Report of a...

VOC Emission Test

Performed for...

Shannon Precision Fastener

Auburn Hills, Michigan

On the...

Quench Exhaust

July 30, 2015

305.01

Network Environmental, Inc.
Grand Rapids, MI

Performed For:

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Performed at:

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Performed by:

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I. INTRODUCTION

Network Environmental, Inc. was retained by Shannon Precision Fastener to perform an emission study at their facility in Auburn Hills, Michigan. The purpose of the study was to quantify VOC emissions from the Quench exhaust of the Heat Treating Line.

The following reference test methods were employed to conduct the sampling:

- VOC – U.S. EPA Method 25A
- Exhaust Gas Parameters – U.S. EPA Methods 1 through 4

The sampling was performed on July 30, 2015 by Stephan K. Byrd and Richard D. Eerdmans of Network Environmental, Inc. Assisting with the study was Mr. Phil Menzies of Shannon Precision Fastener. Mr. Tom Maza and Mr. Francisco Lim of the Michigan Department of Environmental Quality (MDEQ) – Air Quality Division were present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
VOC EMISSION RESULTS SUMMARY (as propane)
QUENCH EXHAUST
SHANNON PRECISION FASTENER
AUBURN HILLS, MICHIGAN
JULY 30, 2015

Source	Date	Time	Concentration	Mass Emission Rate
			PPM[1]	Lbs/Hr[2]
Quench	7/30/15	10:26-11:26	12.2	0.283
	7/30/15	11:37-12:37	11.6	0.271
	7/30/15	12:51-13:51	13.7	0.321
Average			**12.5**	**0.292**

(1) PPM = Parts per million by volume on a wet basis as propane
(2) Lbs/Hr = Pounds of VOC per hour as propane

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Table 1 (Section II.1). The results are presented as follows:

III.1 VOC Emission Results (Table 1)

Table 1 summarizes the VOC emission results as follows:

- Source
- Date
- Time
- Concentration (PPM) – Parts per million on a wet basis as propane
- Mass Emission Rate (Lbs/Hr) – Pounds of VOC Per hour as propane

IV. SOURCE DESCRIPTION

The source tested was a heat treating production line. The heat treating line consists of a natural gas fired hardening furnace, endothermic generator, tempering furnace, pre and post wash stations an internal oil quench and a post temper water and oil emulsion tank. The furnace is continuous belt and is rated at 6000 pounds per hour. The exhaust of the quench was tested. The parts treated during each test represented maximum normal production. Source operation information can be found in Appendix C.

V. SAMPLING AND ANALYTICAL PROTOCOL

V.1 VOC – The VOC testing was conducted in accordance with U.S. EPA Method 25A. The sample gas was extracted from the source through a heated Teflon sample line, which led to a J.U.M Model 3-500 portable flame ionization detector (FID). This analyzer produces instantaneous readouts of the total hydrocarbon concentrations (PPM). Three sixty minute samples were collected from the exhaust of the quench. The analyzer was operated on the 0-100 PPM scale. Prior to performing the three one hour test runs, fifteen minute preliminary test runs were collected from the Quench and Flare exhausts to determine which exhaust had the higher emission rate.

A systems (from the back of the stack probe to the analyzer) calibration was conducted for the analyzers prior to the testing. A span gas of 85.78 PPM propane was used to establish the initial instrument

calibration for the analyzer. Propane calibration gases of 50.19 PPM and 29.17 PPM were used to determine the calibration error of the analyzers. After each sample (60 minute sample period), a system zero and system injection of 29.17 PPM propane were performed to establish system drift of analyzer during the test period. All calibration gases used were EPA Protocol 1 Certified. All the results were calibration corrected using Equation 7E-1 from U.S. EPA Method 7E.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from heat treat line exhausts. All quality assurance and quality control requirements specified in the method were incorporated in the performance of this determination. A diagram of the sampling train is shown in Figure 1.

V.2 Exhaust Gas Parameters – The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4. One velocity traverse was performed for each sample period. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

This report was prepared by:

Stephan K. Byrd
Project Manager

This report was reviewed by:

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Vice President

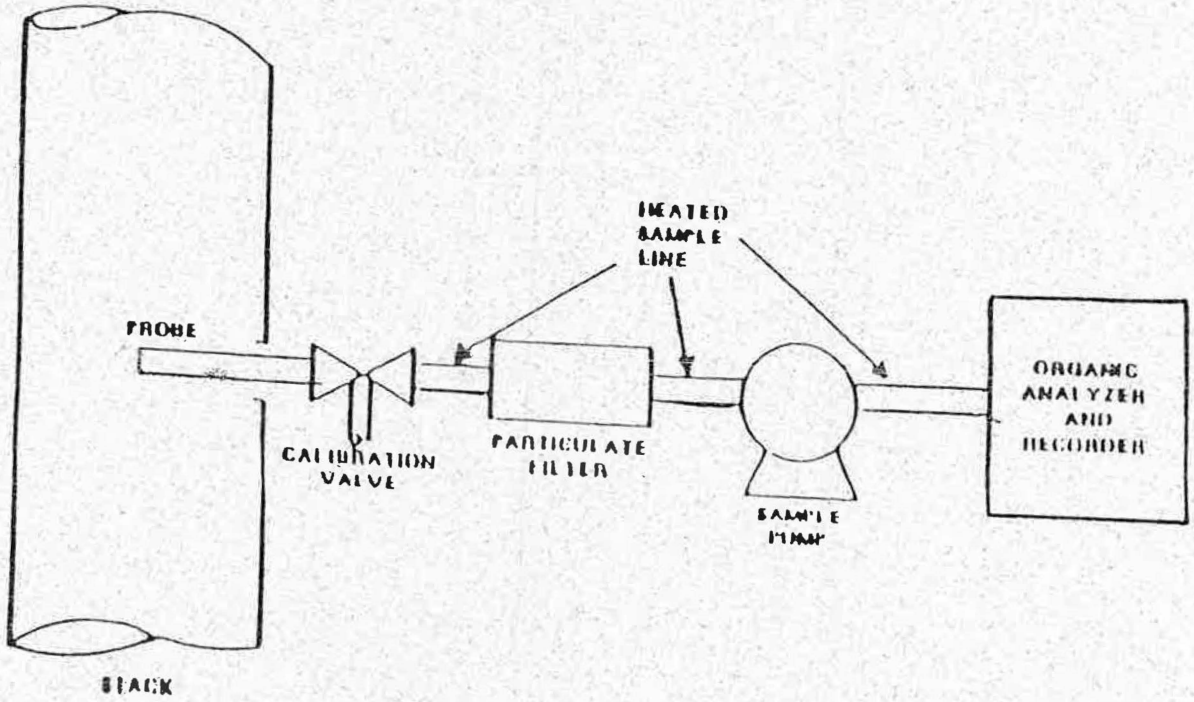

Figure 1

VOC Sampling Train

APPENDIX A

EXHAUST GAS PARAMETERS

SOURCE: Shannon Precision Fastener
Quench

VELOCITY TRAVERSE

Run 1
7/30/2015

STACK DIAMETER (INCHES) = 12

AREA (SQ.FT) = 0.785398163

BAR. PRESS. (IN HG) = 28.7

AVG TEMP (DEG.F) = 102

PITOT (CP) = 0.99

STATIC (IN H20) = 0.12

% MOISTURE = 1.23

%O2 = 20.9

%CO2 = 0

%CO = 0

%N2 = 79.1

PORT:	1	
POINT	V.PRESS	TEMP
1	1.10	102
2	1.20	103
3	1.25	103
4	1.35	102
5	1.40	100
6	1.45	101
7	1.40	100
8	1.28	102

PORT:	2	
POINT	V.PRESS	TEMP
1	1.20	100
2	1.30	101
3	1.30	100
4	1.30	105
5	1.45	103
6	1.53	101
7	1.50	101
8	1.30	102

AVG SQRT VEL PRESS = 1.15301

% EXCESS AIR = -118750.000

DENSITY, DRY, @STP (LBS/CU.FT) = 0.07455

DENSITY, WET, @STP (LBS/CU.FT) = 0.07421

DENSITY, WET, @STACK COND (LBS/CU.FT) = 0.06695

MOLECULAR WEIGHT, DRY (LBS/MOLE) = 28.8444

AVG. GAS VELOCITY (FPM) = 4835.14

ACFM = 3797.51

SCFM = 3426.01

SCFH = 205,561

DSCFM = 3383.87

SOURCE: Shannon Precision Fastener
Quench

VELOCITY TRAVERSE

Run 1
7/30/2015
10:36-10:46

STACK DIAMETER (INCHES) = 12

AREA (SQ.FT) = 0.785398163

BAR. PRESS. (IN HG) = 28.7

AVG TEMP (DEG.F) = 101

PITOT (CP) = 0.99

STATIC (IN H20) = 0.16

% MOISTURE = 1.23

%O2 = 20.9

%CO2 = 0

%CO = 0

%N2 = 79.1

PORT:	1	
POINT	V.PRESS	TEMP
1	1.05	98
2	1.15	99
3	1.20	100
4	1.42	101
5	1.33	100
6	1.35	102
7	1.28	102
8	1.30	103

PORT:	2	
POINT	V.PRESS	TEMP
1	1.30	101
2	1.25	101
3	1.27	101
4	1.30	103
5	1.55	102
6	1.50	101
7	1.45	102
8	1.38	103

AVG SQRT VEL PRESS = 1.14655

% EXCESS AIR = -118750.000

DENSITY, DRY, @STP (LBS/CU.FT) = 0.07455

DENSITY, WET, @STP (LBS/CU.FT) = 0.07421

DENSITY, WET, @STACK COND (LBS/CU.FT) = 0.06700

MOLECULAR WEIGHT, DRY (LBS/MOLE) = 28.8444

AVG. GAS VELOCITY (FPM) = 4806.21

ACFM = 3774.79

SCFM = 3408.13

SCFH = 204,488

DSCFM = 3366.21

SOURCE: Shannon Precision Fastener
Flare

VELOCITY TRAVERSE

Run 1
7/30/2015
10:50-10:56

STACK DIAMETER (INCHES) = 12

AREA (SQ.FT) = 0.785398163

BAR. PRESS. (IN HG) = 28.7

AVG TEMP (DEG.F) = 425

PITOT (CP) = 0.99

STATIC (IN H20) = -0.03

% MOISTURE = 1.23

%O2 = 20.9

%CO2 = 0

%CO = 0

%N2 = 79.1

SCFH= 34,227

PORT:	1			PORT:	2	
POINT	V.PRESS	TEMP		POINT	V.PRESS	TEMP
1	0.06	422		1	0.06	425
2	0.07	424		2	0.07	427
3	0.07	427		3	0.06	426
4	0.04	425		4	0.04	424
5	0.06	422		5	0.06	425
6	0.07	424		6	0.07	427
7	0.07	427		7	0.06	426
8	0.04	425		8	0.04	424

AVG SQRT VEL PRESS = 0.24107

% EXCESS AIR = -118750.000

DENSITY, DRY, @STP (LBS/CU.FT) = 0.07455

DENSITY, WET, @STP (LBS/CU.FT) = 0.07421

DENSITY, WET, @STACK COND (LBS/CU.FT) = 0.04246

MOLECULAR WEIGHT, DRY (LBS/MOLE) = 28.8444

AVG. GAS VELOCITY (FPM) = 1269.43

ACFM = 997.01

SCFM = 570.45 **SCFH = 34,227**

DSCFM = 563.43

APPENDIX B

DAS OUTPUT DATA

Company:	Shannon Precision Fastener
Location:	Auburn Hills, Michigan
Source:	Quench
Date:	07/30/15

Channel:	1	2	3	4	5	6	7	8	9	10
Compound:	THC									
Units:	PPM									

Summary Table

Sample	THC PPM									
1	12.8									
2	12.8									
3	15.1									

Shannon Precision Fastener
Auburn Hills, Michigan
Quench
Sample # 1
Start Time 10:26:30
Date 07/30/15

Date	Time	THC PPM
07/30/15	10:26:30	12.8
07/30/15	10:27:30	24.9
07/30/15	10:28:30	23.7
07/30/15	10:29:30	22.2
07/30/15	10:30:30	11.0
07/30/15	10:31:30	11.8
07/30/15	10:32:30	12.4
07/30/15	10:33:30	8.2
07/30/15	10:34:30	11.8
07/30/15	10:35:30	11.1
07/30/15	10:36:30	10.2
07/30/15	10:37:30	8.1
07/30/15	10:38:30	10.4
07/30/15	10:39:30	10.5
07/30/15	10:40:30	12.1
07/30/15	10:41:30	11.7
07/30/15	10:42:30	11.7
07/30/15	10:43:30	8.9
07/30/15	10:44:30	14.6
07/30/15	10:45:30	15.4
07/30/15	10:46:30	12.7
07/30/15	10:47:30	6.7
07/30/15	10:48:30	14.3
07/30/15	10:49:30	15.2
07/30/15	10:50:30	8.7
07/30/15	10:51:30	10.6
07/30/15	10:52:30	9.9
07/30/15	10:53:30	15.8
07/30/15	10:54:30	14.5
07/30/15	10:55:30	10.4
07/30/15	10:56:30	13.0
07/30/15	10:57:30	11.5
07/30/15	10:58:30	11.3
07/30/15	10:59:30	12.5
07/30/15	11:00:30	13.2
07/30/15	11:01:30	12.4
07/30/15	11:02:30	8.5
07/30/15	11:03:30	8.6
07/30/15	11:04:30	13.2
07/30/15	11:05:30	11.7
07/30/15	11:06:30	10.8
07/30/15	11:07:30	11.4
07/30/15	11:08:30	11.9
07/30/15	11:09:30	14.5
07/30/15	11:10:30	14.3
07/30/15	11:11:30	13.6
07/30/15	11:12:30	13.4
07/30/15	11:13:30	13.9
07/30/15	11:14:30	11.8
07/30/15	11:15:30	13.3
07/30/15	11:16:30	8.7
07/30/15	11:17:30	13.9
07/30/15	11:18:30	7.5
07/30/15	11:19:30	14.9
07/30/15	11:20:30	17.5
07/30/15	11:21:30	13.6
07/30/15	11:22:30	21.4
07/30/15	11:23:30	20.2
07/30/15	11:24:30	8.9
07/30/15	11:25:30	16.6

Sample 1 Average 12.8

Shannon Precision Fastener
Auburn Hills, Michigan
Quench
Sample # 2
Start Time 11:37:20
Date 07/30/15

