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TRACE TECHNOLOGY CATALYTIC CONVERSION DEVICE TECHNICAL BULLETIN AUGUST 2024

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SECTION 1 - OVERVIEW

For several decades, the hydrocarbon processing industry has used catalytic combustion technology for the mitigation of hydrocarbon fugitive emissions from low-pressure or atmospheric vents commonly found with process analyzer systems. The catalytic technology offered by Trace Technology Inc., commonly referred to as the “TRACERASE ™” (Figure 1.1) and others, is documented in the public domain with stated BTU throughputs of 750 BTU-HR [1,2], 1,000 BTU-HR, and 2,000 BTU-HR [3]. While sizing these devices for a client’s project, Smith Analytical reviewed the engineering and design of the 750, 1,0000 and 2,000 BTU-HR devices. It was determined during this technical review that there were no changes in size, catalyst loading, flow rate, or other mechanical changes to the device which would properly explain the actual BTU throughput of the device. Additionally, we could not locate any testing data to support any of the BTU claims made. For this reason, Smith Analytical undertook the process of testing this technology to determine the actual BTU throughput of the catalytic mitigation technology.

FIGURE 1.1 – CATALYTIC FUGITIVE EMISSIONS MITIGATION TECHNOLOGY

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While it is was not the intent of this study to discuss the number of catalytic devices installed at a given location, it is not unusual for multiple devices to be installed at a single location. As shown in Figure 1.2 below, this shelter was equipped with twenty (20) of the catalytic devices. Assuming these devices were sized using the 750 BTU-HR throughput value and the stream contained 100% Methane, the fugitive emissions from this single shelter would be 5,560 pounds per year. If the stream was 100% Ethylene, the fugitive emissions from this single shelter would be 1,820 pounds per year. If the stream was 100% Propylene, the fugitive emissions from this single shelter would be 1,420 pounds per year.

FIGURE 1.2 – MULTIPLE CATALYTIC DEVICES INSTALLED ON A SINGLE SHELTER

SECTION 2 - DEVICE OVERVIEW

Operation of the catalytic technology is straightforward. The hydrocarbon gas stream is sent to the device, which is electrically heated and is equipped with a catalyst to convert hydrocarbons into Carbon Dioxide and Water. Per the published manufacture's information, oxygen for the combustion of hydrocarbon products is provided by ambient air and additional oxygen or air is not required [1,2,3]. The products of conversion, which are primarily CO2, N2, and water vapor, are emitted through the outer housing or flame arrestor.

It is important to understand that testing the catalytic device is not straightforward as many have long thought. Most end users simply believe if the device is "Hot," then it is working properly. Many installations employ a thermocouple to measure the operating temperature of the device, and if the device is "Hot," it is deemed operable. Other end users employ an IR temperature gun to measure the skin temperature of the flame arrestor, and again, if the device is "Hot," it is deemed operable. The flame arrestor used on the device measures 3" OD x 9" L and has an approximate surface area of 64 square inches. The flow rate through the device is a function of the BTU content of the gas. All the catalytic device literature states the flow rate can be up to 1,000 cc or 1 liter per minute. Table 2.1 lists the maximum flow rates through the device at the various BTU throughputs stated in public domain documents.

TABLE 2.1 – FLOW MAXIMUM RATE

GAS	750 BTU-HR MAX FLOW RATE (CC-MIN)	1,000 BTU-HR FLOW RATE (CC-MIN)	2,000 BTU-HR FLOW RATE (CC-MIN)
Hydrogen-100%	1,089	1,450	2,900
Methane-100%	350	466	932
Ethane-100%	198	264	528
Propane-100%	137	183	366
Methane 50%, Ethane 25% & Propane 25%	222	296	592
Ethylene 30% & Propylene 70%	166.6	222	444

The challenge in testing the catalytic technology is the surface area of the flame arrestor, through which the gas flow passes upon exiting the catalyst assembly. Table 2.2 lists the flow rate per square inch through the flame arrestor for each of the stated BTU throughputs.

TABLE 2.2 – CC OF FLOW PER SQUARE INCH

750 BTU DEVICE CC FLOW PER SQ. IN.	1,000 BTU DEVICE CC FLOW PER SQ. IN.	2,000 BTU DEVICE CC FLOW PER SQ. IN.
17.02	22.6	45.31
5.47	7.28	14.56
3.10	4.12	8.25
2.15	2.85	5.72
3.47	4.63	9.25
2.60	3.47	6.94

When you consider that a sample is taken from the surface of the flame arrestor for determining the fugitive volatile organic carbons (FVOC) present, the challenge becomes even more difficult. Any sample taken from the surface of the flame arrestor would typically be done with a ¼” sample probe. The sample taken from the surface of the flame arrestor would be taken under vacuum and thus would result in a highly air diluted sample. Table 2.3 lists the sample flow per ¼” of the flame arrestor surface.

TABLE 2.3 – CC OF FLOW PER SQUARE INCH

750 BTU DEVICE CC FLOW PER SQ. IN.	1,000 DEVICE CC FLOW PER SQ. IN.	2,000 DEVICE CC FLOW PER SQ. IN.
4.25	5.66	11.33
1.37	1.82	3.64
0.78	1.03	2.06
0.54	0.71	1.43
0.87	1.16	2.31
0.65	0.87	1.73

The major challenge was developing a test device and protocol which would allow for the proper measurement of the FVOC’s, determination of the catalytic technology BTU throughput, and conversion efficiency, which is stated as being 99.9% with a catalyst that has been in service less than one year. Note that at least one of the documents in the public domain mentions the catalyst only needs to be changed every two years to achieve the 99/9% conversion efficiency. [1]

SECTION 3 -TESTING PROTOCOL

Testing began in May 2023 and was completed in June 2024. During this period, a variety of analytical instruments and brand-new catalytic units were tested. The equipment used to conduct the testing included the following:

1. Smith Analytical containment system
2. Siemens Ultramat IR analyzer measuring for Methane, CO2, and CO
3. Siemens Maxum II Gas Chromatograph with Syscon 4.2 and GC portal software with application measuring for Methane, Ethane, Ethylene, Propane, Propylene, Water, CO2, CO, N2 and O2
4. Servomex 1400 Paramagnetic Oxygen analyzer
5. Various NIST calibration gases. Note the primary bottle used contained 50% Methane, 25% Ethane and 25% Propane. To test Ethylene and Propylene conversion, a NIST bottle containing 30% Ethylene and 70% propylene was used. Also a NIST bottle containing 100% Methane was used during the testing. All calibration gases were provided by Applied Gas located in Angleton, Texas
6. The testing apparatus is shown in Figure 3.1 below
7. The replicated testing was completed using the same testing equipment and standards. Smith Analytical subject matter specialists and outside analyzer specialists conducted the testing on multiple brand-new catalytic devices purchased from the Vendor or provided by current stake holders

During all testing, a eight cubic foot (8 SFC) containment system was employed to collect the vent gases from the catalytic device. This allowed for accurate measurement of the catalytic device effluent stream.

In Step 1, testing was conducted using the catalytic device at operating temperature, but with the catalyst removed. This allowed for the measurement of the air diluted hydrocarbon mixture passing thought the heated catalytic device to determine baseline. This test was conducted numerous times to establish an average of the hydrocarbon concentrations present in the containment system.

In Step 2, the catalyst was reinstalled, and the test was conducted again.

By comparing the results from Step 1 to the results in Step 2, the conversion efficiency of the catalyst could be properly determined. In all cases, the flow rates and gas composition being sent to the catalytic device was constant. Multiple brand new catalytic devices sourced from the vendor or provided by Stake Holders involved in the testing were used.

