Operation Page - Engine #5

03/23/93 11:29:00

ENGINE OPERATION STATUS
AUTO
Engine Online

MAIN GAS	Header Number	Temp (oF)	Press (PSI)
Suction	1	45	600
Discharge	1	92	802
Pump Cap. (Actual)		268.9	MMCFD

ENGINE PERFORMANCE	
Present Load Step	13
Calc. Horsepower	4302 HP
Eng. Efficiency	94.7 %
Engine Speed	333 RPM
Turbine Speed	12386 RPM
Fuel Flowrate	35.8 MCFH

ENGINE TORQUE	ACTUAL	OPER SP	MAX ALLOW	CNTRL SP
Calculated Torque #	101.3	100	99.7	99.7
Fuel Torque	106.9			

- Indicates controlling value

Engine Wait Timer	
Start	0 Sec
Stop	0 Sec

Manual Mode
Speed SP
330 RPM

Start Command OFF
Start Step # 0

Stop Command OFF
Stop Step # 0

PLOTPLAN | SETPOINT | OVERVIEW | MISCDATA | COOLERS | SHUTDOWNS | ENGINE 6

Page 1

HELP SYSTEM

:F1:	Station Plot Plan	:F2:	Main Menu
:Alt-P:	Password Security	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-W:	Reset Watchdog
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

ENGINE # 5 - RUN # 2-3

ENGINE # 5- RUN # 3-1

Misc. Temp & Press	Temp (°F)	Press (PSI)
Suction #1	45	527
Air Manifold	92	798
Discharge #1	120	20.4
Jacket Water In	150	----
Jacket Water Out	158	----
PCC Fuel Manifold	----	42.7
Engine Oil In	146	----
Engine Oil Out	153	----
Fuel Manifold	----	----
Fuel Flow	62	76
Fuel Flow DP (MA23)	----	78.1
Pre-Turbine Exhaust	725	----
Post-Turbine Exhaust	530	----
Turbo Oil	133	19
Engine Vibration (m/sec)	12.60	24.30

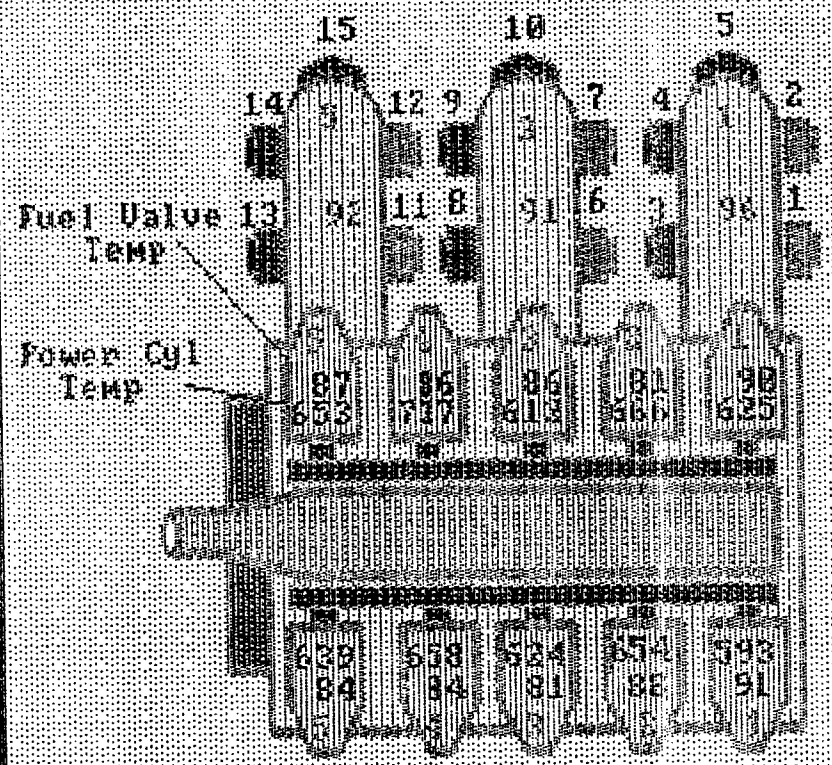
ENGINE # 5 - RUN # 3-2

ENGINE #5 - RUN # 3-2

Engine Data Page - Engine #5

03/23/93 12:33:29

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	45	595
Discharge #1	98	747
Air Manifold	120	20.6
Jacket Water In	150	----
Jacket Water Out	153	----
PCC Fuel Manifold	---	42.6
Engine Oil IN	145	----
Engine Oil OUT	159	55
Fuel Manifold	---	42
Fuel Flow	62	76
Fuel Flow DP ("H2O)	---	70.0
Pre-Turbine Exhaust	726	----
Post-Turbine Exhst	530	----
Turbo Oil	134	19
Engine Vibration ("/sec)		22.04
Turbine Vibration ("/sec)		24.06



PLOTPLANT SETPOINT OVERVIEW OPERATE COOLERS ENGINES SHUTDOWNS ENGINE 6

HELP SYSTEM

Page 1

:F1:	Station Plot Plan	:F2:	Main Menu
:Alt-P:	Password Security	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-W:	Reset Deadline
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

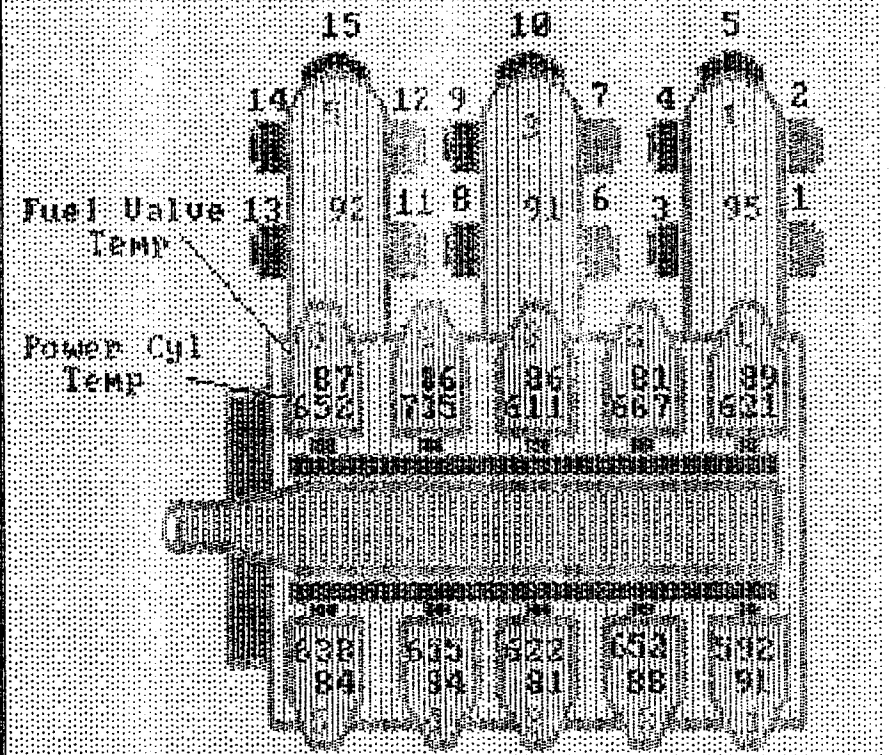
ENGINE #5 - RUN # 3-3

ENGINE # 5 - RUN # 3-3

Engine Data Page - Engine #5

03/23/93 12:53:54

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	45	596
Discharge #1	92	796
Air Manifold	120	20.4
Jacket Water In	150	-----
Jacket Water Out	153	----
PCC Fuel Manifold	---	42.5
Engine Oil IN	145	----
Engine Oil OUT	159	53
Fuel Manifold	---	42
Fuel Flow	62	76
Fuel Flow DP ("H20)	---	70.0
Pre-Turbine Exhaust	725	----
Post-Turbine Exhst	530	----
Turbo Oil	136	19
Engine Vibration ("/sec)		21.35
Turbine Vibration ("/sec)		21.61



PLOT PLANT | SEQUENCE | MONITOR | OPERATE | COOLERS | COMMS | SETUP | ENGINE 6

HELP SYSTEM

Page 1

:F1:	Station Flow Plan	:F2:	Main Menu
:Alt-P:	Password Security	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-W:	Scroll Up/Down
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

Engine 6

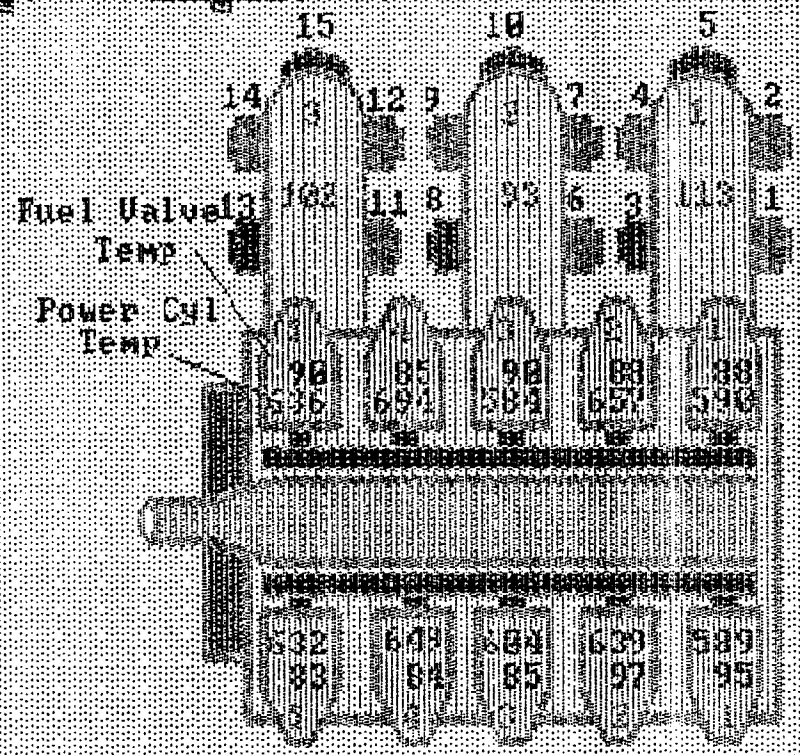
ENGINE OPERATION STATUS
AUX.
Engine Off-line
ENGINE PERFORMANCE
Present Load Step
Gas Horsepower 4117 HP
Eff. Efficiency 1283.5 %
Eng. Speed 5042 RPM
Engine Speed 1223.5 RPM
Turbine Speed
Fuel Flowrate 27.8 MCFH
Engine Fuel Consumed
Start Command
Stop Command
Start Step # 0
Stop Step # 0
OFF
OFF
Fuel Torque
Calculated Torque
ENGINE TORQUE
ACTUAL
OPER SP
MAX ALLOW
CHIRL SP
Pump Cap. (Generic) 2B.3
Discharge
Suction
MAIN GAS
Header Temp (op)
Header Press (PSI)
Number
Page 1
Engine Operation Page - Engine #6
03/24/93 10:05:17

ENGINE #6 - RUN #1 - 1

Engine Data Page - Engine #6

03/24/93 10:06:54

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	41	539
Discharge #1	192	780
Air Manifold	119	18.9
PCC Fuel Manifold	---	39.9
Jacket Water In	156	----
Jacket Water Out	163	----
Engine Oil IN	145	----
Engine Oil OUT	159	59
Fuel Manifold	---	38
Fuel Flow	64	73
Fuel Flow DP	---	43.0
Pre-Turbine Exhaust	783	----
Post-Turbine Exhst	532	----
Turbo Oil	156	28
Engine Vibration ("/sec)		27.30
Turbine Vibration ("/sec)		38.45



PROGRAM SETPOINTS CURRENT GRAPHS COOLERS PCC'S SHUTDOWNS ENGINE 5

HELP SYSTEM

Page 1

:F1: Station Flow Plan
:Alt-P: Passwd Screening
:Alt-A: Alarm Summary
:Ctrl-Prt: Print Screen
:F2: Main Menu
:?: Help System
:ALT-W: Speed Controlling
:PGDN: Next Help Screen

SYSTEM
PERFORMANCE
CONTROL
MISCELLANEOUS
SERVICE
PERFORMANCE
MANUAL
Manual Mode
Speed SP
148 RPM
0 Sec
Start
0 Sec
Stop
Engine
Wait Timer
Start Command
Stop Command
OFF
Start Step #
0
Stop Step #
0
OFF
Fuel Flowrate
27.8 MCFH
Turbine Speed
12374 RPM
Engine Speed
881 RPM
Eng. Efficiency
113 %
Calc. Horsepower
4183 HP
Present Load Step
18
ENGINE PERFORMANCE
Engine Outlet
Gas
ENGINE OPERATION STATUS
Engine Operation Page
05/24/93 10:44:35
Engine #5
ENGINE TORQUE
Calculated Torque
Fuel Torque
63.5
98.3
ACTUAL
OPER
SP
MAX
ALLOW
SP
CNTRL
SP
100.0
100.0
100.0
MWCTD
Pump Cap. (Ambient)
238.3
Discharge
Suction
Main SKS
TPC
GSG
(PSI)
Press
102
(oF)
Temp
71
Number
Header
1
1
Engine #5 - RUN # 1-2

Engine Oil Pressure (psi)	61	55
Engine Oil Temp (°C)	201	206
Air Manifold T#	110	111
PCC Fuel Manifold	---	---
Jacket Water In	154	154
Jacket Water Out	151	151
Engine Oil In	154	154
Engine Oil Out	151	151
Fuel Manifold	---	---
Fuel Flow DP	64	73
Post-Turbine Exhaust	704	704
Pre-Turbine Exhaust	---	---
Turbo Oil	154	154
Engine Ultrasonic Impulse	22.71	22.71
Engine Ultrasonic (%)	61.61	61.61
Miscl. Temp & Press		
Section #1		
Discharge #1		
Air Manifold		
PCC Fuel Manifold		
Jacket Water In		
Jacket Water Out		
Engine Oil In		
Engine Oil Out		
Fuel Manifold		
Fuel Flow DP		
Post-Turbine Exhaust		
Pre-Turbine Exhaust		
Turbo Oil		
Engine Ultrasonic Impulse		
Engine Ultrasonic (%)		