Date	Time	THC PPM
07/30/15	11:37:20	15.0
07/30/15	11:38:20	14.2
07/30/15	11:39:20	7.5
07/30/15	11:40:20	10.6
07/30/15	11:41:20	12.6
07/30/15	11:42:20	13.2
07/30/15	11:43:20	12.3
07/30/15	11:44:20	12.2
07/30/15	11:45:20	12.2
07/30/15	11:46:20	12.0
07/30/15	11:47:20	12.3
07/30/15	11:48:20	12.2
07/30/15	11:49:20	12.5
07/30/15	11:50:20	11.4
07/30/15	11:51:20	14.0
07/30/15	11:52:20	12.7
07/30/15	11:53:20	13.0
07/30/15	11:54:20	13.5
07/30/15	11:55:20	12.7
07/30/15	11:56:20	11.6
07/30/15	11:57:20	9.5
07/30/15	11:58:20	7.9
07/30/15	11:59:20	17.7
07/30/15	12:00:20	17.0
07/30/15	12:01:20	15.9
07/30/15	12:02:20	14.3
07/30/15	12:03:20	19.4
07/30/15	12:04:20	15.6
07/30/15	12:05:20	17.1
07/30/15	12:06:20	16.2
07/30/15	12:07:20	9.5
07/30/15	12:08:20	14.8
07/30/15	12:09:20	15.4
07/30/15	12:10:20	15.3
07/30/15	12:11:20	17.6
07/30/15	12:12:20	13.2
07/30/15	12:13:20	9.2
07/30/15	12:14:20	10.7
07/30/15	12:15:20	12.5
07/30/15	12:16:20	13.8
07/30/15	12:17:20	13.6
07/30/15	12:18:20	11.5
07/30/15	12:19:20	8.6
07/30/15	12:20:20	11.9
07/30/15	12:21:20	12.2
07/30/15	12:22:20	12.8
07/30/15	12:23:20	12.5
07/30/15	12:24:20	13.4
07/30/15	12:25:20	13.0
07/30/15	12:26:20	14.5
07/30/15	12:27:20	13.8
07/30/15	12:28:20	13.9
07/30/15	12:29:20	13.6
07/30/15	12:30:20	11.3
07/30/15	12:31:20	9.8
07/30/15	12:32:20	9.7
07/30/15	12:33:20	10.4
07/30/15	12:34:20	7.9
07/30/15	12:35:20	9.1
07/30/15	12:36:20	11.2

Sample 2 Average 12.8

Shannon Precision Fastener
Auburn Hills, Michigan
Quench
Sample # 3
Start Time 12:51:21
Date 07/30/15

Date	Time	THC PPM
07/30/15	12:51:21	18.3
07/30/15	12:52:21	17.9
07/30/15	12:53:21	21.7
07/30/15	12:54:21	17.5
07/30/15	12:55:21	17.1
07/30/15	12:56:21	18.8
07/30/15	12:57:21	22.0
07/30/15	12:58:21	21.4
07/30/15	12:59:21	11.0
07/30/15	13:00:21	13.9
07/30/15	13:01:21	13.7
07/30/15	13:02:21	10.3
07/30/15	13:03:21	12.6
07/30/15	13:04:21	13.8
07/30/15	13:05:21	13.3
07/30/15	13:06:21	14.5
07/30/15	13:07:21	14.1
07/30/15	13:08:21	15.3
07/30/15	13:09:21	15.7
07/30/15	13:10:21	14.3
07/30/15	13:11:21	12.6
07/30/15	13:12:21	8.8
07/30/15	13:13:21	11.0
07/30/15	13:14:21	9.4
07/30/15	13:15:21	12.9
07/30/15	13:16:21	13.3
07/30/15	13:17:21	13.9
07/30/15	13:18:21	13.5
07/30/15	13:19:21	10.1
07/30/15	13:20:21	23.2
07/30/15	13:21:21	19.9
07/30/15	13:22:21	16.0
07/30/15	13:23:21	26.8
07/30/15	13:24:21	25.2
07/30/15	13:25:21	12.4
07/30/15	13:26:21	11.7
07/30/15	13:27:21	14.1
07/30/15	13:28:21	13.7
07/30/15	13:29:21	15.0
07/30/15	13:30:21	14.4
07/30/15	13:31:21	14.6
07/30/15	13:32:21	14.0
07/30/15	13:33:21	14.1
07/30/15	13:34:21	15.5
07/30/15	13:35:21	13.8
07/30/15	13:36:21	14.8
07/30/15	13:37:21	14.0
07/30/15	13:38:21	10.6
07/30/15	13:39:21	10.3
07/30/15	13:40:21	16.5
07/30/15	13:41:21	22.2
07/30/15	13:42:21	13.2
07/30/15	13:43:21	13.2
07/30/15	13:44:21	12.4
07/30/15	13:45:21	14.6
07/30/15	13:46:21	15.9
07/30/15	13:47:21	11.4
07/30/15	13:48:21	14.4
07/30/15	13:49:21	14.5
07/30/15	13:50:21	21.6

Sample 3 Average 15.1

Company:	Shannon Precision Fastener
Location:	Auburn Hills, Michigan
Source:	Quench & Flare
Date:	07/30/15

Channel:	1	2	3	4	5	6	7	8	9	10
Compound:	THC									
Units:	PPM									

Summary Table

Sample	THC PPM									
1	12.6									
2	13.8									
3										

Shannon Precision Fastener
Auburn Hills, Michigan
Quench & Flare
Sample # 1
Start Time 9:09:33
Date 07/30/15

Date	Time	THC PPM
07/30/15	9:09:33	21.4
07/30/15	9:10:33	15.0
07/30/15	9:11:33	25.6
07/30/15	9:12:33	13.3
07/30/15	9:13:33	11.6
07/30/15	9:14:33	7.3
07/30/15	9:15:33	11.0
07/30/15	9:16:33	10.6
07/30/15	9:17:33	10.8
07/30/15	9:18:33	7.9
07/30/15	9:19:33	10.8
07/30/15	9:20:33	11.4
07/30/15	9:21:33	11.5
07/30/15	9:22:33	9.9
07/30/15	9:23:33	11.3

Sample 1 Average 12.6

Shannon Precision Fastener
Auburn Hills, Michigan
Quench & Flare
Sample # 2
Start Time 9:28:14
Date 07/30/15

Date	Time	THC PPM
07/30/15	9:28:14	8.0
07/30/15	9:29:14	9.7
07/30/15	9:30:14	8.9
07/30/15	9:31:14	8.3
07/30/15	9:32:14	8.6
07/30/15	9:33:14	9.0
07/30/15	9:34:14	7.2
07/30/15	9:35:14	7.7
07/30/15	9:36:14	8.3
07/30/15	9:37:14	8.5
07/30/15	9:38:14	7.1
07/30/15	9:39:14	20.7
07/30/15	9:40:14	25.5
07/30/15	9:41:14	45.4
07/30/15	9:42:14	23.6

Sample 2 Average 13.8

APPENDIX C

PROCESS OPERATION DATA

$Date	$Time	F1_LDR_S_ACTUALJOBWT	Draft Weight lbs	F1_LDR_S_ACTUALEFFICIENCY	F1_LDR_S_FLOWRATE
7/30/2015	9:00:25	4335.2	29.4	99	5200
7/30/2015	9:00:40	4335.2	0	99	5200
7/30/2015	9:00:55	4363.1	27.9	99	5200
7/30/2015	9:01:10	4389.3	26.2	99	5200
7/30/2015	9:01:25	4419.6	30.3	99	5200
7/30/2015	9:01:40	4419.6	0	99	5200
7/30/2015	9:01:55	4449.8	30.2	99	5200
7/30/2015	9:02:10	4477.9	28.1	99	5200
7/30/2015	9:02:25	4504.5	26.6	99	5200
7/30/2015	9:02:40	4504.5	0	99	5200
7/30/2015	9:02:55	4533.4	28.9	99	5200
7/30/2015	9:03:10	4565.3	31.9	99	5200
7/30/2015	9:03:25	4594.4	29.1	99	5200
7/30/2015	9:03:40	4594.4	0	99	5200
7/30/2015	9:03:55	4624.3	29.9	99	5200
7/30/2015	9:04:10	4652.1	27.8	99	5200
7/30/2015	9:04:25	4680.8	28.7	99	5200
7/30/2015	9:04:40	4680.8	0	99	5200
7/30/2015	9:04:55	4710	29.2	99	5200
7/30/2015	9:05:10	4737.5	27.5	99	5200
7/30/2015	9:05:25	4766.5	29	99	5200
7/30/2015	9:05:40	4766.5	0	99	5200
7/30/2015	9:05:55	4792.8	26.3	99	5200
7/30/2015	9:06:10	4822.7	29.9	99	5200
7/30/2015	9:06:25	4850.6	27.9	99	5200
7/30/2015	9:06:40	4850.6	0	99	5200
7/30/2015	9:06:55	4882.6	32	99	5200
7/30/2015	9:07:10	4909.4	26.8	99	5200
7/30/2015	9:07:25	4937.8	28.4	99	5200
7/30/2015	9:07:40	4937.8	0	99	5200
7/30/2015	9:07:55	4968.4	30.6	99	5200
7/30/2015	9:08:10	4999.4	31	99	5200
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7/30/2015	9:08:40	5028.5	0	99	5200