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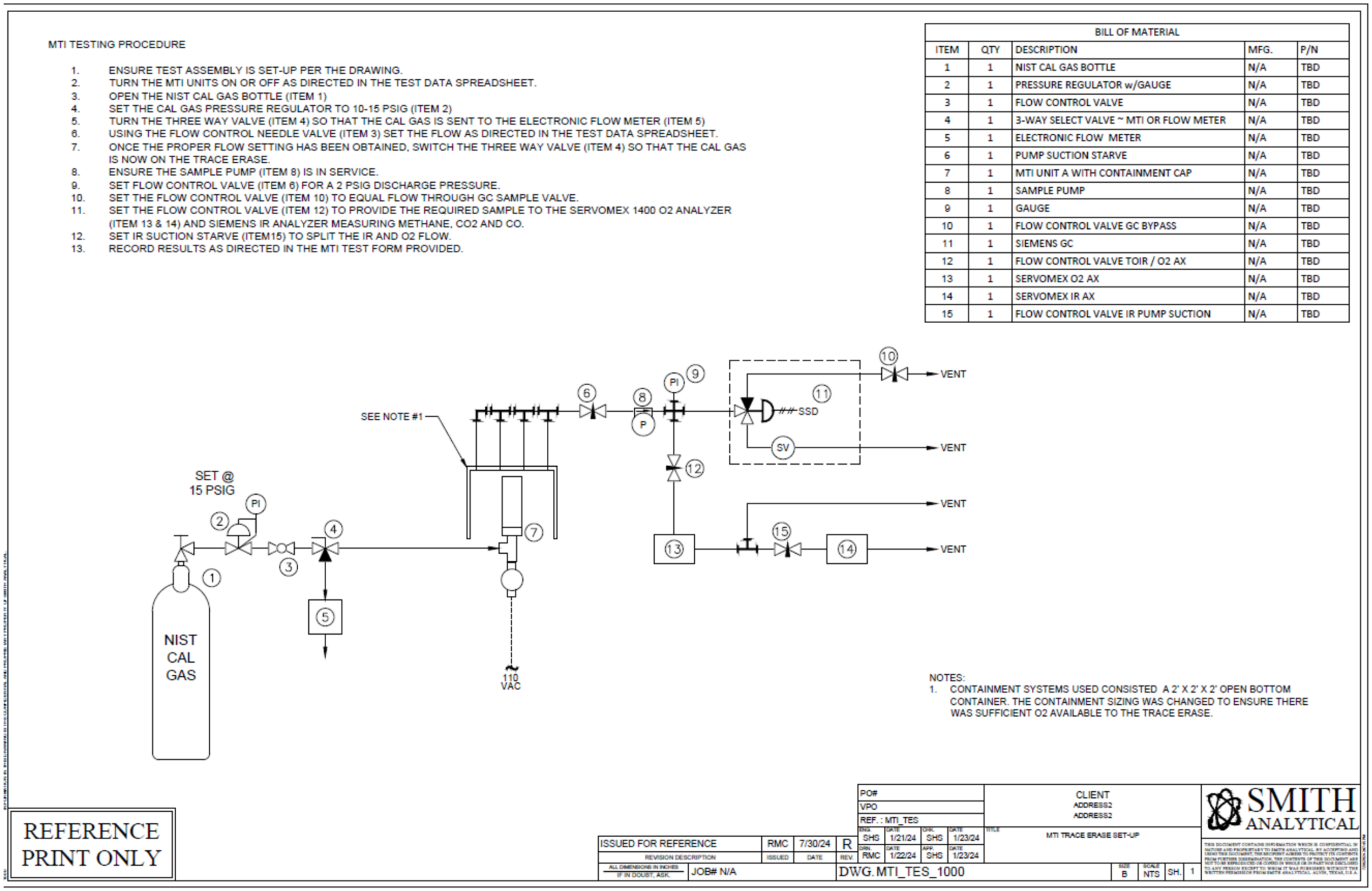
FIGURE 3.1 – TRACEERASE^{TM} TESTING DEVICE



MTI TESTING PROCEDURE

1. ENSURE TEST ASSEMBLY IS SET-UP PER THE DRAWING.
2. TURN THE MTI UNITS ON OR OFF AS DIRECTED IN THE TEST DATA SPREADSHEET.
3. OPEN THE NIST CAL GAS BOTTLE (ITEM 1)
4. SET THE CAL GAS PRESSURE REGULATOR TO 10-15 PSIG (ITEM 2)
5. TURN THE THREE WAY VALVE (ITEM 4) SO THAT THE CAL GAS IS SENT TO THE ELECTRONIC FLOW METER (ITEM 5)
6. USING THE FLOW CONTROL NEEDLE VALVE (ITEM 3) SET THE FLOW AS DIRECTED IN THE TEST DATA SPREADSHEET.
7. ONCE THE PROPER FLOW SETTING HAS BEEN OBTAINED, SWITCH THE THREE WAY VALVE (ITEM 4) SO THAT THE CAL GAS IS NOW ON THE TRACE ERASE.
8. ENSURE THE SAMPLE PUMP (ITEM 8) IS IN SERVICE.
9. SET FLOW CONTROL VALVE (ITEM 6) FOR A 2 PSIG DISCHARGE PRESSURE.
10. SET THE FLOW CONTROL VALVE (ITEM 10) TO EQUAL FLOW THROUGH GC SAMPLE VALVE.
11. SET THE FLOW CONTROL VALVE (ITEM 12) TO PROVIDE THE REQUIRED SAMPLE TO THE SERVOMEX 1400 O2 ANALYZER (ITEM 13 & 14) AND SIEMENS IR ANALYZER MEASURING METHANE, CO2 AND CO.
12. SET IR SUCTION STARVE (ITEM15) TO SPLIT THE IR AND O2 FLOW.
13. RECORD RESULTS AS DIRECTED IN THE MTI TEST FORM PROVIDED.

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	MFG.	P/N
1	1	NIST CAL GAS BOTTLE	N/A	TBD
2	1	PRESSURE REGULATOR w/GAUGE	N/A	TBD
3	1	FLOW CONTROL VALVE	N/A	TBD
4	1	3-WAY SELECT VALVE ~ MTI OR FLOW METER	N/A	TBD
5	1	ELECTRONIC FLOW METER	N/A	TBD
6	1	PUMP SUCTION STARVE	N/A	TBD
7	1	MTI UNIT A WITH CONTAINMENT CAP	N/A	TBD
8	1	SAMPLE PUMP	N/A	TBD
9	1	GAUGE	N/A	TBD
10	1	FLOW CONTROL VALVE GC BYPASS	N/A	TBD
11	1	SIEMENS GC	N/A	TBD
12	1	FLOW CONTROL VALVE TOIR / O2 AX	N/A	TBD
13	1	SERVOMEX O2 AX	N/A	TBD
14	1	SERVOMEX IR AX	N/A	TBD
15	1	FLOW CONTROL VALVE IR PUMP SUCTION	N/A	TBD

NOTES:
1. CONTAINMENT SYSTEMS USED CONSISTED A 2' X 2' X 2' OPEN BOTTOM CONTAINER. THE CONTAINMENT SIZING WAS CHANGED TO ENSURE THERE WAS SUFFICIENT O2 AVAILABLE TO THE TRACE ERASE.

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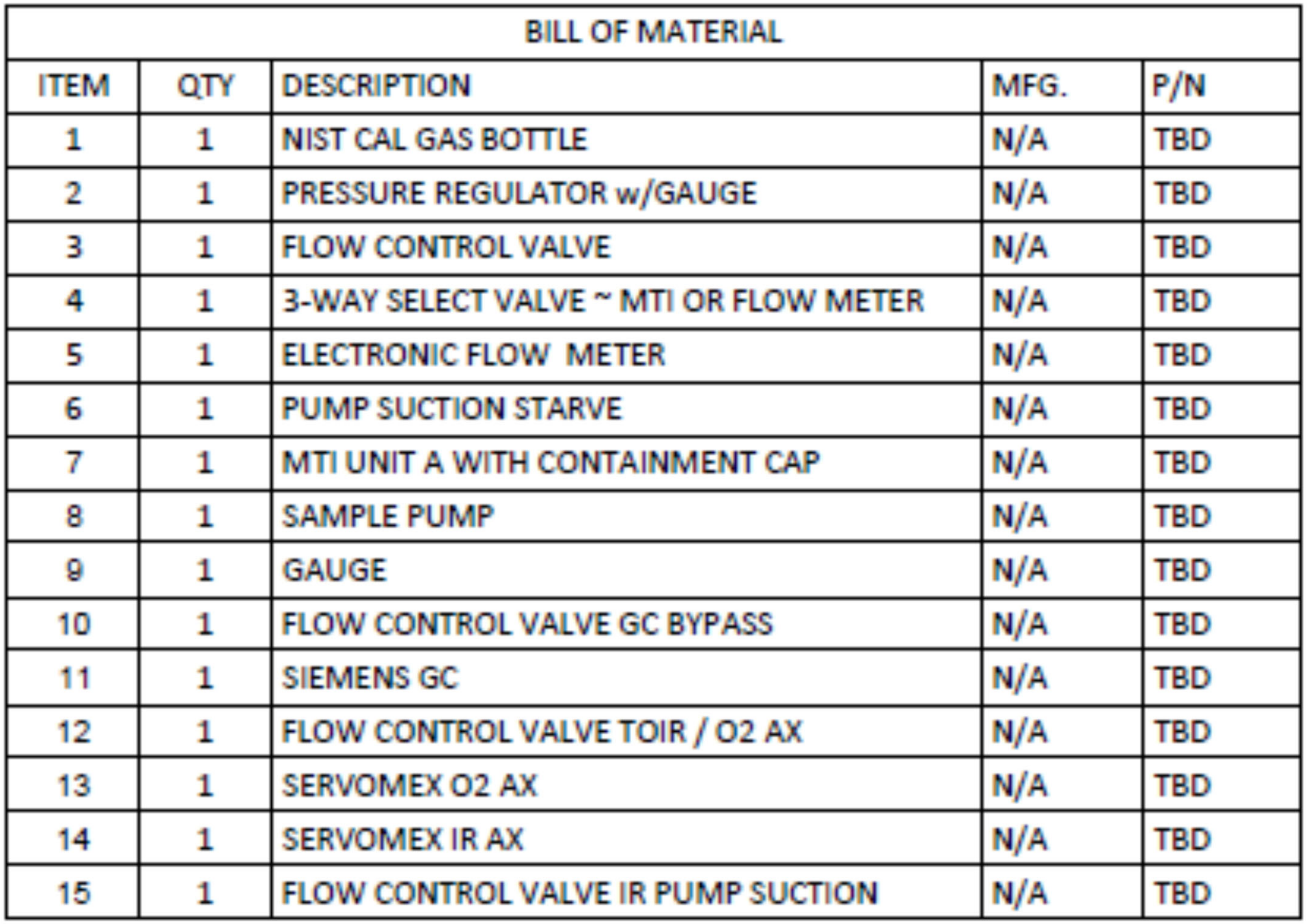
FIGURE 3.1 – TRACEERASE™ TESTING DEVICE BOM