ENGINE #6 - RUN #1

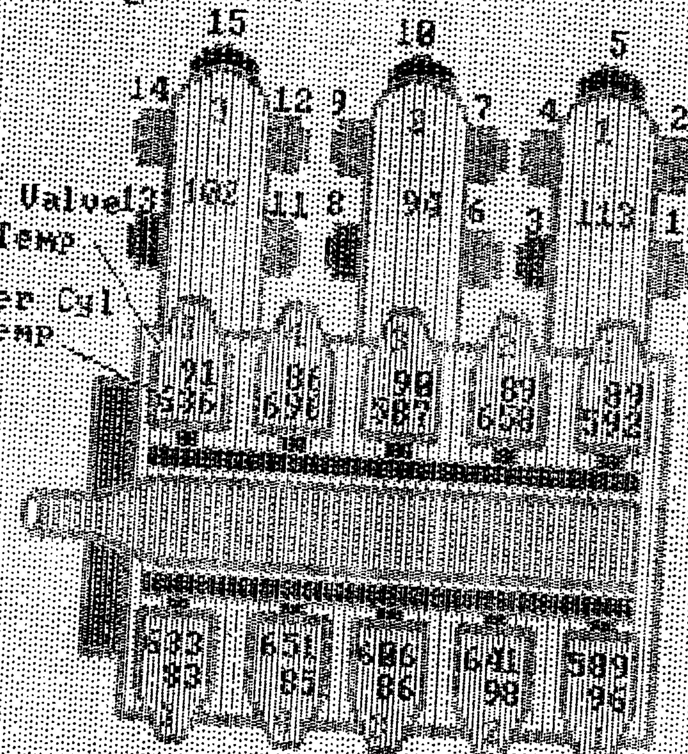
CONTROL
SHUTDOWN
SYSTEM
CONTROL
DISCHARGE
ENGINE
CONTROL
SYSTEM
ENGINE
PERFORMANCE
Engine Mode
Speed 45
Idle RPM
Start Mode
0 sec
0 sec
0 sec
Start
Wait Time
Engine
Start Command
Start Step # 0
Stop Command
Stop Step # 0
OFF
OFF
Fuel Flowrate 27.9 MCFH
Turbine Speed 12068 RPM
Engine Speed 302 RPM
Eng. Efficiency 113.3 %
Calc. Horsepower 4188 HP
Present Load Step 10
ENGINE PERFORMANCE
Engine Oil Pressure 40 PSI
ENGINE OPERATING STATUS
Fuel Torque 23.3
Calculated Torque 0
ENGINE TORQUE
CMTBL SP
MAX ALLOW
ACTUAL SP
DESIGN SP
99.9
100.0
99.6
0.0
Pump Cap. (Gal/min) 232.3 MMGPD
Discharge 1
Suction 1
MAIN GAS
SP 2
SP 1
SP 3
Number
Header
Temp (OF)
Press (PSI)
539
1
1
1
Engine 1
Engine 2
Engine 3
Engine 4
03/24/93 10:58:57
Operation Page - Engine #5

ENGINE # 6 - RUN #1-3

Engine Data Page - Engine #6

03/24/93 11:00:24

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	41	540
Discharge #1	102	780
Air Manifold	117	13.3
PCC Fuel Manifold	---	39.3
Jacket Water In	153	----
Jacket Water Out	161	----
Engine Oil IN	194	----
Engine Oil OUT	159	59
Fuel Manifold	---	38
Fuel Flow	64	73
Fuel Flow DP	---	43.9
Pre-Turbine Exhaust	705	----
Post-Turbine Exhst	535	----
Turbo Oil	147	20
Engine Vibration ("/sec)		26.25
Turbine Vibration ("/sec)		19.91



Average Fuel Valve Temp 89.3

Average Power Cyl Temp 620.7

SETPOINT | OVERVIEW | OPERATE | COOLERS | PROCESS | SHUTDOWNS | ENGINE 5

ENGINE #6 - RUN # 2 -/

ENGINE # 6 - RUN # 2-

ENGINE # 6- RUN # 2-2

ENGINE # 6 - RUN # 2-2

ENGINE #6- RUN # 2-3

Engine Operation Page - Engine #6 03/24/93 13:13:12

ENGINE OPERATION STATUS
AUTO
Engine Online

MAIN GAS	Header Number	Temp (oF)	Press (PSI)
Suction	1	42	548
Discharge	1	99	771
Pump Cap. (Actual)	231.1	MMCFD	

ENGINE PERFORMANCE	
Present Load Step	12
Calc. Horsepower	4280 HP
Eng. Efficiency	116.5 %
Engine Speed	330 RPM
Turbine Speed	12594 RPM
Fuel Flowrate	38.5 MCFH

ENGINE TORQUE	ACTUAL	OPER SP	MAX ALLOW	CNTRL SP
Calculated Torque *	100.1	100	102.1	100.0
Fuel Torque	85.0			

* - Indicates controlling value

Engine Wait Timer	
Start	0 Sec
Stop	0 Sec

Manual Mode
Speed SP
330 RPM

Start Command OFF
Start Step # 0

Stop Command OFF
Stop Step # 0

PROPERTIES ENTERPRISE EQUIPMENT HISTORY COOLERS SHUTDOWNS ENGINES

Page 1

HELP SYSTEM

:F1: Station Flow Plan
:Alt-P: Password Security
:Alt-A: Alarm Summary
:Ctrl-Prt: Print Screen
:F2: Main Menu
:?: Help System
:ALT-W: Scroll Backlight
:PGDN: Next Help Screen

ENGINE
MAIN
COMPRESSOR
COMBUSTOR
TURBINE
POWER
ENGINE
HELP SYSTEM
Page 1
Turbine Blade Temp
Average Power Temp
Average Fuel Temp
Fuel Valve Temp
Power Cyl Temp
Fuel Manifold
Engine Oil Tn
Jacket Water Out
PCC Fuel Water In
Air Manifold
Discharge #1
Suction #1
Misc. Temp & Press
Turbine Exhaust
Post-Turbine Exhaust
Pre-Turbine Exhaust
Fuel Flow
Fuel Flow DP
Fuel Manifold
Engine Oil Out
Jacket Water Out
PCC Fuel Water In
Air Manifold
Discharge #1
Suction #1
Turbine Oil Tn
Engine Oil Out
Turbine Oil Temp
Page 1
03/24/93 13:16:23

ENGINE #6 - RUN # 3-1

ENGINE # 6 - RUN # 3-1

ENGINE # 6 - RUN # 3-2

Engine Operation Page - Engine #6 03/24/93 14:20:53

ENGINE OPERATION STATUS
AUTO
Engine Online

MAIN GAS	Header Number	Temp (oF)	Press (PSI)
Suction	1	42	549
Discharge	1	100	770
Pump Cap. (Actual)	252.5	MMCFD	

ENGINE PERFORMANCE		
Present Load Step	11	
Calc. Horsepower	4163	HP
Eng. Efficiency	117.4	%
Engine Speed	332	RPM
Turbine Speed	12459	RPM
Fuel Flowrate	27.9	MCFH

ENGINE TORQUE	ACTUAL	OPER SP	MAX ALLOW	CNTRL SP
Calculated Torque #	96.6	100	100.0	96.0
Fuel Torque	64.3			

- Indicates controlling value

Engine Wait Timer	
Start	0 Sec
Stop	0 Sec

Manual Mode
Speed SP
330 RPM

Start Command OFF
Start Step # 0

Stop Command OFF
Stop Step # 0

PROGRAM ENGINE PURGE DISCHG COOLER SHUTDOWN ENGINE

HELP SYSTEM Page 1

:F1:	Station Flow Plan	:F2:	Main Menu
:Alt-P:	Password Security	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-N:	Next Turbine
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

ENGINE # 6- RUN # 3-2

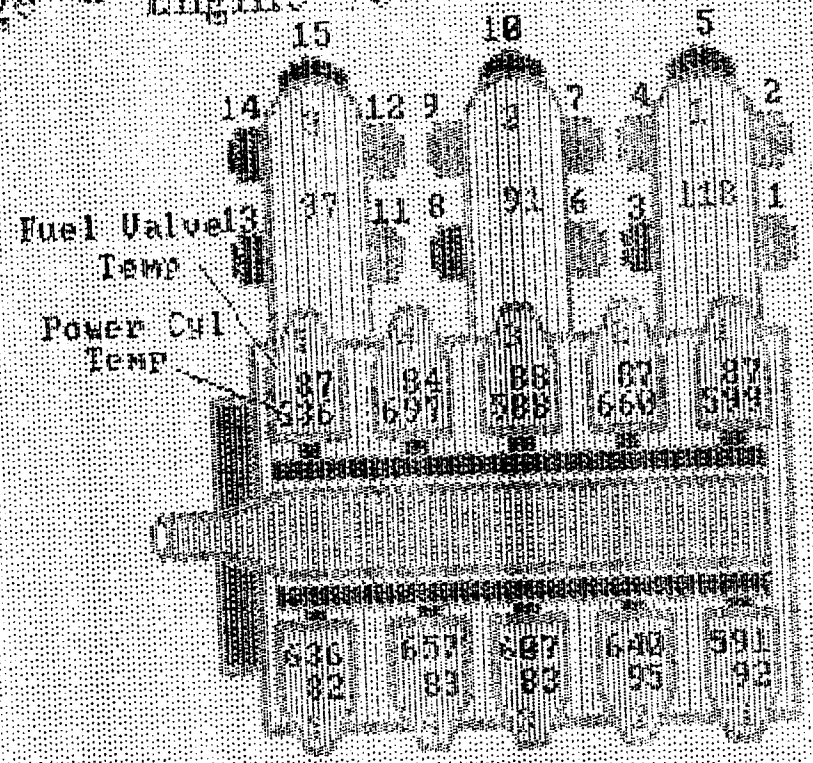
ENGINE #6 - RUN # 3-3

ENGINE # 6 - RUN # 3-3

03/24/93 14:35:20

Engine Data Page - Engine #6

MISC. TEMP & PRESS	Temp (°F)	Press (PSI)
Suction #1	42	751
Discharge #1	140	768
Air Manifold	119	18.4
PCC Fuel Manifold	---	39.7
Jacket Water In	157	----
Jacket Water Out	164	----
Engine Oil IN	145	----
Engine Oil OUT	148	58
Fuel Manifold	---	38
Fuel Flow	69	76
Fuel Flow DP	---	42.5
Pre-Turbine Exhaust	787	----
Post-Turbine Exhst	525	----
Turbo Oil	146	28
Engine Vibration (°/sec)		36.72
Turbine Vibration (°/sec)		18.52



PROGRAM SETPOINTS MONITOR OPERATOR COOLERS PROFILES SCHEDULES ENGINE 5

Page 1

HELP SYSTEM

:F1:	Station Flow Plan	:F2:	Main Menu
:Alt-P:	Password Grouping	:?:	Help System
:Alt-A:	Alarm Summary	:ALT-W:	Reset Watchdog
:Ctrl-Prt:	Print Screen	:PGDN:	Next Help Screen