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7/30/2015	9:09:25	5114.7	29.3	99	5200
7/30/2015	9:09:40	5114.7	0	99	5200
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7/30/2015	9:13:25	5457.3	25.4	99	5200
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7/30/2015	9:14:10	5519.2	30.4	99	5200
7/30/2015	9:14:25	5547.9	28.7	99	5200
7/30/2015	9:14:40	5547.9	0	99	5200
7/30/2015	9:14:55	5575.9	28	99	5200
7/30/2015	9:15:10	5605.3	29.4	99	5200
7/30/2015	9:15:25	5635.3	30	99	5200
7/30/2015	9:15:40	5635.3	0	99	5200
7/30/2015	9:15:55	5662.3	27	99	5200
7/30/2015	9:16:10	5687.7	25.4	99	5200
7/30/2015	9:16:25	5719.1	31.4	99	5200
7/30/2015	9:16:40	5719.1	0	99	5200
7/30/2015	9:16:55	5751.1	32	99	5200
7/30/2015	9:17:10	5779.5	28.4	99	5200

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7/30/2015	9:19:10	5950	27.4	99	5200
7/30/2015	9:19:25	5981.799	31.799	99	5200
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7/30/2015	9:20:10	6039.1	28.6	99	5200
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7/30/2015	9:22:10	6213.299	29	99	5200
7/30/2015	9:22:25	6213.299	0	99	5200
7/30/2015	9:22:40	6238.899	25.6	99	5200
7/30/2015	9:22:55	6269.899	31	99	5200
7/30/2015	9:23:10	6298.999	29.1	99	5200
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7/30/2015	9:24:10	6383.999	27.1	99	5200
7/30/2015	9:24:25	6383.999	0	99	5200
7/30/2015	9:24:40	6414.899	30.9	99	5200
7/30/2015	9:24:55	6442.499	27.6	99	5200
7/30/2015	9:25:10	6470.599	28.1	99	5200
7/30/2015	9:25:25	6470.599	0	99	5200
7/30/2015	9:25:40	6503.499	32.9	99	5200

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7/30/2015	9:26:10	6557.699	27.9	99	5200
7/30/2015	9:26:25	6557.699	0	99	5200
7/30/2015	9:26:40	6587.199	29.5	99	5200
7/30/2015	9:26:55	6614.799	27.6	99	5200
7/30/2015	9:27:10	6644.399	29.6	99	5200
7/30/2015	9:27:25	6672.899	28.5	99	5200
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7/30/2015	9:28:10	6729.399	29.6	99	5200
7/30/2015	9:28:25	6760.599	31.2	99	5200
7/30/2015	9:28:40	6760.599	0	99	5200
7/30/2015	9:28:55	6785.999	25.4	99	5200
7/30/2015	9:29:10	6814.199	28.2	99	5200
7/30/2015	9:29:25	6845.499	31.3	99	5200
7/30/2015	9:29:40	6845.499	0	99	5200
7/30/2015	9:29:55	6877.099	31.6	99	5200
7/30/2015	9:30:10	6905.799	28.7	99	5200
7/30/2015	9:30:25	6905.799	0	99	5200
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7/30/2015	9:30:55	6963.199	28.8	99	5200
7/30/2015	9:31:10	6991.799	28.6	99	5200
7/30/2015	9:31:25	6991.799	0	99	5200
7/30/2015	9:31:40	7022.5	30.701	99	5200
7/30/2015	9:31:55	7050.799	28.299	99	5200
7/30/2015	9:32:10	7078.799	28	99	5200
7/30/2015	9:32:25	7108.799	30	99	5200
7/30/2015	9:32:40	7108.799	0	99	5200
7/30/2015	9:32:55	7136.799	28	99	5200
7/30/2015	9:33:10	7165.5	28.701	99	5200
7/30/2015	9:33:25	7165.5	0	99	5200
7/30/2015	9:33:40	7194	28.5	99	5200
7/30/2015	9:33:55	7221.299	27.299	99	5200
7/30/2015	9:34:10	7251.899	30.6	99	5200

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7/30/2015	9:34:40	7280.699	28.8	99	5200
7/30/2015	9:34:55	7308.799	28.1	99	5200
7/30/2015	9:35:10	7338.799	30	99	5200
7/30/2015	9:35:25	7338.799	0	99	5200
7/30/2015	9:35:40	7367.199	28.4	99	5200
7/30/2015	9:35:55	7397.599	30.4	99	5200
7/30/2015	9:36:10	7424.899	27.3	99	5200
7/30/2015	9:36:25	7424.899	0	99	5200
7/30/2015	9:36:40	7452.799	27.9	99	5200
7/30/2015	9:36:55	7483.499	30.7	99	5200
7/30/2015	9:37:10	7512.699	29.2	99	5200
7/30/2015	9:37:25	7512.699	0	99	5200
7/30/2015	9:37:40	7541.399	28.7	99	5200
7/30/2015	9:37:55	7570.5	29.101	99	5200
7/30/2015	9:38:10	7599.299	28.799	99	5200
7/30/2015	9:38:25	7599.299	0	99	5200
7/30/2015	9:38:40	7627.699	28.4	99	5200
7/30/2015	9:38:55	7655.199	27.5	99	5200
7/30/2015	9:39:10	7681.299	26.1	99	5200
7/30/2015	9:39:25	7681.299	0	99	5200
7/30/2015	9:39:40	7709.899	28.6	99	5200
7/30/2015	9:39:55	7741.1	31.201	99	5200
7/30/2015	9:40:10	7772.899	31.799	99	5200
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7/30/2015	9:40:55	7831.1	29.5	99	5200
7/30/2015	9:41:10	7859.6	28.5	99	5200
7/30/2015	9:41:25	7859.6	0	99	5200
7/30/2015	9:41:40	7888.899	29.299	99	5200
7/30/2015	9:41:55	7917.5	28.601	99	5200
7/30/2015	9:42:10	7945.399	27.899	99	5200
7/30/2015	9:42:25	7945.399	0	99	5200
7/30/2015	9:42:40	7974	28.601	99	5200

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7/30/2015	9:44:10	8119.799	29.1	99	5200
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7/30/2015	9:44:55	8173.699	29	99	5200
7/30/2015	9:45:10	8204.6	30.901	99	5200
7/30/2015	9:45:25	8204.6	0	99	5200
7/30/2015	9:45:40	8233.199	28.599	99	5200
7/30/2015	9:45:55	8261.699	28.5	99	5200
7/30/2015	9:46:10	8292.699	31	99	5200
7/30/2015	9:46:25	8292.699	0	99	5200
7/30/2015	9:46:40	8320.799	28.1	99	5200
7/30/2015	9:46:55	8350.099	29.3	99	5200
7/30/2015	9:47:10	8379.198	29.099	99	5200
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7/30/2015	9:47:40	8408.599	29.401	99	5200
7/30/2015	9:47:55	8436.599	28	99	5200
7/30/2015	9:48:10	8465.198	28.599	99	5200
7/30/2015	9:48:25	8465.198	0	99	5200
7/30/2015	9:48:40	8493.599	28.401	99	5200
7/30/2015	9:48:55	8523.499	29.9	99	5200
7/30/2015	9:49:10	8550.199	26.7	99	5200
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7/30/2015	9:51:10	8723.7	27.2	99	5200