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	MFG.	P/N
1	1	NIST CAL GAS BOTTLE	N/A	TBD
2	1	PRESSURE REGULATOR w/GAUGE	N/A	TBD
3	1	FLOW CONTROL VALVE	N/A	TBD
4	1	3-WAY SELECT VALVE ~ MTI OR FLOW METER	N/A	TBD
5	1	ELECTRONIC FLOW METER	N/A	TBD
6	1	PUMP SUCTION STARVE	N/A	TBD
7	1	MTI UNIT A WITH CONTAINMENT CAP	N/A	TBD
8	1	SAMPLE PUMP	N/A	TBD
9	1	GAUGE	N/A	TBD
10	1	FLOW CONTROL VALVE GC BYPASS	N/A	TBD
11	1	SIEMENS GC	N/A	TBD
12	1	FLOW CONTROL VALVE TOIR / O2 AX	N/A	TBD
13	1	SERVOMEX O2 AX	N/A	TBD
14	1	SERVOMEX IR AX	N/A	TBD
15	1	FLOW CONTROL VALVE IR PUMP SUCTION	N/A	TBD

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CATALYTIC DEVICE TEST PROCEDURE

The following is the test procedure for the TRACERASE™.

1. Cal gas bottle with:
    a. Methane = 50%
    b. Ethane = 25%
    c. Propane = 25%
2. Calibrate all the analyzers and record calibration results
3. Place the top 2/3 of the TRACErase™ inside Containment System
4. Connect Sample Inlet from Cal Gas Bottle to Flow Meter
5. Connect outlet of containment system to Servomex O2 AX, then Siemens Ultramat, and last Siemens Maxum II GC
6. Run the test for 1 hour with the Cal Gas Flow set at each of the following flows:
    a. 100 cc/min = 338 BTU-HR
    b. 200 cc/min = 676 BTU-HR
    c. 300 cc/min = 1,014 BTU-HR
    d. 600 cc/min = 2,028 BTU-HR
7. Record results. Fill in testing spreadsheet for each test.
8. Record the excess O2 readings from the Servomex 1400 analyzer
9. Record the Methane, CO2, and CO readings from the Siemens Ultramat IR analyzer
10. Record the Siemens Maxum II GC readings for the Methane, Ethane, Propane, CO2, N2, O2 and water
11. At the end of the test, check the calibration on all analyzers and record the results
12. Repeat the test two additional times
13. After the first triplicate test is completed on TRACErase™ #1, then this was test was duplicated for TRACErase™#2

Note that during the testing, different size containment systems were used to ensure the containment hardware was not creating an issue for the catalytic technology. During the test, the following containment devices were used:

1. 4” x 6” - 316SS Pipe
2. 2’W x 2’D x 2’H - Containment system
3. 2.5’W x 2.5’D x 6’H – Containment system

Except for the first test with results shown in Table 4.1, all final test results were developed using the 2’W x 2’D x 2’H – 8 SCF Containment system. The oxygen concentration was always > 20%.

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SECTION 4 - TESTING RESULTS

The initial testing was done simply to determine the correct BTU throughput of the catalytic device. As there are different BTU throughputs provided in vendor documents in the public domain, the goal of the testing was to determine whether the 750, 1,000 or 2,000 BTU per hour claim was correct. During the initial testing, the only hydrocarbon measured was Methane. Two analyzers were employed during the initial testing. These were the Servomex 1400 paramagnetic oxygen analyzer to ensure there was excess oxygen on the surface of the flame arrestor. A Siemens Ultramat IR measuring for Methane (%), CO2 (%), and CO was also used. Table 4.1 below provides the average Methane and excess Oxygen readings from the initial testing. Note, the average data is the result from 13 individual tests. Each test was conducted for a period of 1 hour with analysis results taken every five minutes. A total of 169 individual analyses were used to compile the average test results. This test was conducted May 30th and 31st, 2023.

During this testing, a NIST calibration gas bottle containing 50% Methane, 25% Ethane, and 25% Propane was used. Flow rates were changed to determine the conversion of Methane into CO2 or Water Vapor. During the test, the excess O2 present on the surface of the flame arrestor was also monitored.

As seen in the test data, at all flow settings Methane was present in the containment system. As the flow rate was increased, the concentration of the Methane also increased. At the same instance, the excess O2 decreased. This was an indication to those reviewing the data that conversion was taking place, but not 99.9% conversion; otherwise, the Methane readings would have been at or near zero in the effluent gas. Also to be noted, but not shown in Table 4.1, are the CO2 analysis results as reported by the Siemens Ultramat IR. In all cases during the testing, once the hydrocarbon stream was introduced, the CO2 reading was over-ranged. This was again an indication the catalytic device was working but did not allow for the conversion efficiency to be determined. As the flow rate of the gas to be converted was increased, the Methane reading also increased. The initial test results indicated the Methane was not being converted at the stated efficiency of 99.9% at any of the BTU throughputs noted in Table 4.1.

TABLE 4.1 – METHANE AND OXYGEN RESULTS FROM EFFLUENT GAS OF TRACERSE™ – STANDARD WAS A NIST SAMPLE GAS CONTAINING METHANE 50%, EHTANE 25% AND PROPANE 25% - SMALL CONTANMENT SYSTEM

TEST	FLOW RATE CC/MIN	MTI-BTU THROUGHPUT PER HOUR	METHANE READING -%	O2 READING-%
1	150	495.5404451	2.95	15.61
2	200	660.7205934	4.32	15.11
3	225	743.3106676	6.66	14.90
4	300	991.0808901	7.37	14.72
5	500	1651.801484	10.71	14.31

After completing the initial testing, a Siemens Maxum II GC was applicated to measure for Methane, Ethane, Ethylene, Propane, Propylene, CO2, N2, O2, and water vapor. The intent of this test was to determine the conversion efficiency for the hydrocarbons present in the calibration gas bottle containing 50% Methane, 25% Ethane, and 25% Propane. In Table 4.2 below are the average analysis results of the catalytic device in operation but with the catalyst removed. The data to establish the average is compiled from six individual tests conducted over a period of one hour. A total of 72 individual analyses were used to determine the average for each component present in the effluent stream of the catalytic device.

TABLE 4.2 – ANALYSIS AVERAGE RESULTS FROM EFFLUENT GAS OF HOT CATALYTIC DEVICE WITH THE CATALYST REMOVED

750 BTU-HR	METHANE-SIEMENS IR (%)	O2-SERVOMEX (%)	METHANE-SIEMENS GC (%)	ETHANE-SIEMENS GC (%)	PROPANE-SIEMENS GC (%)
AVERAGE NO CATALYST	0.2544	20.2055	0.1578	0.0875	0.0728

After determining the concentration of the hydrocarbons present in the catalytic device containment system, the catalyst was reinstalled into the TRACErase^{TM} and the test conducted again under the same prior conditions or baseline test. Results from this test are below in Table 4.3.

TABLE 4.3 – ANALYSIS AVERAGE RESULTS FROM EFFLUENT GAS OF HOT CATALYTIC DEVICE WITH THE CATALYST INSTALLED

750 BTU-HR	METHANE-SIEMENS IR (%)	O2-SERVOMEX (%)	METHANE-SIEMENS GC (%)	ETHANE-SIEMENS GC (%)	PROPANE-SIEMENS GC (%)
AVERAGE WITH CATALYST	0.216	19.7733	0.1300	0.0697	0.0441

By comparing the gas effluent results from the catalytic device containment system in Table 4.2 with the results in Table 4.3, the actual conversion efficiency could be established. These are noted in Table 4.4 below.