SELECTION OF SAMPLING SITES AND NUMBER OF

TRAVERSE POINTS - VELOCITY TRAVERSES

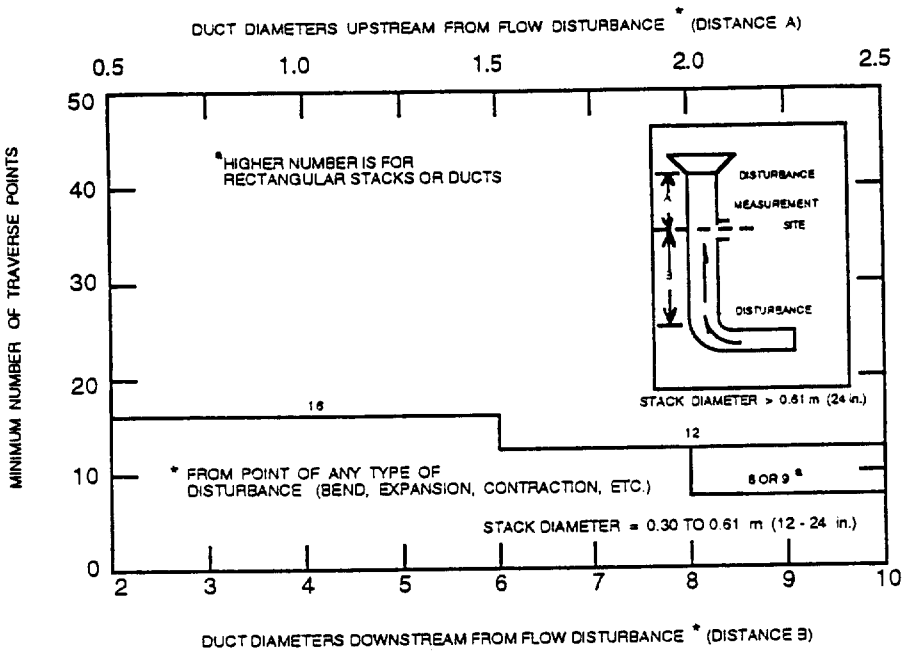


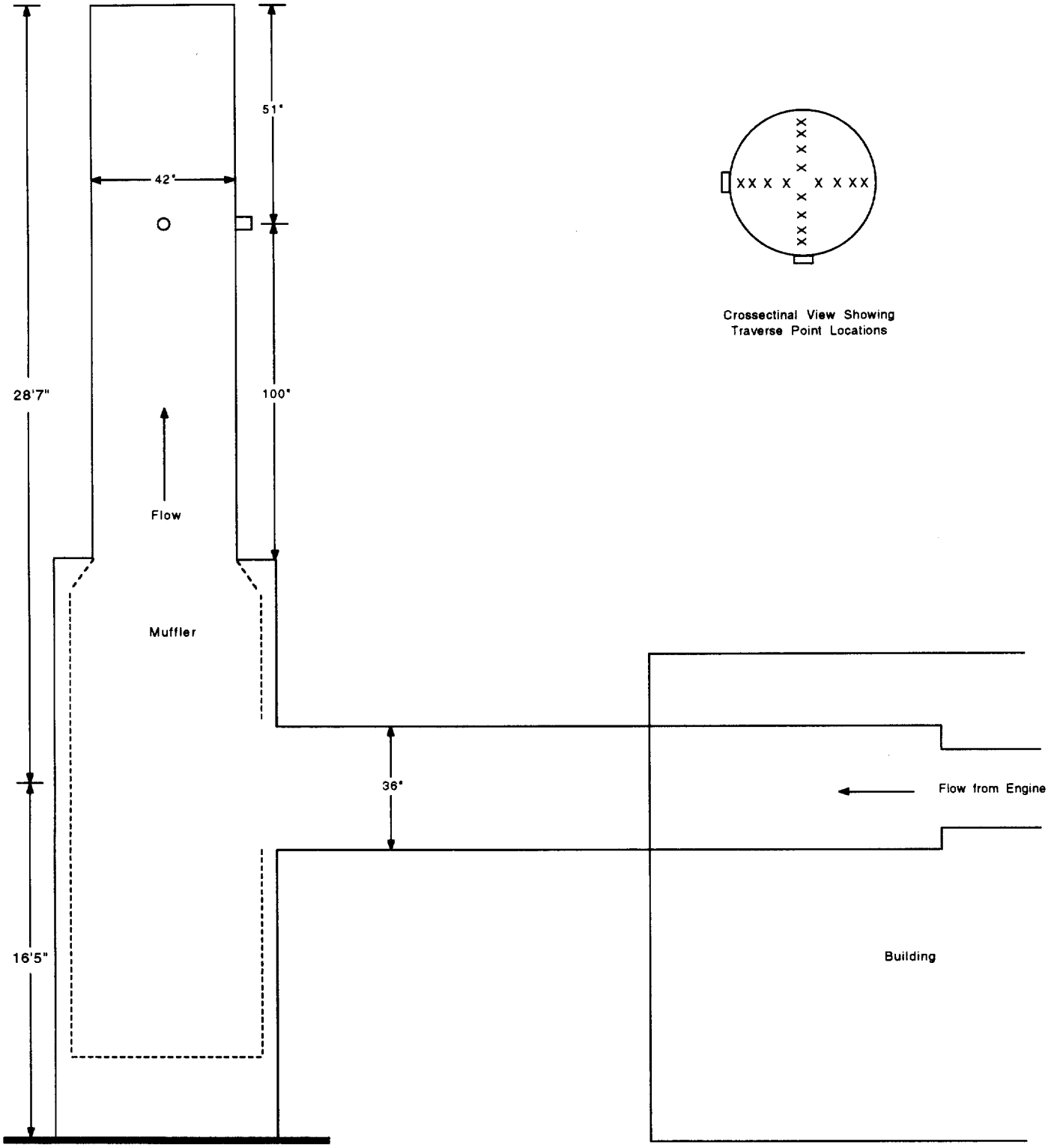
Figure 1-1. Minimum number of traverse points for velocity (nonparticulate) traverses.

(Method 1 – Figure 1-2 revised by 48 FR 45035, September 30, 1983)

Whenever sufficient straight stack or duct is available, the sampling site is located at least 8 stack diameters downstream and at least 2 stack diameters upstream from any flow disturbance such as a bend or an elbow or a fan. In situations where the above criteria cannot be met, the number of traverse points is increased according to the above graph.

For circular stacks, the traverse points are located on two diameters, the traverse axes dividing the stack cross-section into equal parts.

For rectangular stacks, the cross-section is divided into equal areas, such that the ratio of the length to width of the rectangles formed is between 1 and 2. The traverse points are located at the center of each area.



GALSON Corporation Environmental Sciences Div. 6601 Kirkvile Rd. East Syracuse, NY 13057	SCALE: NA	JOB NUMBER: GE-282	ENGINE EXHAUST (TYP)
	DATE: 12/92	DRAWN BY: P.G.	CNG-TRANSMISSION CORPORATION LEBANON COMPRESSOR STATION

TRAVERSE LOCATIONS
(circular stack)

STACK IDENTIFICATION:	CNG-Lebanon Engine Exhaust
STACK DIAMETER:	42 inches
SAMPLING LOCATIONS:	2.4 diameters downstream 1.2 diameters upstream
MINIMUM NUMBER OF TRAVERSE POINTS AS SPECIFIED BY EPA METHOD 1	16

Traverse Point Number	Percent of Stack Diameter From Inside Wall	Distance in Inches From Inside Wall
1	3.2	1.3
2	10.5	4.4
3	19.4	8.1
4	32.3	13.6
5	67.7	28.4
6	80.6	33.6
7	89.5	37.6
8	96.8	40.7

Pre-Test Calibrations

PRETEST CALIBRATION DATA

GALSON
Corporation
6601 Kirkville Road
Post Office Box 516
E. Syr., N.Y. 13057
Tel: (315) 432-0506

Calibration Data - Stack Sampling Train
Orifice And Dry Gas Meters

Date 3/15/93
Meter Box ID 010

Wet Test Meter ID DGM#1
Barometric Pressure 29.90

Orifice Reading Hd In. H20	WET TEST METER GAS Volume (Vw) cu.ft.	WET TEST METER TEMP. (Tw) °F	DRY GAS METER GAS Volume (Vd) cu.ft.	Temperature Data °F TIME	Td IN	Td OUT	Td Average	TIME delta t (min)	Gamma	Delta H@
0.5	190.903 184.175 6.728	514	F 650.678 I 644.048 Diff. 6.630		62 65 67	62 63 63	523.5	17.0	1.032	1.71
1.0	198.050 191.178 6.872	514	F 657.900 I 650.973 Diff. 6.927		67 71 74	64 65 67	528	12.5	1.017	1.76
2.0	211.562 198.267 13.295	514	F 671.675 I 658.118 Diff. 13.557		66 70 75	66 66 67	528.3	17.4	1.003	1.87
3.0	226.043 211.749 14.294	514	F 686.503 I 671.843 Diff. 14.660		73 78 82	68 70 71	533.7	15.0	1.005	1.73
								Average	1.014	1.76

Gamma = Vw/Vd((Td avg + 460)/(Tw+460)) x ((Pb)/(Pb+(Hd/13.6))

Delta H@ = 0.0317 Hd((delta t / Vw)^2 x (Tw + 460)^2 / Pb(Td + 460))

Technician : PG

0000054

DRY GAS METER TEMPERATURE CALIBRATION

Control Box ID 010

Ice Water Bath	Temp °R
Reference Temp.	493
DGM Inlet	493
% Deviation	0%
DGM Outlet	493
% Deviation	0%

Ambient	Temp °R
Reference Temp.	522
DGM Inlet	522
% Deviation	0%
DGM Outlet	522
% Deviation	0%

Hot Water Bath	Temp °R
Reference Temp.	672
DGM Inlet	671
% Deviation	.15%
DGM Outlet	671
% Deviation	.15%

Date : 1/27/93

Technician : PJG

THERMOCOUPLE TEMPERATURE CALIBRATION

Ice Water Bath	Temp °R
Reference Temp.	492
Thermocouple #50	492
% Deviation	0.00
Thermocouple #51	492
% Deviation	0.00
Thermocouple #52	492
% Deviation	0.00

Ambient	Temp °R
Reference Temp.	522
Thermocouple #50	523
% Deviation	0.19
Thermocouple #51	522
% Deviation	0.00
Thermocouple #52	521
% Deviation	0.19

Hot Water Bath	Temp °R
Reference Temp.	672
Thermocouple #50	672
% Deviation	0.00
Thermocouple #51	671
% Deviation	0.15
Thermocouple #52	672
% Deviation	0.00

Date: 11/2/92

Technician: WRH

IMPINGER OUTLET TEMPERATURE CALIBRATION

Ambient		Temp °R
Reference Temp.		526
Impinger Outlet	#24	526
% Deviation		0.00
Impinger Outlet	#25	526
% Deviation		0.00
Impinger Outlet		
% Deviation		

Ice Water Bath		Temp °R
Reference Temp.		492
Impinger Outlet	#24	492
% Deviation		0.00
Impinger Outlet	#25	495
% Deviation		0.61
Impinger Outlet		
% Deviation		

Date: 10/30/92

Technician: JLS

Galson
Corporation
6601 Kirkville Road
E. Syracuse, N.Y. 13057
Tel. (315) 432-0506
Environmental Sciences Division

PITOT TUBE CALIBRATION - VERIFICATION OF CONSTRUCTION SPECIFICATIONS

Pitot ID: P-64 Date: 11/18/92

Technician: PG

1. D_t - external tubing diameter

$0.188" < D_t < 0.375"$ *

D_t = .375 inches

2. $P = \frac{P_A + P_B}{2}$

$1.05\ D_t < P < 1.50\ D_t$ *

$P_A + P_B$ = .914 inches

P = .457 inches

3. $Z = (P_A + P_B) \sin \gamma$

$Z < 0.125"$ * *

γ = 1°

Z = .016 inches

4. $W = (P_A + P_B) \sin \sigma$

$W < 0.031"$ * *

σ = 1°

W = .016 inches

5. $\beta_A, \beta_B < 5°$ * *

β_A = 2°

β_B = 3°

6. $\alpha_A, \alpha_B < 10°$ * *

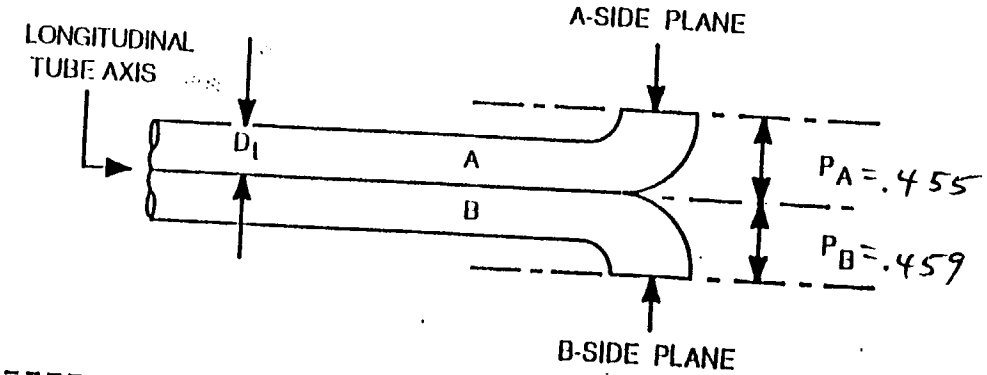
α_A = 1°

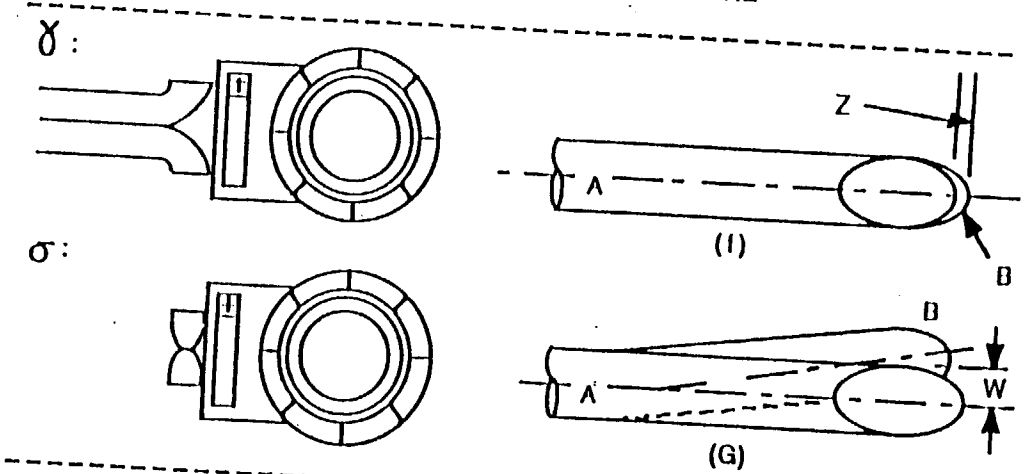
α_B = 2°

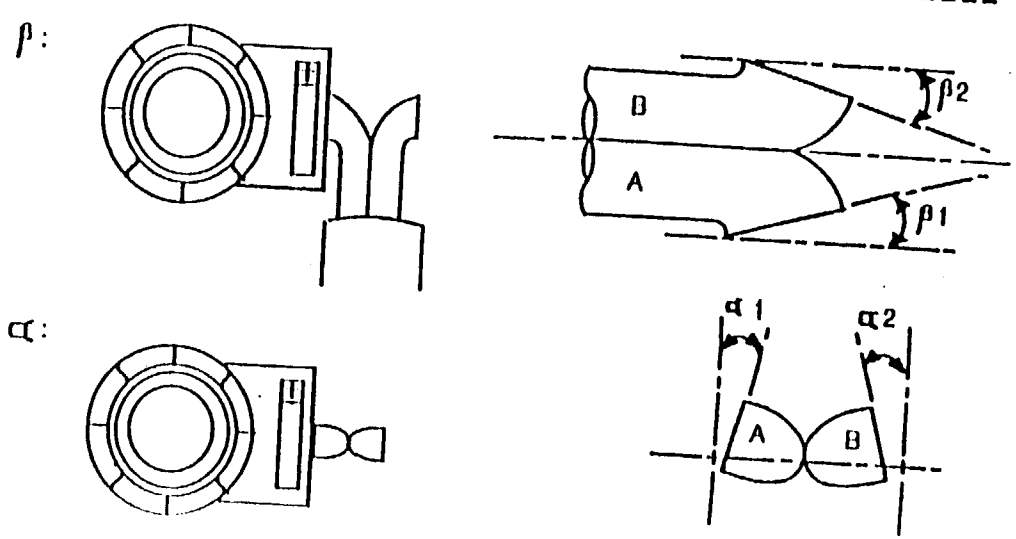
* , * * Acceptable limits.