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7/30/2015	9:51:40	8752.101	28.401	99	5200
7/30/2015	9:51:55	8782.7	30.599	99	5200
7/30/2015	9:52:10	8812.601	29.901	99	5200
7/30/2015	9:52:25	8812.601	0	99	5200
7/30/2015	9:52:40	8840.601	28	99	5200
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7/30/2015	9:53:10	8896.101	26.3	99	5200
7/30/2015	9:53:25	8896.101	0	99	5200
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7/30/2015	9:54:10	8985.602	31.401	99	5200
7/30/2015	9:54:25	8985.602	0	99	5200
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7/30/2015	9:55:10	9072.301	28.5	99	5200
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7/30/2015	9:56:10	9158.901	30.5	99	5200
7/30/2015	9:56:25	9158.901	0	99	5200
7/30/2015	9:56:40	9188.302	29.401	99	5200
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7/30/2015	9:59:10	9418.702	28.7	99	5200
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7/30/2015	9:59:40	9448.702	30	99	5200

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7/30/2015	10:01:10	9591.602	28.5	99	5200
7/30/2015	10:01:25	9591.602	0	99	5200
7/30/2015	10:01:40	9619.502	27.9	99	5200
7/30/2015	10:01:55	9648.502	29	99	5200
7/30/2015	10:02:10	9678.902	30.4	99	5200
7/30/2015	10:02:25	9678.902	0	99	5200
7/30/2015	10:02:40	9707.702	28.8	99	5200
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7/30/2015	10:03:10	9765.303	29.401	99	5200
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7/30/2015	10:03:55	9824.503	30	99	5200
7/30/2015	10:04:10	9853.103	28.6	99	5200
7/30/2015	10:04:25	9853.103	0	99	5200
7/30/2015	10:04:40	9881.402	28.299	99	5200
7/30/2015	10:04:55	9909.103	27.701	99	5200
7/30/2015	10:05:10	9938.803	29.7	99	5200
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7/30/2015	10:06:10	10019.7	28.097	99	5200
7/30/2015	10:06:25	10019.7	0	99	5200
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7/30/2015	10:06:55	10081.1	30.6	99	5200
7/30/2015	10:07:10	10111.2	30.1	99	5200
7/30/2015	10:07:25	10111.2	0	99	5200
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7/30/2015	10:08:10	10198.6	28.6	99	5200

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7/30/2015	10:09:10	10286.5	28.4	99	5200
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7/30/2015	10:09:40	10314.9	28.4	99	5200
7/30/2015	10:09:55	10343.3	28.4	99	5200
7/30/2015	10:10:10	10372.1	28.8	99	5200
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7/30/2015	10:11:10	10458.4	28.4	99	5200
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7/30/2015	10:11:40	10488	29.6	99	5200
7/30/2015	10:11:55	10517.8	29.8	99	5200
7/30/2015	10:12:10	10545.2	27.4	99	5200
7/30/2015	10:12:25	10545.2	0	99	5200
7/30/2015	10:12:40	10573.9	28.7	99	5200
7/30/2015	10:12:55	10604.2	30.3	99	5200
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7/30/2015	10:13:55	10690.1	30.3	99	5200
7/30/2015	10:14:10	10717.1	27	99	5200
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7/30/2015	10:14:40	10744	26.9	99	5200
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7/30/2015	10:15:10	10806.3	31.9	99	5200
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7/30/2015	10:17:55	11031.6	31.5	99	5200
7/30/2015	10:18:10	11062.5	30.9	99	5200
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7/30/2015	10:18:55	11124	29.8	99	5200
7/30/2015	10:19:10	11152.8	28.8	99	5200
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7/30/2015	10:19:40	11182.4	29.6	99	5200
7/30/2015	10:19:55	11210.6	28.2	99	5200
7/30/2015	10:20:10	11239.3	28.7	99	5200
7/30/2015	10:20:25	11239.3	0	99	5200
7/30/2015	10:20:40	11267.8	28.5	99	5200
7/30/2015	10:20:55	11296.9	29.1	99	5200
7/30/2015	10:21:10	11325.7	28.8	99	5200
7/30/2015	10:21:25	11325.7	0	99	5200
7/30/2015	10:21:40	11352.2	26.5	99	5200
7/30/2015	10:21:55	11382.9	30.7	99	5200
7/30/2015	10:22:10	11412.9	30	99	5200
7/30/2015	10:22:25	11412.9	0	99	5200
7/30/2015	10:22:40	11442	29.1	99	5200
7/30/2015	10:22:55	11471.8	29.8	99	5200
7/30/2015	10:23:10	11499.9	28.1	99	5200
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7/30/2015	10:23:55	11557	28.3	99	5200
7/30/2015	10:24:10	11585.8	28.8	99	5200
7/30/2015	10:24:25	11585.8	0	99	5200
7/30/2015	10:24:40	11614.3	28.5	99	5200
7/30/2015	10:24:55	11642.3	28	99	5200
7/30/2015	10:25:10	11672.2	29.9	99	5200

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7/30/2015	10:26:25	11759.1	0	99	5200
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7/30/2015	10:27:10	11846.7	29.6	99	5200
7/30/2015	10:27:25	11846.7	0	99	5200
7/30/2015	10:27:40	11875.2	28.5	99	5200
7/30/2015	10:27:55	11903.5	28.3	99	5200
7/30/2015	10:28:10	11932.2	28.7	99	5200
7/30/2015	10:28:25	11932.2	0	99	5200
7/30/2015	10:28:40	11960.2	28	99	5200
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7/30/2015	10:29:10	12016.1	27.5	99	5200
7/30/2015	10:29:25	12016.1	0	99	5200
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7/30/2015	10:33:40	12393.9	27.8	99	5200

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7/30/2015	10:34:10	12452.1	27.6	99	5200
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7/30/2015	11:47:55	4372.5	34.1	98	6000
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7/30/2015	11:48:25	4406.6	34.1	98	6000
7/30/2015	11:48:40	4438.4	31.8	98	6000
7/30/2015	11:48:55	4472.1	33.7	98	6000
7/30/2015	11:49:10	4472.1	0	98	6000
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7/30/2015	11:49:55	4570.8	32.1	98	6000
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7/30/2015	11:56:55	5273.1	33.9	98	6000
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7/30/2015	12:01:55	5773.001	33.6	98	6000
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7/30/2015	12:51:25	10705.5	34.8	98	6000
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7/30/2015	12:52:10	10773.8	34.3	98	6000
7/30/2015	12:52:25	10805.2	31.4	98	6000
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7/30/2015	12:53:25	10906.4	34	98	6000
7/30/2015	12:53:40	10939.3	32.9	98	6000
7/30/2015	12:53:55	10939.3	0	98	6000
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7/30/2015	12:54:55	11038.8	0	98	6000
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7/30/2015	13:02:40	11838.5	32.2	98	6000
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7/30/2015	13:05:10	12073.7	34.2	98	6000
7/30/2015	13:05:25	12104.4	30.7	98	6000
7/30/2015	13:05:40	12136.5	32.1	98	6000
7/30/2015	13:05:55	12136.5	0	98	6000
7/30/2015	13:06:10	12167.9	31.4	98	6000
7/30/2015	13:06:25	12202.9	35	98	6000
7/30/2015	13:06:40	12231.9	29	98	6000