TABLE 4.4 – AVERAGE HYDROCARBON CONVERSION EFFICIENCY OF THE TRACEERASE^{TM} DEVICE

TEST DATA AVERAGE – 750 BTU-HR	METHANE CONVERSION - SIEMENS IR (%)	METHANE CONVERSION - SIEMENS GC (%)	ETHANE CONVERSION -SIEMENS GC (%)	PROPANE CONVERSION - SIEMENS GC (%)
CONVERSION	**15.11%**	**17.56%**	**20.30%**	**39.42%**

Tables 4.2, 4.3, and 4.4 above provide the average analysis results and thus conversion for all the various TraceErase^{TM} devices tested by the Smith Analytical and Stake Holder Analyzer Specialists who conducted the testing. Tables 4.5, 4.6, and 4.7 provide the conversion data for the best operating TRACErase^{TM} unit used during the testing.

TABLE 4.5 – ANALYSIS RESULTS FROM EFFLUENT GAS OF CATALYTIC DEVICE WITH THE UNIT HOT AND THE CATALYST REMOVED FOR THE SINGLE BEST OPERATING UNIT

TRACERASE HOT WITH NO CATALYST 750 BTU-HR	METHANE-SIEMENS IR (%)	O2-SERVOMEX (%)	METHANE-SIEMENS GC (%)	ETHANE-SIEMENS GC (%)	PROPANE-SIEMENS GC (%)
READING	**0.315**	**20.5**	**0.150833333**	**0.0825**	**0.058333333**

TABLE 4.6 – ANALYSIS AVERAGE RESULTS FROM EFFLUENT GAS OF HOT CATALYTIC DEVICE WITH THE CATALYST INSTALLED

TRACERASE HOT WITH CATALYST 750 BTU-HR	METHANE-SIEMENS IR (%)	O2-SERVOMEX (%)	METHANE-SIEMENS GC (%)	ETHANE-SIEMENS GC (%)	PROPANE-SIEMENS GC (%)
READING	**0.275**	**20.2166667**	**0.125833333**	**0.0533333**	**0.0265**

TABLE 4.7 – AVERAGE HYDROCARBON CONVERSION EFFICIENCY OF THE TRACEERASE™ DEVICE

SINGLE TRACE ERASE UNIT PERFORMANCE @ 750 BTU-HR	METHANE-SIEMENS IR (%)	METHANE-SIEMENS GC (%)	ETHANE-SIEMENS GC (%)	PROPANE-SIEMENS GC (%)	BTU-THROUGHPUT PER HOUR
READING	**12.70%**	**16.57%**	**35.35%**	**54.57%**	**750**

As the number of carbons increase in the hydrocarbon molecule, the conversion increases. None of the hydrocarbon conversions meet the 99.9% conversion efficiency noted in the manufacturer's literature. In all test cases, the calibration gas flow was maintained with the BTU throughput of 750 per hour. The testing to determine the efficiency of the catalytic device was conducted using the same equipment, with a total of ten tests conducted over a period of approximately twenty-four hours by six different analyzer specialists. A total of 117 analyses were used to determine the average data.

A separate test was conducted to determine the conversion efficiency for Ethylene and Propylene, which are defined as highly reactive volatile organic hydrocarbons (HRVOC's). Their release into the atmosphere in the EPA non-attainment areas is regulated by local, state, and or federal government agencies. As with the test done for the Methane, Ethane, and Propane conversion, the catalytic device was placed into service with the catalyst removed, and the exhaust gas from the containment system was analyzed. Analysis results for this test are found in Table 4.8 below. Then the catalyst was reinstalled, and the test was conducted again. Analysis results for this test are found in Table 4.9 below. Note the change in the CO2 concentration in Table 4.8 versus Table 4.9. This is an indication the catalytic device was converting. Also, note the presence of CO in Table 4.9 when the Ethylene and Propylene were introduced into the catalytic device. The CO is produced by the incomplete conversion of the unsaturated hydrocarbons into CO2. This is an indication there is insufficient air available for proper conversion. As the gas to be converted is starved of air, it generates higher levels of CO due to insufficient oxygen to produce carbon dioxide (CO2) [4]. The conversion efficiency was calculated by comparing the test data with the catalyst removed to the test results with the catalyst installed. All other conditions during the test were controlled. See Table 4.10 below provides the conversion noted during the test.

TABLE 4.8 – HRVOC CONVERSION EFFICIENCY OF THE TRACEERASE^{TM} DEVICE - ANALYSIS RESULTS WITH UNIT HOT AND CATALYST REMOVED

	ETHYLENE-SIEMENS GC (%)	PROPYLENE SIEMENS GC (%)	02 SIEMENS GC (%)	N2-SIEMENS GC (%)	CO2-SIEMENS GC (%)	CO-SIEMENS GC (%)	BTU-THROUGHPUT PER HOUR
SPAN TEST BOTTLE	**30**	**70**	**0**	**0**	**0**	**0**	**1832**
1	0.0607	0.1461	20.51	76.53	0.1015	0	**750**
2	0.0672	0.144	20.53	76.47	0.1014	0	**750**
3	0.0656	0.1417	20.53	76.46	0.1012	0	**750**
4	0.0628	0.1456	20.53	76.48	0.104	0	**750**
5	0.0673	0.1476	20.535	76.51	0.1047	0	**750**
6	0.0673	0.1476	20.53	76.51	0.1047	0	**750**
7	0.0682	0.1483	20.538	76.51	0.106	0	**750**
8	0.0704	0.1518	20.52	76.46	0.1098	0	**750**
9	0.0655	0.1404	20.55	76.56	0.1059	0	**750**
10	0.0673	0.146	20.52	76.483	0.1073	0	**750**
11	0.0633	0.136	20.549	76.497	0.1049	0	**750**
12	0.0645	0.1411	20.56	76.57	0.1069	0	**750**
13	0.0658	0.1411	20.57	76.601	0.1082	0	**750**
AVERAGE	**0.06583846**	**0.144407692**	**20.53631**	**76.51084615**	**0.105115**	**0**	**750**

TABLE 4.9 – HRVOC CONVERSION EFFICIENCY OF THE TRACEERASE^{TM} DEVICE - ANALYSIS RESULTS WITH UNIT HOT AND CATALYST INSTALLED

	ETHYLENE-SIEMENS GC (%)	PROPYLENE SIEMENS GC (%)	02 SIEMENS GC (%)	N2-SIEMENS GC (%)	CO2-SIEMENS GC (%)	CO-SIEMENS GC (%)	BTU-THROUGHPUT PER HOUR
SPAN TEST BOTTLE	**30**	**70**	**0**	**0**	**0**	**0**	**1832**
1	0.0137	0.0464	20.25	76.55	0.2607	0	**750**
2	0.0156	0.0498	20.3	76.69	0.2855	0.0086	**750**
3	0.0175	0.0484	20.29	76.79	0.3023	0.0175	**750**
4	0.0178	0.0466	20.324	76.9	0.3084	0.0175	**750**
5	0.0186	0.0477	20.344	76.91	0.3009	0.0225	**750**
6	0.0192	0.0472	20.34	76.93	0.3033	0.0321	**750**
7	0.0192	0.0486	20.35	76.915	0.3057	0.0326	**750**
8	0.0187	0.0479	20.36	76.98	0.2909	0.0322	**750**
9	0.0186	0.0474	20.39	76.98	0.2899	0.0367	**750**
10	0.0181	0.0463	20.38	77.03	0.2878	0.0376	**750**
11	0.0176	0.0446	20.38	76.94	0.2838	0.037	**750**
12	0.0173	0.044	20.39	76.99	0.2805	0.0411	**750**
13	0.0192	0.0463	20.43	77.11	0.2785	0.0412	**750**
AVERAGE	**0.01777692**	**0.04701538**	**20.3483076**	**76.9011538**	**0.29063076**	**0.0274307**	**750**

TABLE 4.10 – HRVOC CONVERSION EFFICIENCY OF THE TRACEERASE^{TM} DEVICE

TEST 750 BTU-HR	ETHYLENE-SIEMENS GC (%)	PROPYLENE SIEMENS GC (%)	BTU-THROUGHPUT PER HOUR
CONVERSION	**73.00%**	**67.44%**	**750.00**

Table 4.11 provides the calibration data for the Siemens Maxum II GC and the Servomex 1400 Paramagnetic Oxygen analyzer for the testing conducted in the tables above.