* Standards of Performance for New Stationary Sources, Federal Register, 36 (247), December 23, 1971.

* * Valbra, R.F., "The Effects of Impact Opening Misalignment on the Value of the Type-S Pitot Tube Coefficient", U.S. EPA Emission Measurement Branch, Research Triangle Park, N.C., October, 1976.







000058

On-Site CEM Calibrations

CONTINUOUS ANALYZER NOx CONVERTER CHECK

Date of test 3/17/93

Operator C Lapsaddle

Pollutant NOx

Analyzer span 250

Analyzer ID TECO 10S S/N 10S 41940-266

Approx. gas conc. 105

Time	Conc.
1639	105.4
1640	105.4
1641	105.4
1642	105.4
1643	105.6
1644	105.2
1645	105.1
1646	105.1
1647	105.2
1648	105.2
1649	105.0
1650	105.3
1651	105.1
1652	105.1
1653	104.9
1654	105.0
1655	105.0
1656	104.8
1657	105.2
1658	105.3
1659	105.4
1700	105.3
1701	105.3
1702	105.2
1703	105.2
1704	105.1
1705	105.3
1706	105.2
1707	105.2
1708	105.1

CONTINUOUS ANALYZER SYSTEM RESPONSE TIME

Date of test 3/23/93 Operator [illegible]

Pollutant NO_x Analyzer span 250

Analyzer ID TECO 105 Span gas 138

Run #	Upscale response. (sec.)	Downscale response. (sec.)
1	50	55
2	50	45
3	50	50
Avg.	50	50

Date of test 3/23/93 Operator [illegible]

Pollutant CO Analyzer span 400

Analyzer ID TECO 48 Span gas 121

Run #	Upscale response. (sec.)	Downscale response. (sec.)
1	60	75
2	60	80
3	65	75
Avg.	62	77

Maximum system response = _____ sec.

Galson CORPORATION

Comments:

ON-SITE MONITOR CALIBRATIONS (DAILY)

Plant I. D. CNG Lebanon Project No. GE282

Source Engines Operator Clapaddle

Pollutant O_2 Analyzer I. D. IR 2200

Date 3/23/93 Span Value 25

Initial Calibration (Time 0830)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0	0.0	0
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	13.8	13.8	0	13.8	0
High-level gas..	23.5	23.4	0.4	—	—

Final Calibration (Time 1323)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	13.8	13.8	0
High-level gas..	23.5	23.4	0

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

ON-SITE MONITOR CALIBRATIONS (DAILY)

Galson CORPORATION

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 6

Operator Clapsaddle

Pollutant O_2

Analyzer I. D. IR2200

Date 3/24/93

Span Value 25

Initial Calibration (Time 7:45)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0	0	0.0	0.0
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	13.8	13.8	0	13.7	0.02
High-level gas..	23.5	23.3	0.8		

Final Calibration (Time 1455)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	13.8	13.8	0.0
High-level gas..	23.5	23.4	0.4

$$\text{Calibration error} = \frac{\text{(Analyzer response - Cylinder value)}}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{\text{(Final analyzer response - Initial analyzer response)}}{\text{Span value}} \times 100$$

Galson CORPORATION

ON-SITE MONITOR CALIBRATIONS (DAILY)

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engines 5 + 6

Operator Clapsaddle

Pollutant NO_x

Analyzer I. D. TECO 10S

Date 3/23/93

Span Value 250

Initial Calibration (Time 0830)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0	1.0	0.4
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	138	136 136	0.8	135	0.4
High-level gas..	208	210 210	0.8	209	0.4

Final Calibration (Time 1325)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	138	134	0.8
High-level gas..	208	211	0.4

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

Galson CORPORATION

ON-SITE MONITOR CALIBRATIONS (DAILY)

Comments:

Plant I. D. CNG Lebanon

Project No. GE 282

Source Engine 6

Operator [illegible]

Pollutant NOx

Analyzer I. D. TECO 10S

Date 3/24/93

Span Value 250

Initial Calibration (Time 7:45)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0.0	1.0	0.4
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	138	136	0.8	~~1.0~~ 134	0.8
High-level gas..	208	211	1.2		

Final Calibration (Time 1455)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	138	134	0.8
High-level gas..	208	208	1.2

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

ON-SITE MONITOR CALIBRATIONS (DAILY)

Galson CORPORATION

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 6

Operator Clapaddle

Pollutant CO

Analyzer I. D. TECO 10

Date 7/24/93

Span Value 400

Initial Calibration (Time 7:45)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0.0	0.0	0.0
Low-level gas ...	121	119	0.4	118	0.2
Mid-level gas ..	302	306	0.8		
High-level gas..	—	—	—	—	—

Final Calibration (Time 1455)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	121	119	0.0
Mid-Level gas ..	302	308	0.4
High-level gas..	—	—	—

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

Galson CORPORATION

ON-SITE MONITOR CALIBRATIONS (DAILY)

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 5+6

Operator Clapsaddle

Pollutant CO

Analyzer I. D. TECO 48

Date 3/23/93

Span Value 400

Initial Calibration (Time 0833)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0	0.0	0
Low-level gas ...	121	119 (119)	0.5	119	0
Mid-level gas ..	302	306 (306)	1.0	306	0
High-level gas..	—	—	—	—	—

Final Calibration (Time 1326)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	121	119	0
Mid-Level gas ..	302	~~292~~ 306	0
High-level gas..	—	—	—

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

Galson CORPORATION

ON-SITE MONITOR CALIBRATIONS (DAILY)

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 5 + 6

Operator Clapsaddle

Pollutant CO_2

Analyzer I. D. Horiba

Date 3/23/93

Span Value 20

Initial Calibration (Time 0835)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0.0	0	0.0	0
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	11.4	11.4	0	11.3	0.5
High-level gas..	17.3	17.3	0	—	—

Final Calibration (Time 1327)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	11.4	11.9	2.5
High-level gas..	17.3	17.6	1.5

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

Galson CORPORATION

ON-SITE MONITOR CALIBRATIONS (DAILY)

Comments:

Plant I. D. CNG Lebanon

Project No. GE 282

Source Engine 6

Operator Chappaddle

Pollutant CO_2

Analyzer I. D. Horiba PIR 2000

Date 3/24/93

Span Value 20

Initial Calibration (Time 0745)

	Cylinder value, ppm or %	Analyzer response ppm or %	Calibration error % of span	System response ppm or %	System bias % of span
Zero gas	0	0	0	0	0
Low-level gas ...	—	—	—	—	—
Mid-level gas ..	11.4	11.4	0	11.2	0.01
High-level gas..	17.3	17.2	0.5		

Final Calibration (Time 1455)

	Cylinder value, ppm or %	Analyzer response ppm or %	Percent drift
Zero gas	0	0	0
Low-level gas ...	—	—	—
Mid-Level gas ..	11.4	11.3	0.5
High-level gas..	17.3	17.0	1

$$\text{Calibration error} = \frac{(\text{Analyzer response} - \text{Cylinder value})}{\text{Span value}} \times 100$$

$$\text{Percent error} = \frac{(\text{Final analyzer response} - \text{Initial analyzer response})}{\text{Span value}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 5

Operator Clapsaddle

Pollutant O_2

Analyzer I. D. IR2200

Run No. 1

Date/Time 3/23 0830 - 1020

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0.0	0	0
Mid-range	13.8	13.8	0	13.8	0	0

Run No. 2

Date/Time 3/23 1020 - 1050

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0	0.0	0.0
Mid-range	13.8	13.8	0	13.8	0.0	0.0

Run No. 3

Date/Time 3/23 1054 - 1310

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	13.8	13.8	0.0	13.8	0.0	0.0

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 6

Operator Clapsaddle

Pollutant O_2

Analyzer I. D. IR 2200

Run No. 1

Date/Time 3/24/93 0823 - 1102

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	13.8	13.7	0.4	13.8	0.0	0.4

Run No. 2

Date/Time 3/24/93 1218 - 1332

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0	0	0	0.0	0.0	0.0
Mid-range	13.8	13.8	0	13.8	0.0	0.0

Run No. 3

Date/Time 3/24/93 1334 - 1447

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	13.8	13.8	0.0	13.8	0.0	0.0

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 5

Operator Clapaddle

Pollutant NOx

Analyzer I. D. TECO 10S

Run No. 1

Date/Time 3/23 0830 - 1028

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	1.0	0.4	1.5	0.6	0.2
Mid-range	136	135	0.4	133	0.8	0.4

Run No. 2

Date/Time 3/23 1028 - 1154

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	1.0	0.4	1.5	0.6	0.2
Mid-range	136	135	0.4	135	0.4	0

Run No. 3

Date/Time 3/23 1154 - 1317

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	1.5	0.6	1.50	0.6	0
Mid-range	136	135	0.4	134	0.8	0.4

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Galson CORPORATION

Comments:

Plant I. D. CNG Lebanon Project No. GE282

Source Engine 6 Operator [illegible]

Pollutant NO_x Analyzer I. D. TECO 10S

Run No. 1 Date/Time 3/24/93 0824-1108

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	System bias (% of span)	Drift (% of span)
Zero gas	0	0	0	1.75	0.7	0.7
Mid-range	136	134	0.8	135	0.4	0.4

Run No. 2 Date/Time 3/24/93 1225-1338

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	System bias (% of span)	Drift (% of span)
Zero gas	0	1.75	0.7	1.75	0.7	0.0
Mid-range	136	135	0.4	135	0.4	0.0

Run No. 3 Date/Time 3/24/93 1338 -

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	System bias (% of span)	Drift (% of span)
Zero gas	0	1.75	0.7	2.0	0.8	0.1
Mid-range	136	135	0.4	134	0.8	0.4

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 5

Operator Clapaddle

Pollutant CO

Analyzer I. D. TECO 48

Run No. 1

Date/Time 3/23 0830 - 1020

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0.0	0	0
Mid-range	119	119	0	119 ~~116~~	0 ~~0.75~~	0 ~~0.75~~

Run No. 2

Date/Time 3/23 1020 - 1145

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0	0	0
Mid-range	119	119	0	120	0.25	0.25

Run No. 3

Date/Time 3/23 - 1145 - 1312

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0	0	0	0	0	0
Mid-range	119	119	0	119	0	0

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 6

Operator Clapsaddle

Pollutant CO

Analyzer I. D. TECO 48

Run No. 1

Date/Time 3/24/93 0821-1103

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0	0.0	0.0	0.0	0.0	0.0
Mid-range	119	118	0.2	119	0.0	0.2

Run No. 2

Date/Time 3/24/93 1218 - 1332

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	119	119	0.0	119	0.0	0.0

Run No. 3

Date/Time 3/24/93 1332 - 1497

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	119	119	0.0	119	0.0	0.0

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon Project No. GE282

Source Engine 5 Operator Clapsaddle

Pollutant CO_2 Analyzer I. D. Horiba

Run No. 1 Date/Time 3/23 0835 - 1022

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0.0	0	0
Mid-range	11.4	11.3	0.5	11.2	1.0	0.5

Run No. 2 Date/Time 3/23 1022 - 1146

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0	0	0	0
Mid-range	11.4	11.3	0.5	11.3	0.5	0

Run No. 3 Date/Time 3/23 - 1152 - 1312

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0	0	0	0	0	0
Mid-range	11.4	11.3	0.5	11.3	0.5	0

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Galson CORPORATION

PRE-TEST & POST-TEST SYSTEM DRIFT CHECKS

Comments:

Plant I. D. CNG Lebanon

Project No. GE282

Source Engine 6

Operator Clapoaddl

Pollutant CO_2

Analyzer I. D. Horiba PIR-2000

Run No. 1

Date/Time 3/24/93 0820 - 1108

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	11.4	11.2	1.0	11.2	1.0	0.0

Run No. 2

Date/Time 3/24/93 1217 - 1331

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	11.4	11.2	1.0	11.3	0.5	0.5

Run No. 3

Date/Time 3/24/93 1337 — 1447

	Analyzer Calibration Response	Initial values: System Calibration Response	Initial values: System bias (% of span)	Final values: System Calibration Response	Final values: System bias (% of span)	Drift (% of span)
Zero gas	0.0	0.0	0.0	0.0	0.0	0.0
Mid-range	11.4	11.3	0.5	11.2	1.0	0.5

$$\text{System calibration bias} = \frac{\text{System calibration response} - \text{Analyzer calibration response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final system response} - \text{Initial system calibration response response}}{\text{Span}} \times 100$$

Post-test Calibrations

Galson
Corporation
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Post Office Box 516
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Tel: (315) 432-0506
Environmental Sciences Division

POST TEST CALIBRATION - DRY GAS METER

Plant CWG GILMORE/LEBANON Job # 6E-300

Source ENGINE EXHAUSTS Meter Box ID 010

Barometric Pressure, in Hg 29.29 Date 3.29.93

ORIFICE READING (ΔH@) in. H_2	WET TEST METER GAS VOLUME (Vw) ft3	WET TEST METER TEMP. (Tw) °F	DRY GAS METER GAS VOLUME (V_D) ft3	TEMPERATURE DATA °F T_D in	T_D out	T_D avg	TIME Δt min.	Y	ΔH@
2.0	908.612 898.543 10.069	527	021.703 011.695 10.008	63 65 69 71	61 62 64 65	525	13.0	0.997	1.91
2.0	919.643 908.612 11.031	527	032.751 021.703 11.048	70 73 76 78	65 67 69 70	531	14.33	1.001	1.91
2.0	929.645 919.643 10.002	527	042.864 032.751 10.113	80 83 85 86	71 72 73 75	538.12	12.90	1.005	1.86
							AVG.	1.001	1.89
							PRE-TEST	1.014	1.76

$$Y = \frac{V_W}{V_D}\left(\frac{T_{D\,avg} + 460}{T_W + 460}\right)\left(\frac{P_D}{P_D + \frac{\Delta H}{13.6}}\right)$$

$$\Delta H_@ = 0.0317\,\Delta H_c\left(\frac{t}{V_W}\right)^2 \frac{(T_W + 460)^2}{P_D\,(T_D + 460)}$$

Vacuum Setting, in. Hg. 2

POST TEST CALIBRATION - TEMPERATURE SENSORS

	AMBIENT (°R)	% DIFF.	OTHER (°R)	% DIFF.
Stack Thermocouple ID# 52 — Reference	527 527	0.0	672 673	.14
Gas Meter Inlet ID# 010 — Reference	527 527	0.0	672 671	0.14
Gas Meter Outlet ID# 010 — Reference	527 526	0.19	672 672	0.0
Condenser Outlet ID# 004 — Reference	527 527	0.0	492 493	0.20
Heated Oven Box ID# — — Reference	— —	—	— —	—

Technician: William R. Hosey Date: 3.29.93

NA= Not Applicable

Cylinder Gas Certification Sheets

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box O
Liverpool , NY 13088

DATE: 08/25/92

P.O. NO.