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7/30/2015	13:07:25	12233.1	0	98	6000
7/30/2015	13:07:40	12233.1	0	98	6000
7/30/2015	13:07:55	12233.1	0	98	6000
7/30/2015	13:08:10	12233.1	0	98	6000
7/30/2015	13:08:25	12233.1	0	98	6000
7/30/2015	13:08:40	12233.1	0	98	6000
7/30/2015	13:08:55	12233.1	0	98	6000
7/30/2015	13:09:10	12233.1	0	98	6000
7/30/2015	13:09:25	12233.1	0	98	6000
7/30/2015	13:09:40	12233.1	0	98	6000
7/30/2015	13:09:55	12233.1	0	98	6000
7/30/2015	13:10:10	12233.1	0	98	6000
7/30/2015	13:10:25	12233.1	0	98	6000
7/30/2015	13:10:40	12233.1	0	98	6000
7/30/2015	13:10:55	0	-12233.1	0	0
7/30/2015	13:11:10	0	0	0	0
7/30/2015	13:11:25	0	0	0	0
7/30/2015	13:11:40	0	0	0	6000
7/30/2015	13:11:55	0	0	0	6000
7/30/2015	13:12:10	0	0	0	6000
7/30/2015	13:12:25	0	0	0	6000
7/30/2015	13:12:40	0	0	0	6000
7/30/2015	13:12:55	0	0	0	6000
7/30/2015	13:13:10	0	0	0	6000
7/30/2015	13:13:25	0	0	0	6000
7/30/2015	13:13:40	0	0	0	6000
7/30/2015	13:13:55	0	0	0	6000
7/30/2015	13:14:10	0	0	0	6000
7/30/2015	13:14:25	0	0	0	6000
7/30/2015	13:14:40	0	0	0	6000
7/30/2015	13:14:55	0	0	0	6000
7/30/2015	13:15:10	0	0	0	6000

7/30/2015	13:15:25	0	0	0	6000
7/30/2015	13:15:40	0	0	0	6000
7/30/2015	13:15:55	0	0	0	6000
7/30/2015	13:16:10	0	0	0	6000
7/30/2015	13:16:25	0	0	0	6000
7/30/2015	13:16:40	0	0	0	6000
7/30/2015	13:16:55	0	0	0	6000
7/30/2015	13:17:10	0	0	0	6000
7/30/2015	13:17:25	0	0	0	6000
7/30/2015	13:17:40	0	0	0	6000
7/30/2015	13:17:55	0	0	0	6000
7/30/2015	13:18:10	0	0	0	6000
7/30/2015	13:18:25	0	0	0	6000
7/30/2015	13:18:40	0	0	0	6000
7/30/2015	13:18:55	0	0	0	6000
7/30/2015	13:19:10	0	0	0	6000

APPENDIX D

CALCULATIONS

EPA METHOD 7E

AVERAGE GAS CONCENTRATION FORMULA

EQUATION 7E-5

$$C_{gas} = (\overline{C} - C_o)\frac{C_{ms}}{(C_m - C_o)}$$

Where:

C_{gas} = Effluent gas concentration, dry basis ppm or %

$\overline{C}$ = Average gas concentration indicated by gas analyzer, dry basis ppm or %

C_o = Average of initial and final system calibration bias check responses for the zero gas ppm or %

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas ppm or %

C_{ms} = Actual concentration of the upscale gas, ppm or %

Air Flow Rate Calculations (Pg 1 of 2)

A. Stack Dimensions - Inches or Feet, (In. or Ft.)

B. Area of Stack - Square Feet, (Ft^2)

C. Pitot Tube Calibration Factor (C_p)

D. Barometric Pressure - Inches of Mercury, (" Hg)

E. Static Pressure in Stack - Inches of Water, (" H_2O)

F. Stack Gas Temperature - °F

G. Average Square Root of the Velocity Pressures (" H_2O)

H. Percent Moisture in Exhaust Gas

I. Dry Gas Composition: % O_2
% CO_2
% CO
% N_2

J. Density and Molecular Weight of Stack Gas:

1) Dry, @STP, Lbs./Cu.Ft. =

$$\frac{(\%O_2 \times 0.0827) + (\%CO_2 \times 0.1137) + [(\%CO + N_2) \times 0.0724]}{100}$$

2) Moist, @STP, Lbs./Cu.Ft. =

$$(J_1 \times \frac{(100 - H)}{100}) + (0.0465 \times \frac{H}{100})$$

3) Moist Gas, @Stack Conditions, Lbs./Cu.Ft. =

$$J_2 \times (\frac{528}{F + 460}) \times (\frac{D + (0.07355 \times E)}{29.92})$$

4) Molecular Weight, Dry, @STP, Lb./Mole =

$$(J_1 \times 386.9\ Cu.Ft./Mole)$$

K. Average Gas Velocity:

$$FPM = \frac{1096}{\sqrt{J_3}} \times G \times C$$

Air Flow Rate Calculations (Pg 2 of 2)

L. Stack Gas Flow Rate:

1) Stack Conditions (ACFM) =

$$ACFM = B \times K$$

2) Standard Conditions (SCFM) =

$$SCFM = L_1 \times \left(\frac{528}{F + 460}\right) \times \left(\frac{D + (0.07355 \times E)}{29.92}\right)$$

3) Standard Dry Conditions (DSCFM) =

$$DSCFM = L_2 \times \left(\frac{100 - H}{100}\right)$$

* Note: STP = 29.92 " Hg, 68 °F

VOC CALCULATIONS (STP = 68 °F & 29.92 In. Hg)

1. Concentration (in Mg/M^3)

   $Mg/M^3 = (PPM)\ (M.W./24.11)$

   Where: M.W. = molecular weight = 44 for VOC's as propane

2. Air Flow Rate in SCMM or DSCMM (Standard or Dry Standard Cubic Meters Per Minute)

   SCMM = (SCFM) (0.0283)

   DSCMM = (DSCFM) (0.0283)

   Where: SCFM = Standard Cubic Feet Per Minute
   DSCFM = Dry Standard Cubic Feet Per Minute

3. Emission Rate (in Lbs/Hr)

   $Lbs/Hr = (Mg/M^3)\ (M^3/Min)\ (60\ Min/Hr)\ (2.205\ Lbs/Kg)\ (Kg/1000g)\ (g/1000mg)$

   $Lbs/Hr = (Mg/M^3)\ (SCMM)\ (1.323 \times 10^{-4})$

Shannon Precision Fastener 7/30/15							
RUN #	THC	PRE HI	POST HI	PRE ZERO	POST ZERO	FINAL	CAL GAS
1	12.8	29.5	30.4	0	0.9	12.2	29.17
2	12.8	30.4	30.7	0.9	1.1	11.6	29.17
3	15.1	30.7	30.9	1.1	1.3	13.7	29.17

APPENDIX E

CALIBRATION GAS & ANALYZER SPECIFICATION DATA

Company:	Shannon Precision Fastener	Monitor:	J.U.M. 3-500 VOCs
Location:	Auburn Hills, MI	Operator:	SKB/RDE
Source:	Quench Exhaust	Span Value:	85.78
Date:	7/30/15	Page #:	1 of 1

Cal Gas Conc. PPM	Calibration Response, PPM System Injection							Analyzer Cal. Error % of Cal. Gas	Drift % of Span					
	Pretest	Post 1	Post 2	Post 3	Post 4	Post 5	Post 6		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
	10:05	11:34	12:47	14:00										
0.00	0.0	0.9	1.1	1.3					1.05					
29.17	29.5	30.4	30.7	30.9				1.13	1.05	0.35	0.23			
50.19	49.9							-0.58						
85.78	85.8													