TABLE 4.11 – CALIBRATION DATA

Cyl# EB0101059	O2-SERVOMEX (%)	ETHYLENE-SIEMENS GC (%)	PROPYLENE SIEMENS GC (%)
CAL BOTTLE	20.95	30	70
TEST			
1	21.01	30.16	70.13
2	20.96	30.1	70.16
3	21.03	30.09	70.17
4	20.95	30.13	70.24
5	21.00	30.13	70.22
6	20.97	30.11	70.21
AVERAGE	**20.98**	**30.12**	**70.18**

The last test conducted on the Tracerase involved the use of the previously used Methane (50%), Ethane (25%) and Propane (25%) and then a bottle containing Methane (100%). The purpose of the final testing was to perform a final conversion efficiency test on the device, while measuring the effluent with the Smith Analytical owned analyzers and then also collecting samples in summa canisters, which were sent to Enthalpy Analytical, LLC to have an EPA Method 14 Total Organic Analysis (TOA-14) performed on the collected samples. The EPA TOA-14 is a procedure for sampling and analysis of volatile organic compounds (VOCs) in ambient air. The method was originally based on collection of whole air samples in SUMMA® passivated stainless-steel canisters, but has now been generalized to other specially prepared canisters. The VOCs are separated by gas chromatography and measured by a mass spectrometer or by multidetector techniques. This method presents procedures for sampling into canisters to final pressures both above and below atmospheric pressure, respectively referred to as pressurized and sub-atmospheric pressure sampling. [5]

In Table 4.12 are the calibration results in triplicate for the Smith Analytical owned equipment used for the final testing.

TABLE 4.12 – CALIBRATION DATA JUNE 26, 2024

SMITH ANALYTICAL					
TEST	**RUN**	**02-SIEMENS GC (%)**	**METHANE-SIEMENS GC (%)**	**ETHANE-SIEMENS GC (%)**	**PROPANE-SIEMENS GC (%)**
AIR		**20.95**			
METHANE, ETHANE, PROPANE CAL BOTTLE			**50**	**25**	**25**
SPAN TEST	1	20.86	50.53	25.1	24.95
SPAN TEST	2	20.87	50.18	25.02	25.03
SPAN TEST	3	20.87	50.18	25.01	25
	AVERAGE	**20.86**	**50.29**	**25.04**	**24.99**

In Table 4.13 are the conversion results as reported by Smith Analytical equipment and also by Enthalpy Analytical, LLC for the Methane (50%), Ethane (25%) and Propane (25%) from the final test conducted on June 26th and 27th, 2024. Enthalpy performed an EPA Total Organic Analysis Method 14A test on the samples provided by Smith Analytical. Note that Enthalpy holds certifications from the US Department of Defense (DOD) and their rigorous quality standards with their DOD environmental lab. Enthalpy is also accredited under the National Environmental Laboratory Accreditation Program (NELAP), an organization designed to foster the generation of environmental laboratory data of a known and documented quality through uniform national performance standards. Enthalpy maintains NELAP certifications in conjunction with assorted local, state, and government certifications. Enthalpy's quality systems ensure data is technically accurate, legally defensible, and appropriate for its intended purpose through our certified environmental laboratory.

TABLE 4.13 – CONVERSION DATA FROM JUNE 26, 2024 TEST

TEST	**METHANE-SIEMENS GC (%)**	**ETHANE-SIEMENS GC (%)**	**PROPANE-SIEMENS GC (%)**	**BTU PER HOUR THROUGHPUT**
SPAN TEST BOTTLE	**50**	**25**	**25**	
SMITH ANALTICAL TEST DATA -C1, C2 & C3 CONVERSION HOT WITH CATALYST	**29.27%**	**47.58%**	**67.17%**	**750**
ENTHALPY ANALTICAL TEST DATA -C1, C2 & C3 CONVERSION HOT WITH CATALYST	**30.00%**	**47.76%**	**61.19%**	**750**

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While the main objective of this test was to determine the actual BTU throughput of the device, Smith Analytical was informed by the manufacturer that the Tracerase™ had been tested on 100% Methane and that the test data was "not available as this device was not used on streams containing 100% Methane". Smith Analytical tested the catalytic converter on 100% Methane and operated the new unit as designed. As noted in Table 4.14, the Methane conversion with the unit operating at 750 BTU-HR throughput was 81.83% as reported by the Siemens GC. The excess O2 present in the containment system was 20.93% as reported by the Siemens GC. The CO2 concentration was 0.1745% as reported by the Siemens GC.

TABLE 4.14– METHANE CONVERSION DATA WITH TRACERSE™ OPERATING AS DESIGNED ON METHANE GAS-JUNE 27, 2024 TEST

100% METHANE TEST	METHANE-CONVERSION	O2 (%) SIEMENS GC	CO2-SIEMENS GC (%)
SMITH ANALYTICAL DATA FOR CONVERSION OF 100% METHANE - HOT WITH CATALYST AS DESIGNED	81.83%	20.93%	0.1745%

To understand if the 99.9% conversion efficiency in the Vendors documentation could be obtained, air was added and mixed with the combustion gas before being introduced into the Tracerase™. The results of this test are noted in Table 4.15 below. When this was done at the proper ratio of Methane to air, the Methane conversion with the unit operating at 750 BTU-HR throughput was 100% as reported by the Smith Analytical Siemens GC. The excess O2 present in the containment system was 20.90% as reported by the Siemens GC. The CO2 concentration increased from 0.1745% to 0.2436% as reported by the Siemens GC. The increase in the CO2 indicates that air is required to obtain the advertised conversion efficiency. A sample from this test was collected and also analyzed by Enthalpy Analytical, LLC per EPA Method TO-14A. While the Smith Analytical gas chromatograph reported 100% conversion, Enthalpy Analytical reported 96.85% conversion for the Methane. This difference is attributed to the types of detectors being used in the respective gas chromatographs. The Siemens GC used by Smith Analytical is equipped with a thermo-conductivity detector. The Enthalpy Analytical gas chromatograph utilizes a mass spectrometer for the detection method. The mass spectrometer detector is more accurate at the low end of the scale when compared to a thermo-conductivity detector.

TABLE 4.15– METHANE CONVERSION DATA WITH TRACERSE™ OPERATING WITH AIR ADDED TO THE METHANE GAS-JUNE 27, 2024 TEST

AIR ADDITION TEST ON 100% METHANE	METHANE-SIEMENS GC (%)	O2 (%) SIEMENS GC	CO2-SIEMENS GC (%)
SMITH ANALYTICAL DATA FOR CONVERSION OF 100% METHANE - HOT WITH CATALYST AS DESIGNED & AIR ADDED @ 750 BTU-HR	100%	20.90%	0.2436%
ENTHALPY ANALTICAL CONVERSION OF 100% METHANE - HOT WITH CATALYST AS DESIGNED & AIR ADDED @ 750 BTU-HR	96.85%		

In Table 4.16 is the conversion data reported by Smith Analytical and Enthalpy Analytical, LLC when the Methane (50%), Ethane (25%) and Propane (25%) standard gas was mixed with air at the proper ratio prior to being introduced into the catalytic device.

TABLE 4.16– METHANE, ETHANE AND PROPNE CONVERSION DATA WITH TRACERSE™ OPERATING WITH AIR ADDED TO THE TEST GAS-JUNE 27, 2024 TEST

750 BTU-HR TEST ON METHANE, ETHANE AND PROPANE WITH AIR ADDED	METHANE (%)	ETHANE (%)	PROPANE (%)
SMITH ANALYTICAL DATA FOR CONVERSION OF 50% METHANE, 25% ETHANE, 25% PROPANE - HOT WITH CATALYST AS DESIGNED & AIR ADDED	100%	100%	100%
ENTHALPY ANALTICAL DATA FOR CONVERSION OF 50% METHANE, 25% ETHANE, 25% PROPANE - HOT WITH CATALYST AS DESIGNED & AIR ADDED	96.85%	98.76%	99.46%

As with the data in Table 4.15, the conversion data difference in Table 4.16 between Smith Analytical and Enthalpy is attributed to the minimum detection limits of detectors being used in the respective gas chromatographs. This indicates the need for highly accurate test equipment when optimizing the catalytic device for service.

In reviewing peer research on the conversion of saturated and unsaturated hydrocarbons into CO2 and Water Vapor, the data collected during the test is supported by earlier findings. Molecules with double or triple are easier to convert [6,7,8]. Single bonded Methane, Ethane, and Propane are the most difficult to convert. Double bonded Ethylene and Propylene are easier to convert. Triple bonded Ethyne and Propyne will convert with NO O2 added per catalyst research performed by others. Ethane (C2H6) and Propane (C3H8) have a higher molecular mass than Methane (CH4). Ethane and Propane are larger in size, so there is greater interaction between their molecules and the catalyst. Ethane and Propane have a greater number of electrons, so the intermolecular forces of attraction (id-id, since alkanes are non-polar) is greater.