ORDER NO. 114906-001

REF. # AD-612

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1. Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (/ /)	2nd Anal (08/24/92)	Actual
CC103975	OXYGEN	NOT %	13.8 %	13.8 %
		REQUIRED %	13.8 %	
		%	13.8 %	
	Nitrogen	Balance		

Last Analysis Date: 08/24/92 Expiration Date: 02/24/94
Pressure of Contents: 2000 psig

ANALYST

Aaron L. Durr

MG 23301/B 4/92

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box O
Liverpool , NY 13088

DATE: 08/28/92

P.O. NO.

ORDER NO. 114907-001

REF. # AD-618

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1, Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (/ /)	2nd Anal (08/28/92)	Actual
CC107377	CARBON DIOXIDE	NOT %	11.4 %	11.4 %
		REQUIRED %	11.4 %	
		%	11.4 %	
	Nitrogen	Balance		

Last Analysis Date: 08/28/92 Expiration Date: 02/28/92
Pressure of Contents: 2000 psig

ANALYST
Aaron L. Durr

MG 23301/B 4/92

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box 0
Liverpool , NY 13088

DATE: 09/11/92

P.O. NO.

ORDER NO. 114907-001

REF. # EM-1588-2

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1, Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (/ /)	2nd Anal (09/11/92)	Actual
CC106488	Carbon Dioxide	NOT %	17.3 %	17.3 %
		REQUIRED %	17.3 %	
		%	17.3 %	
	Nitrogen	Balance		

Last Analysis Date: 09/11/92 Expiration Date: 03/11/94
Pressure of Contents: 2000 psig

Eben Maxwell

ANALYST

Eben Maxwell

MG 23301/B 4/92

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box O
Liverpool , NY 13088

DATE: 09/02/92

P.O. NO.

ORDER NO. 114911-001

REF. # EM-1572-7

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1, Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (08/26/92)	2nd Anal (09/02/92)	Actual
CC111323	CARBON MONOXIDE	121 ppm	121 ppm	121 ppm
		121 ppm	121 ppm	
		121 ppm	121 ppm	
	Nitrogen	Balance		

Last Analysis Date: 09/02/92 Expiration Date: 03/02/94
Pressure of Contents: 1650 psig

Eben Maxwell ANALYST

MG 23301/B 4/92

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box 0
Liverpool , NY 13088

DATE: 09/02/92

P.O. NO.

ORDER NO. 114911-001

REF. # EM-1573-8

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1, Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (08/26/92)	2nd Anal (09/02/92)	Actual
CC111353	CARBON MONOXIDE	301 ppm	302 ppm	302 ppm
		301 ppm	302 ppm	
		301 ppm	302 ppm	
	Nitrogen	Balance		

Last Analysis Date: 09/02/92 Expiration Date: 03/02/94
Pressure of Contents: 1650 psig

Eben Maxwell

Eben Maxwell ANALYST

000082

MG 23301/R 4/90

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box O
Liverpool , NY 13088

DATE: 03/10/92

P.O. NO.

ORDER NO. 812864-004

REF. # MV-313-V

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1. Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (02/27/92)	2nd Anal (03/05/92)	Actual
CC-92005	Nitric Oxide ~~Carbon Monoxide~~	138.2 ppm	138.2 ppm	138.2 ppm
		138.2 ppm	138.2 ppm	
		138.2 ppm	138.2 ppm	
	Nitrogen	Balance		

The calculated NOX value is: 138.2 ppm

Last Analysis Date: 03/05/92 Expiration Date: 09/05/93
Pressure of Contents: 1800 psig

M. F. Varkonyi
ANALYST
MIKLOS FERENC VARKONYI JR

MG 23301/A 3/89

MG Industries
®Gas Products

1399 NEW FORD MILL RD.
MORRISVILLE, PA 19067
(800)638-6360

ANALYTICAL REPORT – PRODUCT CERTIFICATION

TO:

MG Industries - Syracuse
Intra-Company Transfer
P. O. Box O
Liverpool , NY 13088

DATE: 09/10/92

P.O. NO.

ORDER NO. 114892-001

REF. # EM-1576-9

CYLINDER NO. CONSTITUENTS CONCENTRATION: NOMINAL ACTUAL

The following cylinder has been analyzed according to EPA Protocol No. 1. Section 3.0.4 procedure G1.

Cylinder No.	Constituent	1st Anal (09/01/92)	2nd Anal (09/10/92)	Actual
CC112637	NITRIC OXIDE	208 ppm	208 ppm	208 ppm
		208 ppm	208 ppm	
		208 ppm	208 ppm	
	Nitrogen	Balance		

The calculated NOX value is: 208

Last Analysis Date: 09/10/92 Expiration Date: 03/10/94
Pressure of Contents: 1800 psig

Eben Maxwell ANALYST

000084

MG 23301/B 4/92

CNG Lebanon
Example Calculations used for Emission Concentration and Rate Determinations

Concentration

ppmv, dry = ppmv, actual x [1 + (%H2O / 100)]

ppmv, dry (adj. to 15% O2) = measured pollutant conc., ppmv, dry x [(20.9 -15.0) / (20.9 - measured O2 conc., %)

mg / dscm = [(ppmv x mol. wt.) / 24.04 liter/mole] x (1000 mg/g) x (1 cubic meter/1000 liters)

lb / dscf = (mg / dscm) x (1 lb / 453,590 mg) x (1 cubic meter / 35.314 cubic feet)

Emission Rate

lb/MMBtu = ppm x Ffactor x A x (20.9 / (20.9 - %O2))

where:
A = 7.25 E-08 for CO
A = 1.194 E-07 for NOx
A = 1.660 E-07 for SO2
A = 4.10 E -08 for CH4

$$g / hr = \frac{\text{ppm x molecular weight x 1,000 liters/cubic meter x DSCFM x 60 min/hr x 1.00E-06 grams/microgram}}{\text{24.04 liters/mole x 35.314 cubic feet/cubic meter}}$$

lb / hr = (g / hr) x (1 lb / 453.59 g)

g / BHp - hr = (g / hr) / BHp

000085

CNG Lebanon
CARBON MONOXIDE EMISSION SUMMARY

	Engine #5			Engine #6		
Run I.D.	1	2	3	1	2	3
Date	3/23/93	3/23/93	3/23/93	3/24/93	3/24/93	3/24/93
Time	0915-1015	1040-1140	1205-1305	1000-1100	1230-1330	1541-1641
Fuel F-Factor	8710	8710	8710	8710	8710	8710
Horse Power (BHp)	4280	4282	4252	4183	4196	4162
Stack Gas Volumetric Flow Rate						
DSCFM	20,129	20,377	19,465	18,909	19,405	19,394
Stack Gas Oxygen Concentration						
% O2	15.6	15.6	15.6	15.7	15.6	15.7
Concentration						
ppmv	254.7	260.9	263.5	282.3	270.9	286.9
ppmv (adjusted to 7% O2)	668.0	684.2	691.1	754.6	710.5	766.9
mg / dscm	296.8	304.0	307.0	328.9	315.6	334.3
lb / dscf	1.85E-05	1.9E-05	1.92E-05	2.05E-05	1.97E-05	2.09E-05
ppmv (adjusted to 15% O2)	283.5	290.4	293.3	320.3	301.6	325.5
Emission Rate						
lb/MMBtu	0.634	0.650	0.656	0.716	0.675	0.728
lb / hr	22.37	23.20	22.38	23.30	22.94	24.28
g / hr	10149.0	10524.1	10153.3	10567.0	10406.3	11014.6
g / BHp - hr	2.4	2.5	2.4	2.5	2.5	2.6

980086

CNG Lebanon
NITROGEN OXIDES EMISSION SUMMARY

	Engine #5			Engine #6		
Run I.D.	1	2	3	1	2	3
Date	3/23/93	3/23/93	3/23/93	3/24/93	3/24/93	3/24/93
Time	0915-1015	1040-1140	1205-1305	1000-1100	1230-1330	1541-1641
F-Factor	8710	8710	8710	8710	8710	8710
Horse Power	4280	4282	4252	4183	4196	4162
Stack Gas Volumetric Flow Rate						
DSCFM	20,129	20,377	19,465	18,909	19,405	19,394
Stack Gas Oxygen Concentration						
% O2	15.6	15.6	15.6	15.7	15.6	15.7
Concentration						
ppmv	113.0	108.3	103.5	117.2	127.2	112.8
ppmv (adjusted to 7% O2)	296.4	284.0	271.4	313.3	333.6	301.5
mg / dscm	216.3	207.3	198.1	224.3	243.4	215.9
lb / dscf	1.35E-05	1.29E-05	1.24E-05	1.4E-05	1.52E-05	1.35E-05
ppmv (adjusted to 15% O2)	125.8	120.6	115.2	133.0	141.6	128.0
Emission Rate						
lb/MMBtu	0.463	0.444	0.424	0.490	0.522	0.471
lb / hr	16.31	15.82	14.44	15.89	17.69	15.68
g / hr	7396.3	7176.0	6551.0	7206.2	8026.2	7113.6
g / BHp - hr	1.7	1.7	1.5	1.7	1.9	1.7

000087

CNG Lebanon
NON METHANE HYDROCARBONS (as CH4) EMISSION SUMMARY

	Engine #5			Engine #6		
Run I.D.	1	2	3	1	2	3
Date	3/23/93	3/23/93	3/23/93	3/24/93	3/24/93	3/24/93
Time	0915-1015	1040-1140	1205-1305	1000-1100	1230-1330	1541-1641
F-Factor	8710	8710	8710	8710	8710	8710
Horse Power	4280	4282	4252	4183	4196	4162
Measured Stack Gas Parameters						
Volumetric Flow Rate, DSCFM	20,129	20,377	19,465	18,909	19,405	19,394
% O2	15.6	15.6	15.6	15.7	15.6	15.7
% H2O	5.10	4.20	4.40	6.70	4.10	4.90
Concentration						
NMHC ppmv, dry	71.0	76.0	71.0	77.0	81.0	80.0
NMHC ppmv, dry @ 15% O2	79.0	84.6	79.0	87.4	90.2	90.8
NMHC mg / dscm	47.4	50.7	47.4	51.4	54.0	53.4
NMHC lb / dscf	2.96E-06	3.17E-06	2.96E-06	3.21E-06	3.37E-06	3.33E-06
Emission Rate						
NMHC lb/MMBtu	0.100	0.107	0.100	0.111	0.114	0.115
NMHC lb / hr	3.57	3.87	3.45	3.64	3.93	3.88
NMHC g / hr	1620.1	1755.6	1566.7	1650.5	1781.8	1758.8
NMHC g/hp-hr	0.38	0.41	0.37	0.39	0.42	0.42

000088

Engine 5

Galson CORPORATION

MONITOR SAMPLING RECORD

Comments:

Plant I.D. CNG-Lebanon

Source Engine 5

Date 3/23/93

Project No. GE282

Operator Clapsaddle

Run No. 1

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
Start 0915	—	—	NA	NA	—	—
0920	110.3	250.9			3.1	15.6
0925	109.2	249.6			3.1	15.6
0930	106.9	252.8			3.1	15.6
0935	108.1	252.5			3.1	15.6
0940	109.4	250.3			3.1	15.6
0945	112.0	250.7			3.1	15.6
0950	113.7	246.3			3.1	15.6
0955	113.6	246.9			3.1	15.6
1000	110.6	247.7			3.1	15.6
1005	110.3	250.1			3.1	15.6
1010	106.6	254.2			3.1	15.6
1015	108.5	253.5			3.1	15.6
Average	~~[illegible]~~ 110.0	250.5			3.1	15.6
Bias Corrected Average	113.0	254.7			3.1	15.6

Run #1 Start Time 915

Time	O2 %	NOx ppm	CO ppm	THC ppm	SO2 ppm	CO2 %
920	15.6	110.3	250.9			3.1
925	15.6	109.2	249.6			3.1
930	15.6	106.9	252.8			3.1
935	15.6	108.1	252.5			3.1
940	15.6	109.4	250.3			3.1
945	15.6	112	250.7			3.1
950	15.6	113.7	246.3			3.1
955	15.6	113.6	246.9			3.1
1000	15.6	110.6	247.7			3.1
1005	15.6	110.6	250.1			3.1
1010	15.6	106.6	254.2			3.1
1015	15.6	108.5	253.5			3.1
Average	15.60	109.96	250.46	#DIV/0!	#DIV/0!	3.10
Corrected Average	15.60	113.01	254.67	#DIV/0!	#DIV/0!	3.14

Galson CORPORATION

Comments:

MONITOR SAMPLING RECORD

Plant I.D. CNG-Lebanon
Source Engine 5
Date 3/23/93

Project No. GE282
Operator Clapsaddle

Run No. 2

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
start 1040	—	—	NA	NA	—	—
1045	102.9	262.0			3.10	15.6
1050	109.2	254.8			3.10	15.6
1055	109.2	255.3			3.1	15.6
1100	104.6	257.3			3.1	15.6
1105	107.1	257.4			3.1	15.6
1110	108.1	254.0			3.1	15.6
1115	105.1	259.2			3.1	15.6
1120	104.3	260.5			3.1	15.6
1125	105.7	260.1			3.1	15.6
1130	106.7	257.3			3.1	15.6
1135	106.2	257.4			3.1	15.6
1140	105.4	256.2			3.1	15.6
Average	106.2	257.6			3.1	15.6
Bias Corrected Average	108.3	260.9			3.1	15.6