Airgas

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MI 48067
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	NETWORK ENVIRONMENTAL INC		
Part Number:	E02NI99E15A0930	Reference Number:	32-400368366-1
Cylinder Number:	XC021350B	Cylinder Volume:	144.4 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62014	Valve Outlet:	350
Gas Code:	PPN,BALN	Certification Date:	May 21, 2014

Expiration Date: May 21, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	30.00 PPM	29.17 PPM	G1	+/- 0.9% NIST Traceable	05/21/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060511	CC417240	50.80 PPM PROPANE/AIR	+/-0.6%	Feb 26, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 50ppmFS C3H8, Nicolet 6700	FTIR	May 06, 2014

Triad Data Available Upon Request

Notes:

JB

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVE
ROYAL OAK, MI 48067
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	K07-GRANDVILLE		
Part Number:	E02NI99E15A0931	Reference Number:	32-112171025-1
Cylinder Number:	CC312849	Cylinder Volume:	144.4 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	NONPGVP	Valve Outlet:	350
Gas Code:	PPN,BALN	Certification Date:	Nov 08, 2010

Expiration Date: Nov 08, 2018

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	50.00 PPM	50.19 PPM	G1	+/- 1% NIST Traceable	11/08/2010
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08061012	CC262383	49.62 PPM PROPANE/AIR		Jul 15, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 50ppmFS C3H8, Nicolet 6700	FTIR	Oct 21, 2010

Triad Data Available Upon Request

Notes:

Signature on file

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MO 48067
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	NETWORK ENVIRONMENTAL INC		
Part Number:	E02NI99E15A0581	Reference Number:	32-400020347-1
Cylinder Number:	CC19534	Cylinder Volume:	144.4 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62011	Valve Outlet:	350
Gas Code:	PPN,BALN	Certification Date:	Sep 19, 2011

Expiration Date: Sep 19, 2019

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	85.00 PPM	85.78 PPM	G1	+/- 1% NIST Traceable	09/19/2011
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09061714	CC301763	97.82 PPM PROPANE/AIR		Oct 02, 2013

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 250ppmFS C3H8, Nicolet 6700	FTIR	Aug 20, 2011

Triad Data Available Upon Request

Approved for Release

J.U.M. ENGINEERING

Users Manual

Please read this manual thoroughly and follow all warnings and instructions!

WARNING

A person who has not read and does not understand all operating instructions is not qualified to operate this instrument. Failure to read and understand safety instructions and warnings can result in injury or death!

Technical Data (cont.)

Oven	
Heater	500 Watts
Temperature	190°C (374°F)
Temperature Sensor	Thermocouple Type "J" (Fe-CuNi)
Supply Gas Plumbing	
Solenoid Valves	Brass
Plunger	Stainless Steel/Viton®
Seal	Viton® O-ring
Supply Voltage	24 VDC
Tubing	PA / Teflon® / Viton®
Fittings	Brass, Brass Ni-plated
Sample Gas Plumbing	
Sample Inlet Fitting	Swagelok®, 1/4", 316 SS
Tubing	Stainless Steel 1.4571, 1/4" & 1/8"
Oven Fittings	Swagelok®, 1/4" & 1/8", 316 SS
Electrometer	
Supply voltage	+/- 15 VDC
Input Impedance	$5 \times 10^{12}\ \Omega$
Noise	5×10^{-14} A
Electrical Drift	0,02% / Week
Sensitivity	10^{-12} A FSD
Signal Display	
Supply Voltage	+5 VDC
6 digit	Engineering Unit

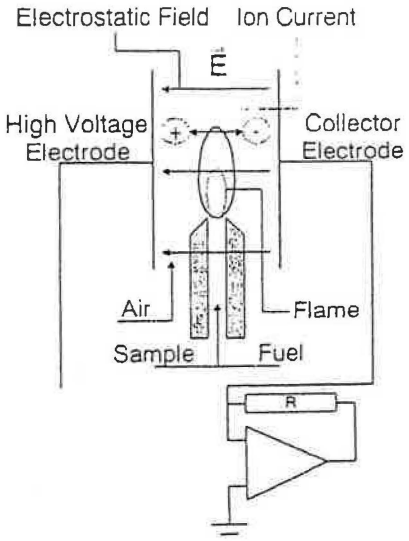
continued on next page

3. The FID Principle

All J.U.M. Engineering heated total hydrocarbon analyzers, our non-methane hydrocarbon analyzer and our non-methane/non-ethane hydrocarbon analyzer use the Flame Ionization Detection (FID) method to determine the presence of total hydrocarbon concentrations in a gaseous sample:

Burning hydrocarbon-free hydrogen in hydrocarbon-free air produces a negligible number of ions.

Once a sample containing hydrocarbons is introduced into this flame a very complex ionization process is started. This process creates a large number of ions. A high polarizing voltage is applied between the two electrodes around the burner nozzle and produces an electrostatic field. Now negative ions migrate to the collector electrode and positive ions migrate to the high voltage electrode. The so generated ionization current between the two electrodes is directly proportional to the hydrocarbon concentration in the sample that is burned by the flame. This signal is measured and amplified by our electrometer-unit.



4. Description

The J.U.M. Flame Ionization Analyzer Model 3-500 is a heated analyzer designed to continuously measure the concentration of total organic hydrocarbons in a gaseous sample. The sample can be ambient air, or the exhaust gases from a combustion process etc. The measurement is obtained by using the Flame Ionization Detector (FID).

It meets the requirements for 2. BImSchV, 13 BImSchV and 17. BImSchV and meets the requirements of EPA CFR 60 Method 25A and EPA CFR 40 Method 503.

The Model 3-500 is supplied in various versions through the use of options. The standard instrument has five total hydrocarbons measuring ranges: from 0-10 to 100,000 ppm with 10:1 decade range adjustment; Flame Out Indication on the front panel via dual color LED (red LED - flame is out, green LED - flame is lit); 0-10 VDC and 4-20 mA recorder outputs. Calibration gases are introduced into the analyzer through the sample inlet (overflow setup required! see also page 43).

A sample pressure regulator provides a controlled back pressure at the sample capillary which gives admittance of a constant sample flow rate to the burner. This technique without the conventional back pressure regulator is used by J.U.M. Engineering for over 30 years to provide the highest possible sample flow rate stability and lowest maintenance. Our compactly designed flow control module for controlling the fuel and air flow rates via needle valves use high precision pressure regulators. The needle valves are factory adjusted and sealed to ensure the optimization of the burner.

The Model 3-500 is specially cleaned at the factory, and "burned in" for 14 days under continuous operating conditions at 190°C (375°F), to remove any residual hydrocarbons in the piping system. Thus, when this instrument reaches the end user, it is totally hydrocarbon background free (less than 0.1 ppm background), so it is extremely important that you equip this analyzer with the highest grade, cleanest gas plumbing system available, in order to allow the analyzer to reach its full potential of measuring trace hydrocarbons.

15. Technical Data

Dimensions	
Width	19" (483 mm)
Height	3 Panel Units (132 mm)
Depth	460 mm (18 1/8")
Weight	23 kg (50 lbs)
Line Voltage/Fuses	
230 VAC/50 Hz	4 A medium
115 VAC/60 Hz	6.3 A medium
Sample Filter	
Type	Single use cartridge
Material Filter	2 µm glass fiber
Seal	Viton® O-ring
Material Housing/Cap	Stainless Steel 1.4571
Inlet Fitting	Swagelok®, 1/4", 316 SS
Outlet Fitting	Swagelok®, 1/8", 316 SS
Sample Pump	
Type	Diaphragm
Material Head	Stainless Steel 1.4571
Material Chamber	Stainless Steel 1.4571
Material Diaphragm	Viton®
Material Valves	Viton®
max. Flow (unrestricted)	2,5 Liters/Minute
Air Pump	
Type	Diaphragm
Material Head	Polyamid 11
Material Chamber	Polyamid 11
Material Diaphragm	Viton®
Material Valves	Viton®
max. Flow (unrestricted)	2,5 Liters/Minute

continued on next page

Technical Data (cont.)