It was noted in the Enthalpy Analytical, LLC EPATO-Method 14A test data that when the catalytic device was operated with the catalyst removed, there was .034% Propylene measured in the test using Methane (50%), Ethane (25%) and Propane (25%) standard gas. When the catalyst was reinstalled and the catalytic device operated as designed, the lack of air available at or near the catalyst bed resulted in the Propane being cracked into Propylene. The concentration reported by the EPA-TO 14A analysis indicates the Propylene concentration was 1.75%. The Smith Analytical Siemens GC reported the same scenario. Ethane is converted into Ethylene and Propane into Propylene when insufficient air is available during the reaction. While the Ethane to Ethylene conversion occurs, the concentration of Ethane converted into Ethylene in an oxygen deficient is small relative to the Propane to Propylene conversion noted.

SECTION 5 - EMISSIONS FROM IMPROPER OPERATION

For the purpose of understanding the fugitive emissions from an improperly operating catalytic device, Table 8 below notes the approximate annual emissions utilizing the established conversion from the testing conducted and noted in Table 5.1.

TABLE 5.1 -- ANNUAL CALCULATED HYDROCARBON FUGITIVE EMISSIONS PER CATALYTIC DEVICE BASED ON VARIOUS BTU THROUGHPUTS IN THE PUBLIC DOMAIN IF THE GAS IS A MIXTURE OF METHANE, ETHANE AND PROPANE

COMPONENT	SIZED FOR 750 BTU-HOUR-ANNUAL EMISSIONS IN POUNDS	SIZED FOR 1,000 BTU-HOUR ANNUAL EMISSIONS IN POUNDS	SIZED FOR 2,000 BTU-HOUR ANNUAL EMISSIONS IN POUNDS
METHANE	194	259	518
ETHANE	171	228	457
ETHYLENE	87	116	231
PROPANE	82	108	217
PROPYLENE	68	91	182

SECTION 6 - SOLUTION TO ENSURE THE CATALYTIC TECHNOLOGY IS PROPERLY WORKING

Smith Analytical conducted additional testing to better understand how the conversion efficiency of 99.9% could be achieved. The issue with this technology is that it relies on ambient oxygen present at the surface of the catalyst for oxidation of the sample into CO2 and Water Vapor. It was determined during testing that the catalytic units will not work at the stated 99.9% efficiency, unless the gas introduced to the catalytic device is a mixture of the gas to be converted in the presence of oxygen, which must be premixed before the gas is introduced into the catalytic device.

The following patent pending modification is required for catalytic emissions technology to work as stated in the manufacturer data cutsheets. With this modification and proper maintenance of the catalytic device, BTU throughput is 750 per hour with 99%+ conversion efficiency.

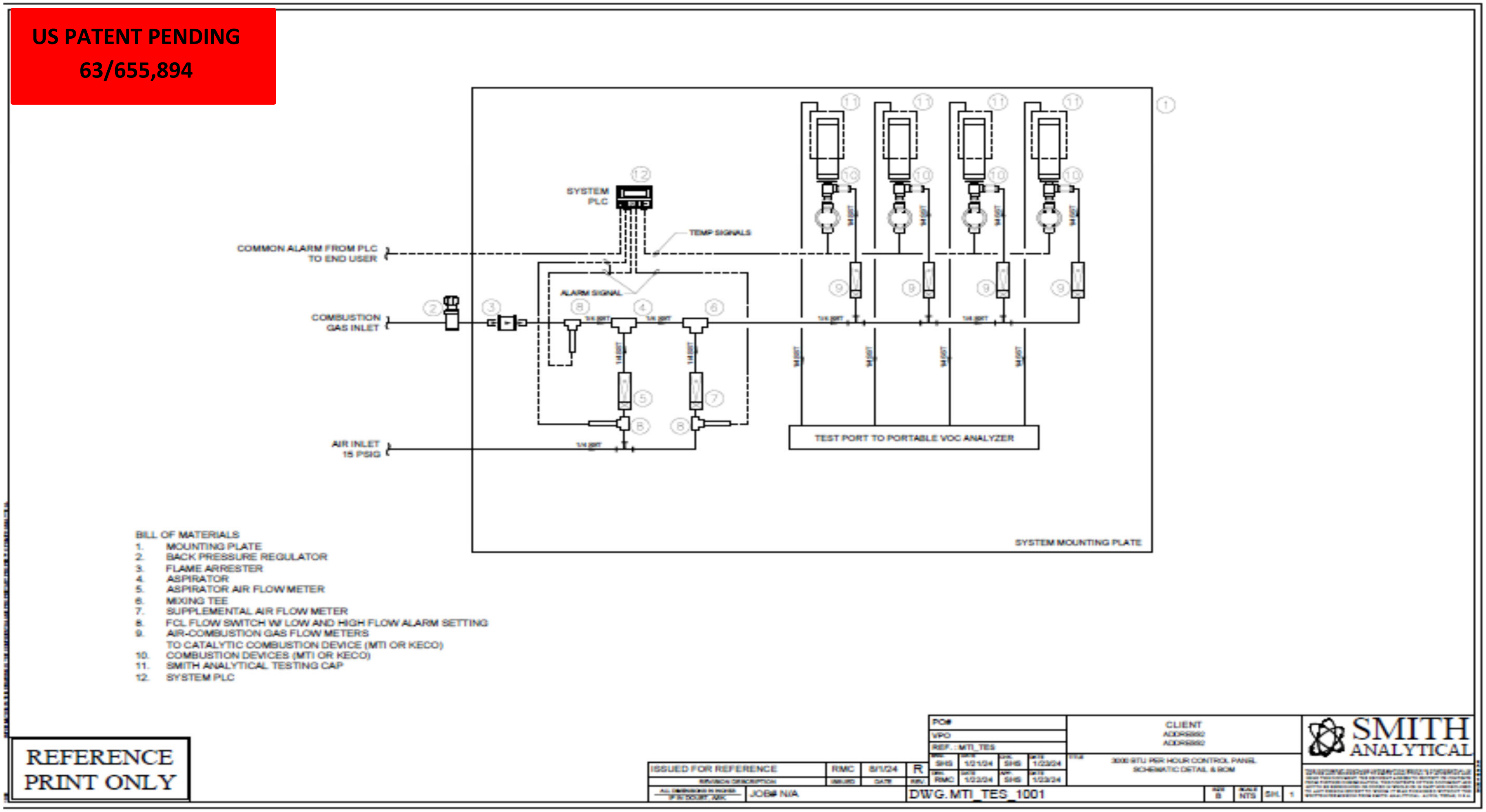
The following must be added:

1. Smith Analytical patent pending flow control panel for the gas conversion and the needed make up air. See Figure 6.1 below.
2. For the catalytic technology to work at the stated conversion efficiency, and the gas to be converted into CO2 and water vapor, the gas must be at a specific BTU value between the LEL and UEL for the gas mix
3. A flame arrestor on the inlet of the control panel is required to prevent flame propagation back into the vent header
4. A vacuum regulator is required to ensure the vent header is maintained at a constant pressure
5. See Figure 3 Control Panel Installation diagram below. Note each control panel is designed to feed up to four catalytic devices

   A. Existing ATM Vent Header
   B. Flame Arrestor to prevent flame propagation back into the ATM Vent Header
   C. Modified Vent Header to Gas Control Panel
   D. Smith Analytical Gas Control Panel
   E. Modified Vent Header to Catalytic Device
   F. Existing catalytic device
   G. LDAR Testing Cap

5318 FM 517 West
Building A
Alvin, Texas 77511
www.SmithAnalytical.com
(832) 738-1841

FIGURE 6.1 – SMITH ANALYTICAL CONTROL PANEL FOR FOUR CATALYTIC DEVICES



BILL OF MATERIALS
1. MOUNTING PLATE
2. BACK PRESSURE REGULATOR
3. FLAME ARRESTER
4. ASPIRATOR
5. ASPIRATOR AIR FLOW METER
6. MIXING TEE
7. SUPPLEMENTAL AIR FLOW METER
8. FCL FLOW SWITCH W/ LOW AND HIGH FLOW ALARM SETTING
9. AIR-COMBUSTION GAS FLOW METERS TO CATALYTIC COMBUSTION DEVICE (MTI OR KECO)
10. COMBUSTION DEVICES (MTI OR KECO)
11. SMITH ANALYTICAL TESTING CAP
12. SYSTEM PLC

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SECTION 7 - SUMMARY & CONCLUSIONS

As noted at the beginning of this report, the testing of the catalytic converter technology was undertaken to determine the correct BTU-HR throughput, as testing data to support any of the BTU throughput claims was not available in the public domain.