Galson CORPORATION

MONITOR SAMPLING RECORD

Comments:

Plant I.D. CNG Lebanon
Source Engine 5
Date 3/23/93

Project No. GE282
Operator Clapaddle

Run No. 3

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
1205	—	—	NA	NA	—	—
1210	104.7	256.6			3.1	15.6
1215	101.2	259.4			3.1	15.6
1220	103.2	257.2			3.1	15.6
1225	101.9	259.6			3.1	15.6
1230	100.4	260.0			3.1	15.6
1235	102.6	258.5			3.1	15.6
1240	100.0	260.0			3.1	15.6
1245	101.5	258.9			3.1	15.6
1250	100.5	258.1			3.1	15.6
1255	99.0	260.3			3.1	15.6
1300	100.3	260.5			3.1	15.6
1305	99.8	261.1			3.1	15.6
Average	101.3	259.2			3.1	15.6
Bias Corrected Average	103.5	263.5			3.1	15.6

Run #3 Start Time 1205

Time	O2 %	NOx ppm	CO ppm	THC ppm	SO2 ppm	CO2 %
1210	15.6	104.7	256.6			3.1
1215	15.6	101.2	259.4			3.1
1220	15.6	103.2	257.2			3.1
1225	15.6	101.9	259.6			3.1
1230	15.6	100.4	260			3.1
1235	15.6	102.6	258.5			3.1
1240	15.6	100	260			3.1
1245	15.6	101.5	258.9			3.1
1250	15.6	100.5	258.1			3.1
1255	15.6	99	260.3			3.1
1300	15.6	100.3	260.5			3.1
1305	15.6	99.8	261.1			3.1
Average	15.6	101.3	259.2	#DIV/0!	#DIV/0!	3.1
Corrected Average	15.6	103.5	263.5	#DIV/0!	#DIV/0!	3.1

Run #	Observed Average (ppm)	Average Zero System Bias (ppm)	Average Span System Bias (ppm)	Certified Span Gas (ppm)	Span Bias Correction Factor	Corrected Value (ppm)
O2 - 1	15.6	0	13.8	13.8	1	15.6
O2 - 2	15.6	0	13.8	13.8	1	15.6
O2 - 3	15.6	0	13.8	13.8	1	15.6
NOx - 1	109.9583	1.25	134	138	1.039548	113.0075
NOx - 2	106.2083	1.25	135	138	1.0317757	108.2935
NOx - 3	101.2583	1.5	134.5	138	1.037594	103.5086
CO - 1	250.4583	0	119	121	1.0168067	254.6677
CO - 2	257.625	0	119.5	121	1.0125523	260.8588
CO - 3	259.1833	0	119	121	1.0168067	263.5394
THC - 1	#DIV/0!	0.1	18.05	0	0	#DIV/0!
THC - 2	#DIV/0!	0.05	9	0	0	#DIV/0!
THC - 3	#DIV/0!	0	11.05	0	0	#DIV/0!
SO2 - 1	#DIV/0!	1.5	423	0	0	#DIV/0!
SO2 - 2	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
SO2 - 3	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
CO2 - 1	3.1	0	11.25	11.4	1.0133333	3.141333
CO2 - 2	3.1	0	11.3	11.4	1.0088496	3.127434
CO2 - 3	3.1	0	11.3	11.4	1.0088496	3.127434

205 ~~224~~ dscfm
6.7 % H_2O

SAMPLE COLLECTION DATA

Galson CORPORATION

Start Time 10:45
Stop Time 11:15
Impinger Outlet # 24
Thermocouple # ~~#~~ 52
Pitot ID ~~52~~ P-64
Pitot Leak Check
Static Pressure -0.50

Plant LNG- Lebanon
Location Eng. #5
Date 3/23/93
Run Number #2
Operator EM
Oven Box ID –
Meter Box ID 010
Probe ID –
Filter # –

Meter γ 1.014
Meter ΔH@ 1.76
Pitot C.F. 0.84
Assumed Moisture % –
Nozzle Diameter in. –
C Factor –
Ambient Temperature 58
Barometric Pressure 29.68
Silica Gel #

System Leak Checks:
Pre: 00 cfm @ 10 "Hg
Mid: — cfm @ — "Hg
Post: 00 cfm @ 10 "Hg

Water Collected:
Impingers, ml. 30
Silica Gel, gms. 2.9

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A 1	5	506	0.65	2.0	IV 793.776	59	58	NA	NA	56	NA	5
2	10	505	0.75	2.0	797.9	63	59	↓	↓	54	↓	5
3	15	505	0.90	2.0	802.7	70	62	↓	↓	58	↓	5
4	20	507	1.10	2.0	806.2	73	63	↓	↓	60	↓	5
5	25	506	1.15	2.0	812.8	78	66	↓	↓	63	↓	5
6	30	507	1.0	2.0	817.981	79	68	↓	↓	65	↓	5
7		503	.80									
8		500	.60									
B 1		505	.55									
2		506	.70									
3		505	.85									
4		507	1.0									
5		505	1.15									
6		505	1.0									
7		504	.70									
8		503	.50									
Averages												

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Start Time	915	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	945	Location	Engine 5 Exhaust			Traverse Point	
Sample Duration, min.	30	Date	3/23/93	Pitot C.F.	0.84	P wake	
Impinger Outlet #	24	Run #	M4-1			P static	-0.5
Thermocouple #	52	Operator	RSH/EM			Stack ID, in.	42
Pitot Tube ID	p-64	Oven Box ID				Rect., width, in.	
Dry Gas Meter Sample Volume	23.764	Meter Box ID	O10	Ambient Temperature	53	Rect., length, in.	
		Probe ID		Barometric Pressure	29.68	Stk Area, sq.ft.	9.62
Leak Check Rates	initial			Silica Gel #		Impingers, ml	20
	0 cfm @		cfm @	final	0 cfm @	Silica Gel,grams	8.4
	10 in. Hg.		in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	505	0.70	2.00	769.877	55	54			55		5		0.8367
2	10	503	0.80	2.00		58	54			56		5		0.8944
3	15	503	0.95	2.00		61	55			57		5		0.9747
4	20	506	1.00	2.00		69	60			61		5		1.0000
5	25	506	1.15	2.00		71	61			63		5		1.0724
6	30	505	0.95	2.00	793.641	74	67			65		5		0.9747
7		503	0.70											0.8367
8		498	0.30											0.5477
B1		502	0.60											0.7746
2		504	0.65											0.8062
3		506	0.75											0.8660
4		508	0.95											0.9747
5		508	1.00											1.0000
6		508	0.85											0.9220
7		505	0.75											0.8660
8		501	0.65											0.8062

000097

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/23/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-1	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
Average	3.1		15.6		0.0	1.71

000098

Start Time	915	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	945	Location	Engine 5 Exhaust			Traverse Point	0
Sample Duration, min.	30	Date	3/23/93	Pitot C.F.	0.84	P wake	0
Impinger Outlet #	24	Run #	M4-1			P static	-0.5
Thermocouple #	52	Operator	RSH/EM			Stack ID, in.	42
Pitot Tube ID	p-64	Oven Box ID	0			Rect., width, in.	0
Dry Gas Meter Sample Volume	23.764	Meter Box ID	O10	Ambient Temperature	53	Rect., length, in.	0
		Probe ID	0	Barometric Pressure	29.68	Stk Area, sq.ft.	9.62
Leak Check Rates initial	0 cfm @		0 cfm @	Silica Gel #	0	Impingers, ml	20
	10 in. Hg.		0 in. Hg.	final	0 cfm @	Silica Gel,grams	8.4
					10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	504.4		2.00	23.764	64.7	58.5	#DIV/0!	#DIV/0!	59.5	#DIV/0!	5.0		0.8846
						avg.Tm (F)	61.6							
max. value recorded		508	1.15	2.00		74	67	0	0	65	0	5		
min. value recorded		498	0.30	2.00		55	54	0	0	55	0	5		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	1.337 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	24.317 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.052
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	266.07 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.54
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	67.8 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	39150 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	20129 dscfm

000099

19465 dscfm
6.8% H_2O

SAMPLE COLLECTION DATA

Galson CORPORATION

Start Time 12:15
Stop Time 12:45
Impinger Outlet # 24
Thermocouple # 52
Pitot ID P-24
Pitot Leak Check
Static Pressure -.65

Plant CN6 - Lebanon
Location Eng #5
Date 3/23/99
Run Number #3
Operator EM
Oven Box ID
Meter Box ID 010
Probe ID
Filter #

Meter γ 1.014
Meter ΔH@ 1.76
Pitot C.F. 0.84
Assumed Moisture % —
Nozzle Diameter in. —
C Factor —
Ambient Temperature 60
Barometric Pressure 29.68
Silica Gel #

System Leak Checks:
Pre: 00 cfm @ 10 "Hg
Mid: — cfm @ — "Hg
Post: 00 cfm @ 10 "Hg

Water Collected:
Impingers, ml. +31
Silica Gel, gms. 5.9

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A 1	5	505	.50	2.0	FV 818.124	62	61	NA	NA	60	NA	1
2	10	506	.75	2.0	822.2	69	63	↓	↓	63	↓	1
3	15	508	.80	2.0	826.3	72	65	↓	↓	64	↓	1
4	20	506	1.0	2.0	830.5	73	67	↓	↓	66	↓	1
5	25	509	1.15	2.0	834.4	74	68	↓	↓	66	↓	1
6	30	507	.85	2.0	FV 841.595	74	70			64		1
7		507	.75									
8		503	.45									
B 1		502	.45									
2		505	.70									
3		507	.75									
4		508	.90									
5		510	1.0									
6		508	.95									
7		508	.60									
8		506	.50									
Averages												

000100

Start Time	1045	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	1115	Location	Engine 5 Exhaust				
Sample Duration, min.	30	Date	3/23/93	Pitot C.F.	0.84	Traverse Point	
Impinger Outlet #	24	Run #	M4-2			P wake	
Thermocouple #	52	Operator	EM			P static	-0.5
Pitot Tube ID	P-64	Oven Box ID				Stack ID, in.	42
Dry Gas Meter Sample Volume	24.205	Meter Box ID	O10	Ambient Temperature	58	Rect., width, in.	
		Probe ID		Barometric Pressure	29.68	Rect., length, in.	
Leak Check Rates	initial			Silica Gel #		Stk Area, sq.ft.	9.62
	0 cfm @		cfm @	final	0 cfm @	Impingers, ml	30
	10 in. Hg.		in. Hg.		10 in. Hg.	Silica Gel,grams	7.9

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	506	0.65	2.00	793.776	59	58			56		5		0.8062
2	10	505	0.75			63	59			54		5		0.8660
3	15	505	0.90			70	62			58		5		0.9487
4	20	507	1.10			73	63			60		5		1.0488
5	25	506	1.15			78	66			63		5		1.0724
6	30	507	1.00		817.981	79	68			65		5		1.0000
7		503	0.80											0.8944
8		500	0.60											0.7746
B1		505	0.55											0.7416
2		506	0.70											0.8367
3		505	0.85											0.9220
4		507	1.00											1.0000
5		505	1.15											1.0724
6		505	1.00											1.0000
7		504	0.70											0.8367
8		503	0.50											0.7071

000101

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/23/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-2	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
Average	3.1		15.6		0.0	1.71

000102

Start Time	1045	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	1115	Location	Engine 5 Exhaust			Traverse Point	0
Sample Duration, min.	30	Date	3/23/93	Pitot C.F.	0.84	P wake	0
Impinger Outlet #	24	Run #	M4-2			P static	-0.5
Thermocouple #	52	Operator	EM			Stack ID, in.	42
Pitot Tube ID	P-64	Oven Box ID	0			Rect., width, in.	0
Dry Gas Meter Sample Volume	24.205	Meter Box ID	O10	Ambient Temperature	58	Rect., length, in.	0
		Probe ID	0	Barometric Pressure	29.68	Stk Area, sq.ft.	9.62
				Silica Gel #	0	Impingers, ml	30
Leak Check Rates initial	0 cfm @		0 cfm @	final	0 cfm @	Silica Gel,grams	7.9
	10 in. Hg.		0 in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	504.9		2.00	24.205	70.3	62.7	#DIV/0!	#DIV/0!	59.3	#DIV/0!	5.0		0.9080
						avg.Tm (F)	66.5							
max. value recorded		507	1.15	2.00		79	68	0	0	65	0	5		
min. value recorded		500	0.50	2.00		59	58	0	0	54	0	5		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	1.784 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	24.537 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.068
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	266.07 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.37
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	69.8 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	40320 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	20377 dscfm

000103

20 129 dscfm
5.2 % H_2O

SAMPLE COLLECTION DATA

Galson CORPORATION

Start Time 0915
Stop Time 0945
Impinger Outlet # 24
Thermocouple # 52
Pitot ID P-64
Pitot Leak Check
Static Pressure -.50

Plant CNG-Lebanon
Location Engine #5 Exhaust
Date 3/23/93
Run Number #1, methods 1-4
Operator BSH / EM
Oven Box ID —
Meter Box ID
Probe ID —
Filter # —

Meter γ 1.014
Meter ΔH@ 1.76
Pitot C.F. 0.84
Assumed Moisture % —
Nozzle Diameter in. —
C Factor —
Ambient Temperature 53
Barometric Pressure 29.68
Silica Gel #

System Leak Checks:
Pre: 0.000 cfm @ 10 "Hg
Mid: — cfm @ — "Hg
Post: 00 cfm @ 10 "Hg

Water Collected:
Impingers, ml. +20
Silica Gel, gms. 8.4

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A1	5	505	.70	2.0	769.872	55	54	NA	NA	56	NA	5
2	10	503	.80	2.0	772.3	58	54			57		5
3	15	503	.95	2.0	777.4	61	55			61		5
4	20	506	1.0	2.0	785.8	69	60			63		5
5	25	506	1.15	2.0	789.1	71	61			65		5
6	30	505	.95	2.0	FV 793.641	74	69					5
7		503	.70			64.67	57.5					
8		498	.30									
B1		502	.60									
2		504	.65									
3		506	.75									
4		508	.95									
5		508	1.0									
6		508	.85									
7		505	.75									
8		501	.65									
Averages												