Detector	
Dynamic Range	10^6 to 10^7
Sensitivity	1 ppb
Voltage	-300 VDC
Material Burner	Stainless Steel 1.4571
Material Nozzle	Stainless Steel 1.4571
Igniter	Platinum Coil 3V / 1A
O_2-Synergism	< 1.2%
Burner Air Flow	70 - 250 cc/min (depending on fuel gas)
Sample Flow	25 cc/min (standard analyzer)
Fuel Consumption 100% H_2	17 - 25 cc/min
Fuel Consumption 60%He/40%H_2 (Option)	80 - 120 cc/min
Measuring ranges	
5 Ranges (ppm, o. mgC/m³)	10/100/1.000/10.000/100.000
6 Ranges (ppm, o. mgC/m³)	25/100/250/1.000/2.500/10.000
Other Range Configuration	Upon Request, see page 38
Signal Output	
Voltage	0-10 VDC (or 0-5 VDC instead or 0-1 VDC instead; see page 38)
Current	either 4-20 mA (Standard), or 0-20 mA instead (Option; see page 38)
Serial (ASCII)	RS 232 output
Supply Gases	
Fuel Gas	1,5 bar (0.15 MPa, 21 psig)
Span Gas	1 bar (0.1 MPa, 15 psig) @ 2.8-3.3 liters/minute free overflow
Zero Gas	1 bar (0.1 MPa, 15 psig) @ 2.8-3.3 liters/minute free overflow
Sample	**NO PRESSURE!**
Analyzer Results	
Response Time (90% FSD)	< 1.2 seconds
Linearity	Up to 10.000 ppm within 1% FSD

Viton® is a registered trademark of DuPont Dow Elastomers; Teflon® is a registered trademark of DuPont; Swagelok® is a registered trademark of the Crawford Fitting Company

APPENDIX F

RAW DATA

NETWORK ENVIRONMENTAL INCORPORATED

Company: Shannon Precision Fastner

Location: Auburn Hills, MI

Source:

Date: 7/30/15

Operator: SKB/RDE

Monitor: J.U.M 5-500

Span Value (PPM): 85.78

Page #:

12" Quench — 8" Flare

Prelim - 12.6 ppm — 13.8

Quench 9:09 - 9:24

Flare 9:28 - 9:43

Run 1 - 10:26 - 11:26

Run 2 - 11:37 - 12:37

Run 3 - 12:51 - 13:51

Quench cont

12.8 - 12.2

12.8 - 11.6

15.1

Calibration Gas Conc., PPM C_3H_8	Calibration Response, PPM C_3H_8					Analyzer Cal. Error, % of Cal. Gas	Drift % of Span		
	Direct Injection	System Injection							
		Pretest	Post 1	Post 2	Post 3		Test 1	Test 2	Test 3
		10:05	11:34	12:47	14:00				
0.0		0.0	0.9	1.1	1.3		1.05	0.23	0.23
29.17		29.5	30.4	30.7	30.9	1.13	1.05	0.35	
50.19		49.9				-0.58			
85.78		86.8							

* As Defined By EPA Method 25A, These Three Values Must Be The Same

Analyzer cal. error, % of cal. gas = (sys. pretest cal. response, PPM C_3H_8 - cal. gas conc., PPM C_3H_8) x 100% / (cal. gas conc., PPM C_3H_8): Limit = 5%

Drift, % of span = (relevant posttest sys. inj. cal. response, PPM C_3H_8 - sys. pretest cal. response, PPM C_3H_8) x 100% / (span value, PPM C_3H_8): Limit = 3%

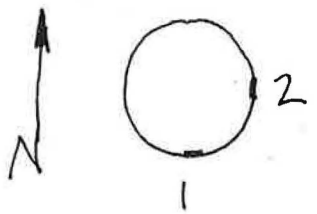
System response time (95% of response for high cal. gas), sec = 1st: 2nd: 3rd: Average: Limit = 30 sec

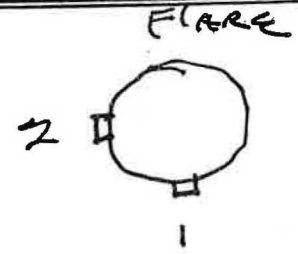
NETWORK ENVIRONMENTAL INCORPORATED

PITOT TRAVERSE DATA FORM		Date: 7/30/15	
Plant: Shannon Precision Fasteners		Auburn Hills, MI	
Source: Quench SV / Flare SV		Staff: BYRD / EERDMANS	
Stack Size, Inches: 12		Barometric Pressure, "Hg: 28.70	
Gas Temperature, °F Dry:	Wet:	Static Pressure, "H_2O: +0.16	-0.03
Pitot Tube#:	X Standard	S-Type	C_p 0.99

Point Location Inches	1 Port	Velocity Pressure "H_2O		2 Port	Velocity Pressure "H_2O		1 Port	Velocity Pressure "H_2O FLARE		2 Port	Velocity Pressure "H_2O	
0.38	1	1.05	98	1	1.30	101	1	0.06	422	1	0.06	425
1.26	2	1.15	99	2	1.25	101	2	0.07	424	2	0.07	427
2.33	3	1.20	100	3	1.27	101	3	0.07	427	3	0.06	426
3.88	4	1.42	101	4	1.30	103	4	0.04	425	4	0.04	424
8.12	5	1.33	100	5	1.55	102	5			5		
9.67	6	1.35	102	6	1.50	101	6			6		
10.74	7	1.28	102	7	1.45	102	7			7		
11.62	8	1.30	103	8	1.38	103	8			8		
	9			9			9			9		
	10	Run #1 - 10:34 - 10:46					10			10		
	11			11			11			11		
	12			12			12			12		

Wall Thickness	N/A
Zero Point	N/A
Port Size/Type	1" Hole





SCFM = ~~3,455~~ ~~3,776~~ 3,408

570

NETWORK ENVIRONMENTAL INCORPORATED

Run #2 & #3

PITOT TRAVERSE DATA FORM		Date: 7/30/15	
Plant: Shannon Precision Fasteners			
Source: Quench SV / Flare		Staff: BYRD / EERDMANS	
Stack Size, Inches: 12		Barometric Pressure, "Hg: 28.70	
Gas Temperature, °F Dry:	Wet:	Static Pressure, "H_2O: +0.12 / +0.14	
Pitot Tube#:	X Standard	S-Type	C_p: 0.99

Point Location Inches	1 Port	Velocity Pressure "H_2O Run #2		2 Port	Velocity Pressure "H_2O		1 Port	Velocity Pressure "H_2O Run #3		2 Port	Velocity Pressure "H_2O	
0.38	1	1.16	102	1	1.20	101	1	1.15	100	1	1.25	103
1.26	2	1.20	103	2	1.30	103	2	1.20	101	2	1.30	100
2.33	3	1.25	103	3	1.30	101	3	1.25	100	3	1.30	102
3.88	4	1.35	102	4	1.30	102	4	1.33	105	4	1.30	102
8.12	5	1.40	100	5	1.45	101	5	1.40	103	5	1.60	103
9.67	6	1.45	101	6	1.53	103	6	1.45	101	6	1.60	101
10.74	7	1.40	100	7	1.50	102	7	1.40	101	7	1.35	101
11.62	8	1.28	102	8	1.30	102	8	1.30	102	8	1.30	101
	9			9			9			9		
	10			10			10	14:03		10	14:08	
	11			11			11			11		
	12			12			12			12		

Wall Thickness		
Zero Point	2 = 3426	3 = ~~3,438~~ 3439 scfm
Port Size/Type		