During tested it was determined that long chain hydrocarbons react first with the catalyst. As the molecules are converted into CO2 and water vapor, these consume the available excess oxygen present at the surface of the catalyst. One molecule of Propane converted into CO2 and water vapor requires two and a half times more oxygen than converting Methane into CO2 and water vapor as shown in Figure 7.1 below.

FIGURE 7.1 HYDROCARBON CONVERSION

$$CH_4 + 2(O_2) \rightarrow CO_2 + 2(H2O)$$

$$C_3H_8 + 5(O_2) \rightarrow 3(CO_2) + 4(H2O)$$

The lack of excess oxygen in the region of the catalyst prevents the stated conversion efficiency from being obtained. During testing on the methane, ethane and propane standard, it was noted that the propane reaction took place first, followed by the ethane and finally the methane. This resulted in the propane having the best overall conversion efficiency, while methane had the worst. When 100% methane was introduced into the catalytic device, the methane conversion improved significantly, as this was the only hydrocarbon molecule present and thus consumed the excess oxygen present at the surface of the catalyst.

When the 30% ethylene and 70% propylene standard was introduced into the catalytic device, the ethylene reacted first with the catalyst followed by the propylene.

In discussing the BTU throughput and efficiency data with Trace Technology who manufacturers the catalytic device, they made the following statements to Smith Analytical in an email correspondence on May 23, 2024:

1. “There is no specific BTU limit on the unit, just a flow rate limit of 1 L/min. The BTU throughput would be based on the gas that flows through it. There is only a single catalyst.”
2. “Our test data on the catalyst material shows over 99% efficiency specifically for 100% clean methane. We don't share the data, since no one is actually using this in their application, and we can't really guarantee performance for unknown/untested gas streams. It should be similar for other hydrocarbon gas streams.”

The published information for the catalytic technology can be confusing to the end user. For example, MTI 750 BTU-HR documentation states: “Flow Rate: 1 liter / minute (0.035 scfm) (750 btu / hour maximum).” Most end users focus on the flow rate noted and not the BTU/ HR noted on the Vendors’ cutsheet.

During testing, it was determined the catalytic technology conversion efficiency in the published Vendors' information was not substantiated. The testing was conducted at the lowest BTU throughput of 750 BTU-HR that is noted in published documents. After extensive testing, the issue with the catalytic technology is that the claim made in the datasheet that, "Oxygen for the combustion of hydrocarbon products is provided by ambient air and additional oxygen or air is not required," could not be substantiated.

In reviewing US Patent for Monolithic ceramic filter Patent (Patent # 5,855,781) Filed: May 13, 1997, Date of Patent: January 5, 1999, Assignee: Noritake Co., Ltd., Inventors: Hiroshi Yorita, Hisatomi Taguchi, Yuji Kamei, the claim that the catalyst would operate properly without the addition of oxygen is not made by the Inventors.

In a quest to understand how the 99.9% conversion efficiency claim was made, additional modifications and testing was completed on the catalytic technology, and it was determined that when the proper amount of air was added to the gas to be converted prior to entering the catalytic device, then the 99%+ conversion efficiency could be obtained. During the air-addition testing, using various samples containing Methane, Ethane, Ethylene, Propane, and Propylene, it was determined that the quantity of air to be added to the gas to be converted prior to entering the catalytic device must be precise. If an insufficient amount of air is added, then all the hydrocarbons will not be converted. If too much air is added, then due to temperature–time trajectories of the catalytic device, it will not operate properly and conversion efficiency is reduced [9,10].

For proper operation of the catalytic technology, the device must be equipped with the control panel discussed in this paper with the required hardware to ensure:

1. The vent header the gas is provided from is maintained at a constant pressure of 14.7 psig or 0 psig
2. Provides for protection against flame propagation back into the vent header from which the gas was supplied
3. Provides the motive force to transport the gas through the control panel
4. The air monitoring and flow control hardware
5. The mixing apparatuses to ensure the combustion gas-air mix is at the proper ratio for a given application
6. A common gas manifold for distribution of the gas to the various catalytic devices
7. Controller to monitor air flow and catalytic device operating temperatures
8. Testing cap to allow for periodic sampling of the catalytic device as grade with a portable VOC analyzer often used during Leak Detection and Repair (LDAR) inspections

To support the claim for an engineered control package to be used in conjunction with the catalytic device, Smith Analytical concluded the testing to determine what the maximum BTU throughput might be with air added to the gas to be converted prior to it entering the catalytic device. At some point greater than 1,000 BTU, there was a catastrophic failure of the catalytic device. Other than a slight smell in the lab, there were no indications the unit was about to fail. This was only suspected when the hydrocarbon content in the containment system increased. See Figure 7.2 below.

FIGURE 7.2 CATALYTIC DEVICE DAMAGED DUE TO EXCSSIVE BTU THROUGHPUT

With the proper control hardware, the catalytic technology will work as noted in the Vendors' published information. The End User should periodically check the performance of the catalytic device as part of the plant LDAR program.

REFERENCES

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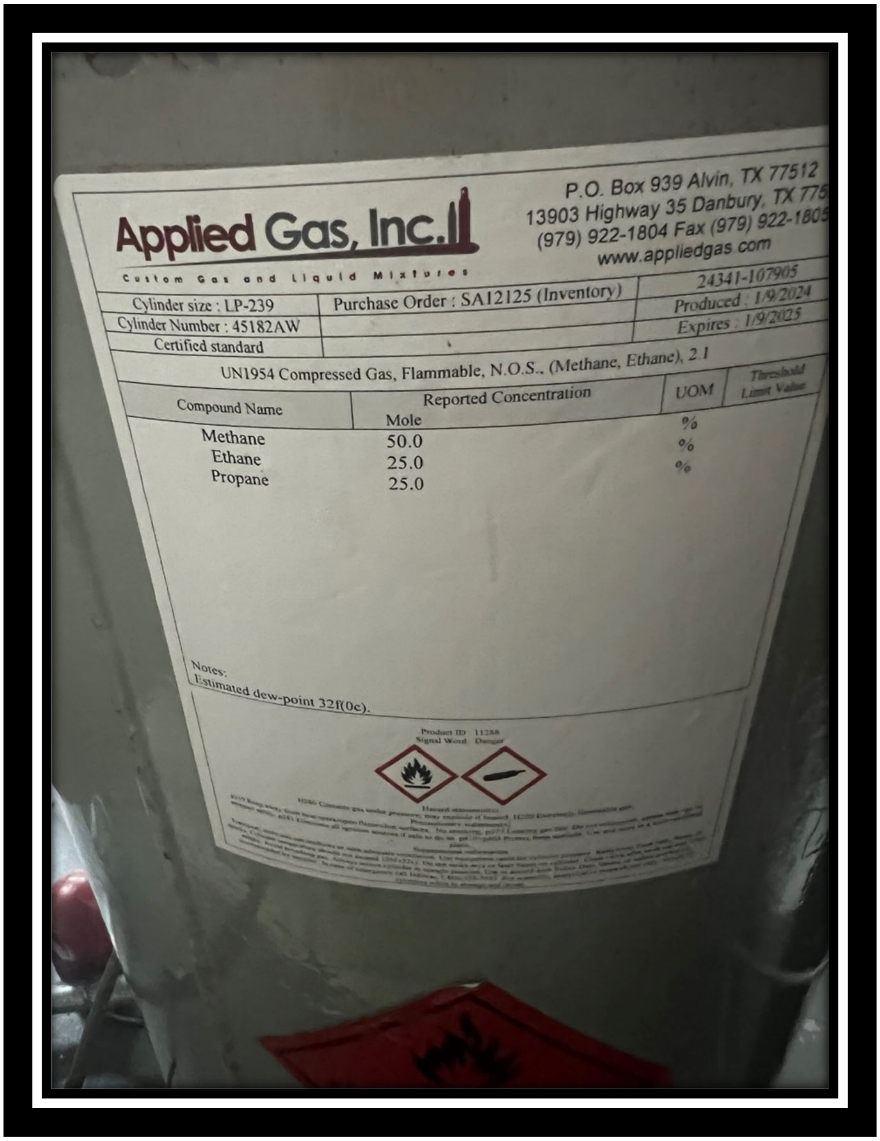
10. "Analysis of the lumped and distributed optimal temperature trajectories for packed bed reactors with concentration dependent catalyst deactivation", The Canadian Chemical Engineering Journal-October 1990, Authors Juan R. Gonzalez-Velasco, Miguel A. Gutierrez-Ortiz, Jose I. Gutierrez-Ortiz, Jose A. Gonzalez-Marcos

APPENDIX A – TESTING INFORMATION

The following provides additional details for the testing conducted on the Trace Technologies catalytic device.