000104

		Plant	CNG Lebanon	Meter Gamma	1.014		
Start Time	1215	Location	Engine 5 Exhaust			Traverse Point	
Stop Time	1245	Date	3/23/93	Pitot C.F.	0.84	P wake	
Sample Duration, min.	30	Run #	M4-3			P static	-0.65
Impinger Outlet #	24	Operator	EM			Stack ID, in.	42
Thermocouple #	52	Oven Box ID				Rect., width, in.	
Pitot Tube ID	P-64	Meter Box ID	O10	Ambient Temperature	60	Rect., length, in.	
Dry Gas Meter Sample Volume	23.471	Probe ID		Barometric Pressure	29.68	Stk Area, sq.ft.	9.62
				Silica Gel #		Impingers, ml	31
Leak Check Rates	initial	0 cfm @	cfm @	final	0 cfm @	Silica Gel,grams	5.9
		10 in. Hg.	in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	505	0.50	2.00	818.124	62	61			60		1		0.7071
2	10	506	0.75			69	63			63		1		0.8660
3	15	508	0.80			72	65			64		1		0.8944
4	20	506	1.00			73	67			66		1		1.0000
5	25	509	1.15			74	68			66		1		1.0724
6	30	507	0.85		814.595	74	70			64		1		0.9220
7		507	0.75											0.8660
8		503	0.45											0.6708
B1		502	0.45											0.6708
2		505	0.70											0.8367
3		507	0.75											0.8660
4		508	0.90											0.9487
5		510	1.00											1.0000
6		508	0.95											0.9747
7		508	0.80											0.8944
8		506	0.50											0.7071

000105

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/23/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-3	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
Average	3.1		15.6		0.0	1.71

000106

Start Time	1215	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	1245	Location	Engine 5 Exhaust			Traverse Point	0
Sample Duration, min.	30	Date	3/23/93	Pitot C.F.	0.84	P wake	0
Impinger Outlet #	24	Run #	M4-3			P static	-0.65
Thermocouple #	52	Operator	EM			Stack ID, in.	42
Pitot Tube ID	P-64	Oven Box ID	0			Rect., width, in.	0
Dry Gas Meter Sample Volume	23.471	Meter Box ID	O10	Ambient Temperature	60	Rect., length, in.	0
		Probe ID	0	Barometric Pressure	29.68	Stk Area, sq.ft.	9.62
				Silica Gel #	0	Impingers, ml	31
Leak Check Rates initial	0 cfm @		0 cfm @	final	0 cfm @	Silica Gel,grams	5.9
	10 in. Hg.		0 in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	506.6		2.00	23.471	70.7	65.7	#DIV/0!	#DIV/0!	63.8	#DIV/0!	1.0		0.8686
						avg.Tm (F)	68.2							
max. value recorded		510	1.15	2.00		74	70	0	0	66	0	1		
min. value recorded		502	0.45	2.00		62	61	0	0	60	0	1		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	1.737 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	23.718 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.068
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	266.07 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.36
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	66.9 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	38613 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	19465 dscfm

000107

Engine 6

MONITOR SAMPLING RECORD

Galson CORPORATION

Comments:

Plant I.D. CNG Lebanon

Source Engine 6

Date 3/24/93

Project No. GE282

Operator Clapp[illegible]

Run No. 1

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
1000	—	—	NA	NA	—	—
1005	109.4	282.9			3.1	15.7
1010	114.0	276.4			3.0	15.7
1015	116.9	274.4			3.1	15.7
1020	116.8	273.6			3.1	15.7
1025	118.3	273.4			3.1	15.7
1030	113.1	279.0			3.1	15.7
1035	114.6	275.6			3.1	15.7
1040	118.6	271.8			3.1	15.7
1045	112.8	278.9			3.1	15.7
1050	112.2	277.1			3.1	15.7
1055	111.8	277.5			3.1	15.7
1100	113.6	276.6			3.1	15.7
					3.09	
Average	114.3	276.4				15.7
Corrected Average	117.2	282.3			3.15	15.86

Run #1 Start Time 1000

Time	O2 %	NOx ppm	CO ppm	THC ppm	SO2 ppm	CO2 %
1005	15.7	109.4	282.9			3.1
1010	15.7	114	276.4			3
1015	15.7	116.9	274.4			3.1
1020	15.7	116.8	273.6			3.1
1025	15.7	118.3	273.4			3.1
1030	15.7	113.1	279			3.1
1035	15.7	114.6	275.6			3.1
1040	15.7	118.6	271.8			3.1
1045	15.7	112.8	278.9			3.1
1050	15.7	112.2	277.1			3.1
1055	15.7	111.8	277.5			3.1
1100	15.7	113.6	276.6			3.1
Average	15.70	114.34	276.43	#DIV/0!	#DIV/0!	3.09
Corrected Average	15.76	117.18	282.27	#DIV/0!	#DIV/0!	3.15

MONITOR SAMPLING RECORD

Galson CORPORATION

Comments:

Plant I.D. CNG Lebanon

Source Engine 6

Date 3/24/93

Project No. GE282

Operator Clapsaddle

Run No. 2

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
1230	–	–	NA	NA	–	–
1235	121.7	266.2			3.1	15.6
1240	124.9	265.1			3.1	15.6
1245	119.8	271.1			3.1	15.6
1250	124.6	266.9			3.1	15.6
1255	127.4	263.5			3.1	15.6
1300	129.6	262.9			3.1	15.6
1305	131.4	260.1			3.1	15.6
1310	128.9	264.3			3.1	15.6
1315	131.4	260.6			3.1	15.6
1320	125.9	266.4			3.1	15.6
1325	120.8	267.7			3.1	15.6
1330	108.3	282.1			3.1	15.7
Average	124.6	266.4			3.1	15.6
Corrected Average	127.2	270.9			3.1	15.6

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Run #2 Start Time 1230

Time	O2 %	NOx ppm	CO ppm	THC ppm	SO2 ppm	CO2 %
1235	15.6	121.7	266.2			3.1
1240	15.6	124.9	265.1			3.1
1245	15.6	119.8	271.1			3.1
1250	15.6	124.6	266.9			3.1
1255	15.6	127.4	263.5			3.1
1300	15.6	129.6	262.9			3.1
1305	15.6	131.3	260.1			3.1
1310	15.6	128.9	264.3			3.1
1315	15.6	131.4	260.6			3.1
1320	15.6	125.9	266.4			3.1
1325	15.6	120.8	267.7			3.1
1330	15.6	108.3	282.1			3.1
Average	15.60	124.55	266.41	#DIV/0!	#DIV/0!	3.10
Corrected Average	15.60	127.18	270.89	#DIV/0!	#DIV/0!	3.14

MONITOR SAMPLING RECORD

Galson CORPORATION

Comments:

Plant I.D. CNG Lebanon
Source Engine 6
Date 3/24/93

Project No. GE282
Operator RSA / CAC

Run No. 3

Clock Time	NO_x (ppm)	CO (ppm)	SO_2 (ppm)	THC (ppm)	CO_2 (%)	O_2 (%)
1345	—	—	NA	NA	—	—
1350	106.4	283.2			3.1	15.7
1355	106.5	283.0			3.1	15.7
1400	108.6	285.0			3.1	15.7
1405	111.9	278.0			3.1	15.7
1410	116.6	276.9			3.1	15.7
1415	107.9	284.8			3.1	15.7
1420	110.9	282.5			3.1	15.7
1425	110.9	280.7			3.1	15.7
1430	112.9	282.3			3.1	15.7
1435	107.6	284.2			3.1	15.7
1440	109.1	285.2			3.1	15.7
1445	113.9	279.3			3.1	15.6
Average	110.3	282.2			3.1	15.7
Corrected Average	112.8	286.9			3.1	15.7

Run #3	Start Time	1345				
Time	O2 %	NOx ppm	CO ppm	THC ppm	SO2 ppm	CO2 %
1350	15.7	106.4	283.2			3.1
1355	15.7	106.5	283			3.1
1400	15.7	108.6	285			3.1
1405	15.7	111.9	279			3.1
1410	15.7	116.6	276.9			3.1
1415	15.7	107.9	284.8			3.1
1420	15.7	110.9	282.5			3.1
1425	15.7	110.9	280.7			3.1
1430	15.7	112.9	282.3			3.1
1435	15.7	107.6	284.2			3.1
1440	15.7	109.1	285.2			3.1
1445	15.6	113.9	279.3			3.1
Average	15.7	110.3	282.2	#DIV/0!	#DIV/0!	3.1
Corrected Average	15.7	112.8	286.9	#DIV/0!	#DIV/0!	3.1

Run #	Observed Average (ppm)	Average Zero System Bias (ppm)	Average Span System Bias (ppm)	Certified Span Gas (ppm)	Span Bias Correction Factor	Corrected Value (ppm)
O2 - 1	15.7	0	13.75	13.8	1.0036364	15.75709
O2 - 2	15.6	0	13.8	13.8	1	15.6
O2 - 3	15.69167	0	13.8	13.8	1	15.69167
NOx - 1	114.3417	0.875	134.5	138	1.0327409	117.1817
NOx - 2	124.55	1.75	135	138	1.0356473	127.1775
NOx - 3	110.2667	1.75	134.5	138	1.039548	112.8083
CO - 1	276.4333	0	118.5	121	1.021097	282.2653
CO - 2	266.4083	0	119	121	1.0168067	270.8858
CO - 3	282.175	0	119	121	1.0168067	286.9174
THC - 1	#DIV/0!	0.1	18.05	0	0	#DIV/0!
THC - 2	#DIV/0!	0.05	9	0	0	#DIV/0!
THC - 3	#DIV/0!	0	11.05	0	0	#DIV/0!
SO2 - 1	#DIV/0!	1.5	423	0	0	#DIV/0!
SO2 - 2	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
SO2 - 3	#DIV/0!	0	0	0	#DIV/0!	#DIV/0!
CO2 - 1	3.091667	0	11.2	11.4	1.0178571	3.146875
CO2 - 2	3.1	0	11.25	11.4	1.0133333	3.141333
CO2 - 3	3.1	0	11.25	11.4	1.0133333	3.141333

18909 dscfm
6.7% H_2O

Galson CORPORATION

SAMPLE COLLECTION DATA

Start Time 10:05
Stop Time 10:35
Impinger Outlet # 24
Thermocouple # ~~25~~ 52
Pitot ID P-64
Pitot Leak Check
Static Pressure -.45

Plant LNG-Lebanon
Location
Date 3/24/93
Run Number #1 Eng 6
Operator EM
Oven Box ID —
Meter Box ID 010
Probe ID —
Filter # —

Meter γ 1.614
Meter ΔH@ 1.76
Pitot C.F. .84
Assumed Moisture %
Nozzle Diameter in.
C Factor
Ambient Temperature 55
Barometric Pressure 29.76
Silica Gel #

System Leak Checks:
Pre: 00 cfm @ 10 "Hg
Mid: cfm @ "Hg
Post: 00 cfm @ 10 "Hg

Water Collected:
Impingers, ml. 26
Silica Gel, gms. 6.4

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A1	5	498	.45	2.0	IV 865.995	58	57	—	—	55	—	3
2	10	499	.75	2.0	868.8	61	58	↓	↓	54	↓	3
3	15	503	.80	2.0	872.7	66	60	↓	↓	59	↓	3
4	20	504	.90	2.0	876.6	71	62	↓	↓	63	↓	3
5	25	505	1.0	2.0	880.1	75	64	↓	↓	65	↓	3
6	30	504	.80	2.0	~~887.8~~	76	66	↓	↓	66	↓	3
7		502	.65		FV 888.120							
8		499	.50									
B1		497	.50									
2		498	.65									
3		498	.70									
4		502	.80									
5		505	.90									
6		504	.75									
7		499	.70									
8		498	.55									
Averages												

000115

		Plant	CNG Lebanon	Meter Gamma	1.014		
Start Time	1005	Location	Engine 6 Exhaust			Traverse Point	
Stop Time	1035	Date	3/24/93	Pitot C.F.	0.84	P wake	
Sample Duration, min.	30	Run #	M4-1			P static	-0.45
Impinger Outlet #	24	Operator	EM			Stack ID, in.	42
Thermocouple #	52	Oven Box ID				Rect., width, in.	
Pitot Tube ID	p-64	Meter Box ID	O10	Ambient Temperature	55	Rect., length, in.	
Dry Gas Meter Sample Volume	22.125	Probe ID		Barometric Pressure	29.76	Stk Area, sq.ft.	9.62
				Silica Gel #		Impingers, ml	28
Leak Check Rates initial	0 cfm @		cfm @	final	0 cfm @	Silica Gel,grams	6.4
	10 in. Hg.		in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	498	0.45	2.00	865.995	58	57			55		3		0.6708
2	10	499	0.75	2.00		61	58			54		3		0.8660
3	15	503	0.80	2.00		66	60			59		3		0.8944
4	20	504	0.90	2.00		71	62			63		3		0.9487
5	25	505	1.00	2.00		75	64			65		3		1.0000
6	30	504	0.80	2.00	888.12	76	66			66		3		0.8944
7		502	0.65											0.8062
8		499	0.50											0.7071
B1		497	0.50											0.7071
2		498	0.65											0.8062
3		498	0.70											0.8367
4		502	0.80											0.8944
5		505	0.90											0.9487
6		504	0.75											0.8660
7		499	0.70											0.8367
8		498	0.55											0.7416

000116

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/24/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-1	3.1	18.8	15.7	18.8	0.0	1.677
	3.1	18.8	15.7	18.8	0.0	1.677
	3.1	18.8	15.7	18.8	0.0	1.677
Average	3.1		15.7		0.0	1.68

000117

Start Time	1005	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	1035	Location	Engine 6 Exhaust			Traverse Point	0
Sample Duration, min.	30	Date	3/24/93	Pitot C.F.	0.84	P wake	0
Impinger Outlet #	24	Run #	M4-1			P static	-0.45
Thermocouple #	52	Operator	EM			Stack ID, in.	42
Pitot Tube ID	p-64	Oven Box ID	0			Rect., width, in.	0
Dry Gas Meter Sample Volume	22.125	Meter Box ID	O10	Ambient Temperature	55	Rect., length, in.	0
		Probe ID	0	Barometric Pressure	29.76	Stk Area, sq.ft.	9.62
Leak Check Rates	initial			Silica Gel #	0	Impingers, ml	28
	0 cfm @		0 cfm @	final	0 cfm @	Silica Gel,grams	6.4
	10 in. Hg.		0 in. Hg.		10 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	500.9		2.00	22.125	67.8	61.2	#DIV/0!	#DIV/0!	60.3	#DIV/0!	3.0		0.8391
						avg.Tm (F)	64.5							
max. value recorded		505	1.00	2.00		76	66	0	0	66	0	3		
min. value recorded		497	0.45	2.00		58	57	0	0	54	0	3		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	1.619 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	22.575 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.067
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	273.67 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.38
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	64.3 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	37122 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	18909 dscfm

000118

19405 dscfm
4.1 % H_2O

Galson CORPORATION

SAMPLE COLLECTION DATA

Start Time 12:35
Stop Time 13:05
Impinger Outlet #
Thermocouple # 52
Pitot ID P-64
Pitot Leak Check
Static Pressure -.60

Plant CNG-Lebanon
Location
Date 3/24/93
Run Number # 2 Eng 6
Operator EM
Oven Box ID —
Meter Box ID 010
Probe ID —
Filter # —

Meter γ 1.014
Meter ΔH@ 1.76
Pitot C.F. -.84
Assumed Moisture %
Nozzle Diameter in.
C Factor
Ambient Temperature 58
Barometric Pressure 29.76
Silica Gel #

System Leak Checks:
Pre: 00 cfm @ 10 "Hg
Mid: — cfm @ — "Hg
Post: 00 cfm @ 12 "Hg

Water Collected:
Impingers, ml. 16
Silica Gel, gms. 5.0

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A 1	5	502	.50	—	FV 912.031	72	71	—	—	58	—	2
2	10	504	.60		916.0	73	72			55		2
3	15	506	.75		919.8	75	72			58		2
4	20	505	.90		923.7	80	74			64		2
5	25	506	1.0		927.4	83	75			67		2
6	30	505	.8		935.405	88	79			69		2
7		503	.75									
8		500	.45									
B 1		502	.45									
2		503	.70									
3		505	.75									
4		507	.85									
5		506	1.0									
6		505	.80									
7		502	.75									
8		501	.50									
Averages												

000119

		Plant	CNG Lebanon	Meter Gamma	1.014		
Start Time	1235	Location	Engine 6 Exhaust			Traverse Point	
Stop Time	1305	Date	3/24/93	Pitot C.F.	0.84	P wake	
Sample Duration, min.	30	Run #	M4-2			P static	-0.6
Impinger Outlet #	24	Operator	EM			Stack ID, in.	42
Thermocouple #	52	Oven Box ID				Rect., width, in.	
Pitot Tube ID	P-64	Meter Box ID	O10	Ambient Temperature	58	Rect., length, in.	
Dry Gas Meter Sample Volume	23.374	Probe ID		Barometric Pressure	29.76	Stk Area, sq.ft.	9.62
				Silica Gel #		Impingers, ml	16
Leak Check Rates initial	0 cfm @		cfm @	final	0 cfm @	Silica Gel,grams	5
	10 in. Hg.		in. Hg.		12 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	502	0.50	2.00	912.031	72	71			58		2		0.7071
2	10	504	0.60	2.00		73	72			55		2		0.7746
3	15	506	0.75	2.00		75	72			58		2		0.8660
4	20	505	0.90	2.00		80	74			64		2		0.9487
5	25	506	1.00	2.00		83	75			67		2		1.0000
6	30	505	0.80	2.00	935.405	88	79			69		2		0.8944
7		503	0.75											0.8660
8		500	0.45											0.6708
B1		502	0.45											0.6708
2		503	0.70											0.8367
3		505	0.75											0.8660
4		507	0.85											0.9220
5		506	1.00											1.0000
6		505	0.80											0.8944
7		502	0.75											0.8660
8		501	0.50											0.7071

000120

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/24/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-2	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
	3.1	18.7	15.6	18.7	0.0	1.710
Average	3.1		15.6		0.0	1.71

000121

Start Time	1235	Plant	CNG Lebanon	Meter Gamma	1.014		
Stop Time	1305	Location	Engine 6 Exhaust			Traverse Point	0
Sample Duration, min.	30	Date	3/24/93	Pitot C.F.	0.84	P wake	0
Impinger Outlet #	24	Run #	M4-2			P static	-0.6
Thermocouple #	52	Operator	EM			Stack ID, in.	42
Pitot Tube ID	P-64	Oven Box ID	0			Rect., width, in.	0
Dry Gas Meter Sample Volume	23.374	Meter Box ID	O10	Ambient Temperature	58	Rect., length, in.	0
		Probe ID	0	Barometric Pressure	29.76	Stk Area, sq.ft.	9.62
Leak Check Rates	initial			Silica Gel #	0	Impingers, ml	16
	0 cfm @		0 cfm @	final	0 cfm @	Silica Gel,grams	5
	10 in. Hg.		0 in. Hg.		12 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	503.9		2.00	23.374	78.5	73.8	#DIV/0!	#DIV/0!	61.8	#DIV/0!	2.0		0.8432
						avg.Tm (F)	76.2							
max. value recorded		507	1.00	2.00		88	79	0	0	69	0	2		
min. value recorded		500	0.45	2.00		72	71	0	0	55	0	2		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	0.988 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	23.330 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.041
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	266.07 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.67
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	64.4 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	37178 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	19405 dscfm

001122

19394 dscfm
6.5 % H_2O

SAMPLE COLLECTION DATA

Galson CORPORATION

Start Time 14:00
Stop Time 14:30
Impinger Outlet #
Thermocouple # 52
Pitot ID P-64
Pitot Leak Check
Static Pressure -.45

Plant CNG Lebanon
Location
Date 3/24/93
Run Number #3 Eng 6
Operator EM
Oven Box ID —
Meter Box ID 020
Probe ID —
Filter # —

Meter γ 1.014
Meter ΔH@ 1.76
Pitot C.F. .84
Assumed Moisture %
Nozzle Diameter in.
C Factor
Ambient Temperature 64
Barometric Pressure 29.81
Silica Gel #

System Leak Checks:
Pre: 00 cfm @ 10 "Hg
Mid: cfm @ "Hg
Post: 00 cfm @ 12 "Hg

Water Collected:
Impingers, ml. 30
Silica Gel, gms. 4.4

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) °F	Stack ΔP in. H2O	Orifice ΔH in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. T in °F	Dry Gas Meter Temp. T out °F	Sample Box Temp. °F	Probe Temp. °F	Impinger Outlet °F	Temp. °F	Pump Vac. in Hg.
A1	5	498	.50	—	936.013	71	71	—	—	60	—	1
2	10	498	.70	↓	940.0	73	72	↓	↓	52	↓	1
3	15	500	.80	↓	943.9	76	73	↓	↓	54	↓	1
4	20	501	.95	↓	947.7	80	75	↓	↓	56	↓	1
5	25	500	.95	↓	951.5	82	77	↓	↓	57	↓	1
6	30	500	.85	↓	955.270	85	79	↓	↓	58	↓	1
7		497	.70									
8		496	.50									
B1		498	.60									
2		500	.65									
3		500	.75									
4		501	.90									
5		502	.95									
6		500	.85									
7		498	.70									
8		495	.55									
Averages												

0001123

		Plant	CNG Lebanon	Meter Gamma	1.014		
Start Time	1400	Location	Engine 6 Exhaust			Traverse Point	
Stop Time	1430	Date	3/24/93	Pitot C.F.	0.84	P wake	
Sample Duration, min.	30	Run #	M4-3			P static	-0.45
Impinger Outlet #	24	Operator	EM			Stack ID, in.	42
Thermocouple #	52	Oven Box ID				Rect., width, in.	
Pitot Tube ID	P-64	Meter Box ID	O10	Ambient Temperature	64	Rect., length, in.	
Dry Gas Meter Sample Volume	23.257	Probe ID		Barometric Pressure	29.81	Stk Area, sq.ft.	9.62
				Silica Gel #		Impingers, ml	30
Leak Check Rates initial	0 cfm @		cfm @	final	0 cfm @	Silica Gel,grams	4.4
	10 in. Hg.		in. Hg.		12 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
A1	5	498	0.50	2.00	936.013	71	71			60		1		0.7071
2	10	498	0.70	2.00		73	72			52		1		0.8367
3	15	500	0.80	2.00		76	73			54		1		0.8944
4	20	500	0.95	2.00		80	75			56		1		0.9747
5	25	501	0.95	2.00		82	77			57		1		0.9747
6	30	500	0.85	2.00	959.27	85	79			58		1		0.9220
7		500	0.70											0.8367
8		497	0.50											0.7071
B1		498	0.60											0.7746
2		500	0.65											0.8062
3		500	0.75											0.8660
4		501	0.90											0.9487
5		502	0.95											0.9747
6		500	0.85											0.9220
7		498	0.70											0.8367
8		495	0.55											0.7416

0001124

FLUE GAS ANALYSIS FIELD DATA

Plant I.D. CNG Lebanon

Date 3/24/93

Leak Check

Pre-Test		Post-Test
	CO2 pipette	
	O2 pipette	
	CO pipette	
	burette	

Gas ID	Run #	CO2	CO2+O2	O2
	1			0.0
	2			0.0
	3			0.0

Sample Bag I.D.	CO2%	CO2+O2%	O2%	CO2+O2+CO	CO%	Fo
M4-3	3.1	18.8	15.7	18.8	0.0	1.677
	3.1	18.8	15.7	18.8	0.0	1.677
	3.1	18.8	15.7	18.8	0.0	1.677
Average	3.1		15.7		0.0	1.68

000125

		Plant	CNG Lebanon	Meter Gamma	1.014		
Start Time	1400	Location	Engine 6 Exhaust			Traverse Point	0
Stop Time	1430	Date	3/24/93	Pitot C.F.	0.84	P wake	0
Sample Duration, min.	30	Run #	M4-3			P static	-0.45
Impinger Outlet #	24	Operator	EM			Stack ID, in.	42
Thermocouple #	52	Oven Box ID	0			Rect., width, in.	0
Pitot Tube ID	P-64	Meter Box ID	O10	Ambient Temperature	64	Rect., length, in.	0
Dry Gas Meter Sample Volume	23.257	Probe ID	0	Barometric Pressure	29.81	Stk Area, sq.ft.	9.62
				Silica Gel #	0	Impingers, ml	30
Leak Check Rates initial	0 cfm @		0 cfm @	final	0 cfm @	Silica Gel,grams	4.4
	10 in. Hg.		0 in. Hg.		12 in. Hg.		

Traverse Point Number	Sampling Time min.	Stack Temp. (Ts) deg.F	Stack delta P in. H2O	Orifice delta H in. H2O	Meter Reading (Vm) ft3	Dry Gas Meter Temp. Tm in	Dry Gas Meter Temp. Tm out	Sample Box Temp deg. F	Probe Temp. deg. F	Impinger Outlet deg. F	Temp. deg. F	Pump Vac. in Hg.		AVG SQ. RT. DELTA P's
AVERAGE	30	499.3		2.00	23.257	77.8	74.5	#DIV/0!	#DIV/0!	56.2	#DIV/0!	1.0		0.8577
						avg.Tm (F)	76.2							
max. value recorded		502	0.95	2.00		85	79	0	0	60	0	1		
min. value recorded		495	0.50	2.00		71	71	0	0	52	0	1		

Vw(std) = volume of water vapor in gas, standard conditions = 0.04707 x Vic	=	1.619 scf
Vm (std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)	=	23.252 scf
Bws = water vapor in gas stream, proportion by volume =Vw(std) / (Vm(std) + Vw(std))	=	0.065
% EA = excess air = (%O2 - 0.5%CO) / (0.264%N2 - (%O2 - 0.5%CO)) x 100	=	273.67 %
Md = molecular weight of stack gas, dry basis =(.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO)]	=	29.12
Ms =molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)	=	28.40
vs = stack gas velocity =85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]	=	65.6 ft/sec
Qs = stack gas flow rate = vs x As x 60	=	37869 acfm
Qs(std) =stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)	=	19394 dscfm

000126

Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF METHANE &

TOTAL GASEOUS NON-METHANE ORGANICS (TGNMO) ANALYSIS

Client: Galson Corporation

Client Project ID: #GE282
PAI Project ID: #5074

Test Code: (FID/TCA)/SCAQMD Method 25.2
Instrument ID: HP 5890A/FID #1
Analyst: Sharon Smithbauer
Verified By: Michael Tuday

Matrix: Summa Canisters
Date Received: 03/29/93
Date Analyzed: 04/02/93 & 04/05/93

Client Sample ID	PAI Sample ID	D.F.	Methane Concentration in ppm, v/v	Total Non-Methane Organics (as Methane) Concentration in ppmc, v/v
Run 1 Engine 5 (03/23/93)	9301031	1.11	1100	71
Run 2 Engine 5 (03/23/93)	9301032	1.15	1200	76
Run 3 Engine 5 (03/23/93)	9301033	1.14	1200	71
Run 1 Engine 6 (03/24/93)	9301034	1.09	1200	77
Run 2 Engine 6 (03/24/93)	9301035	1.11	1300	81
Run 3 Engine 6 (03/24/93)	9301036	1.14	1300	80
N/A (04/02/93)	Method Blank	1.00	ND < 0.50	ND < 1.0
N/A (04/05/93)	Method Blank	1.00	ND < 0.50	ND < 1.0

ND = Not Detected - Less Than Indicated Detection Limit

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