Applied Gas, Inc.
Custom Gas and Liquid Mixtures

P.O. Box 939 Alvin, TX 77512
13903 Highway 35 Danbury, TX 77
(979) 922-1804 Fax (979) 922-180
www.appliedgas.com

Cylinder size : LP-239	Purchase Order : SA12125 (Inventory)	24341-107905
Cylinder Number : 45182AW		Produced : 1/9/2024
Certified standard		Expires : 1/9/2025

UN1954 Compressed Gas, Flammable, N.O.S., (Methane, Ethane), 2.1

Compound Name	Reported Concentration Mole	UOM	Threshold Limit Value
Methane	50.0	%	
Ethane	25.0	%	
Propane	25.0	%	

Notes:
Estimated dew-point 32f(0c).

Product ID 11288
Signal Word Danger

FIGURE A1 - NIST TEST GAS USED FOR METHANE, ETHANE, AND PROPANE CONVERSION TEST

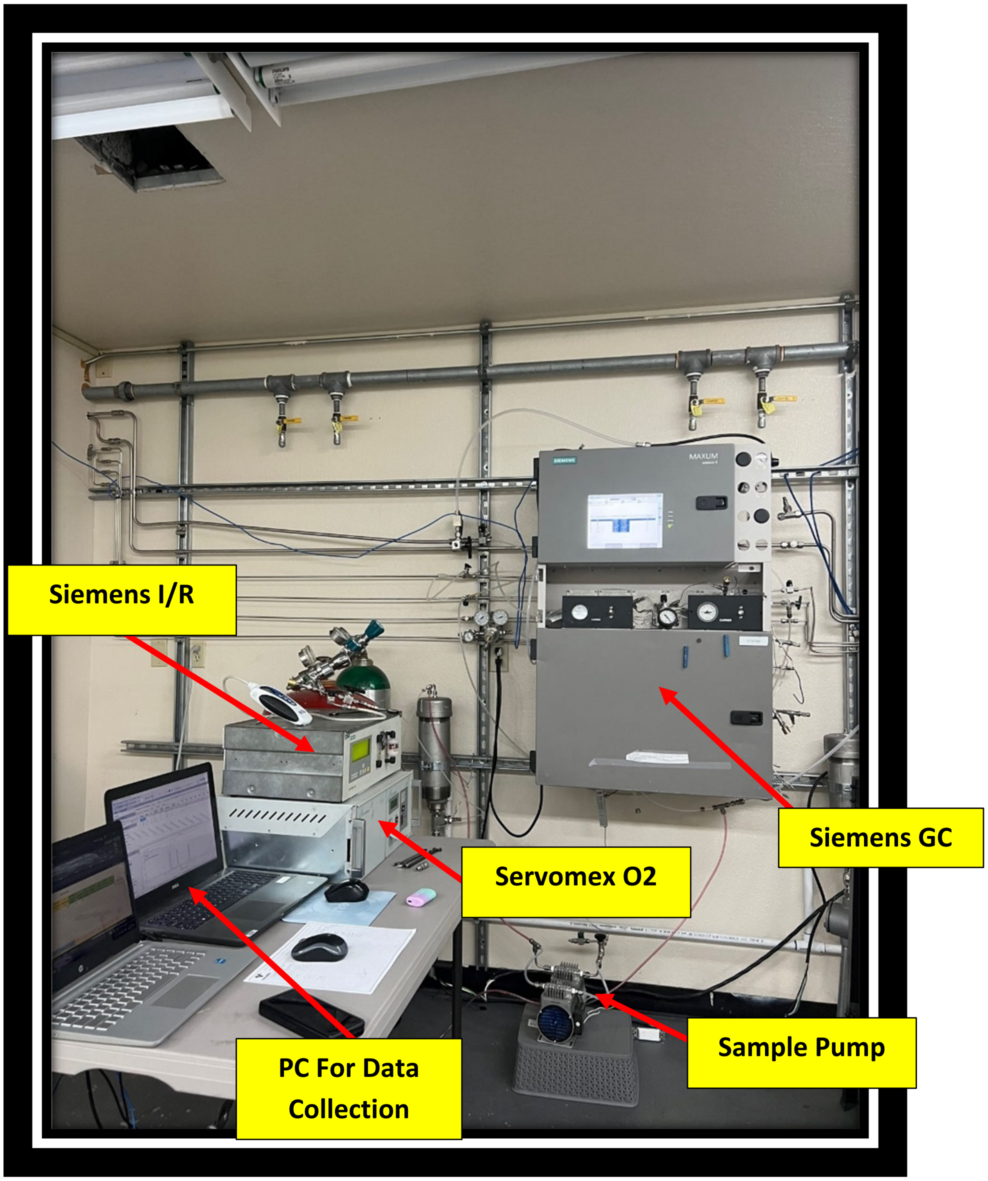


FIGURE A2 - TESTING HARDWARE

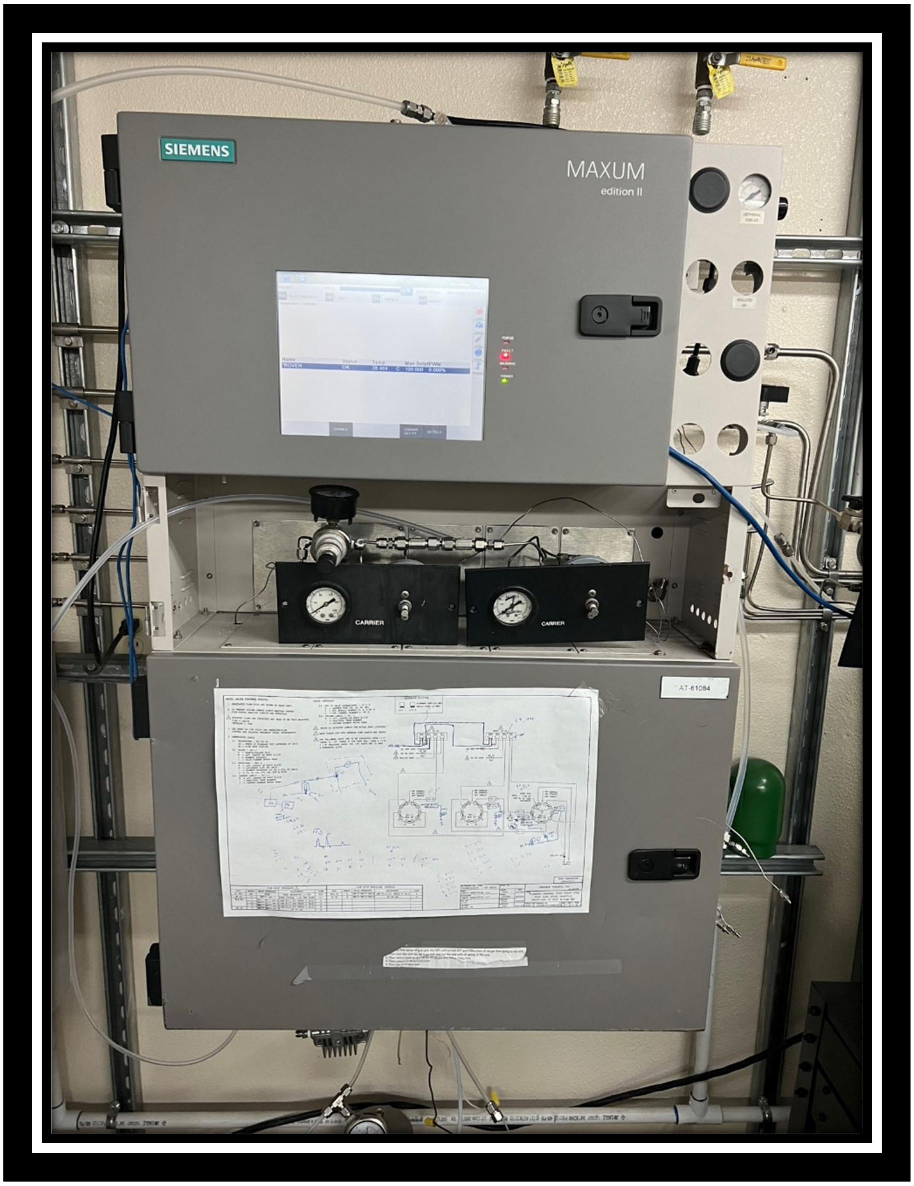


FIGURE A3 - SIEMENS MAXUM II USED IN TEST

FIGURE A4 - SIEMENS ULTRAMAT METHANE, CO2, AND CO (TOP) AND SERVOMEX 1400 OXYGEN (BOTTOM) ANALYZERS USED IN TESTING

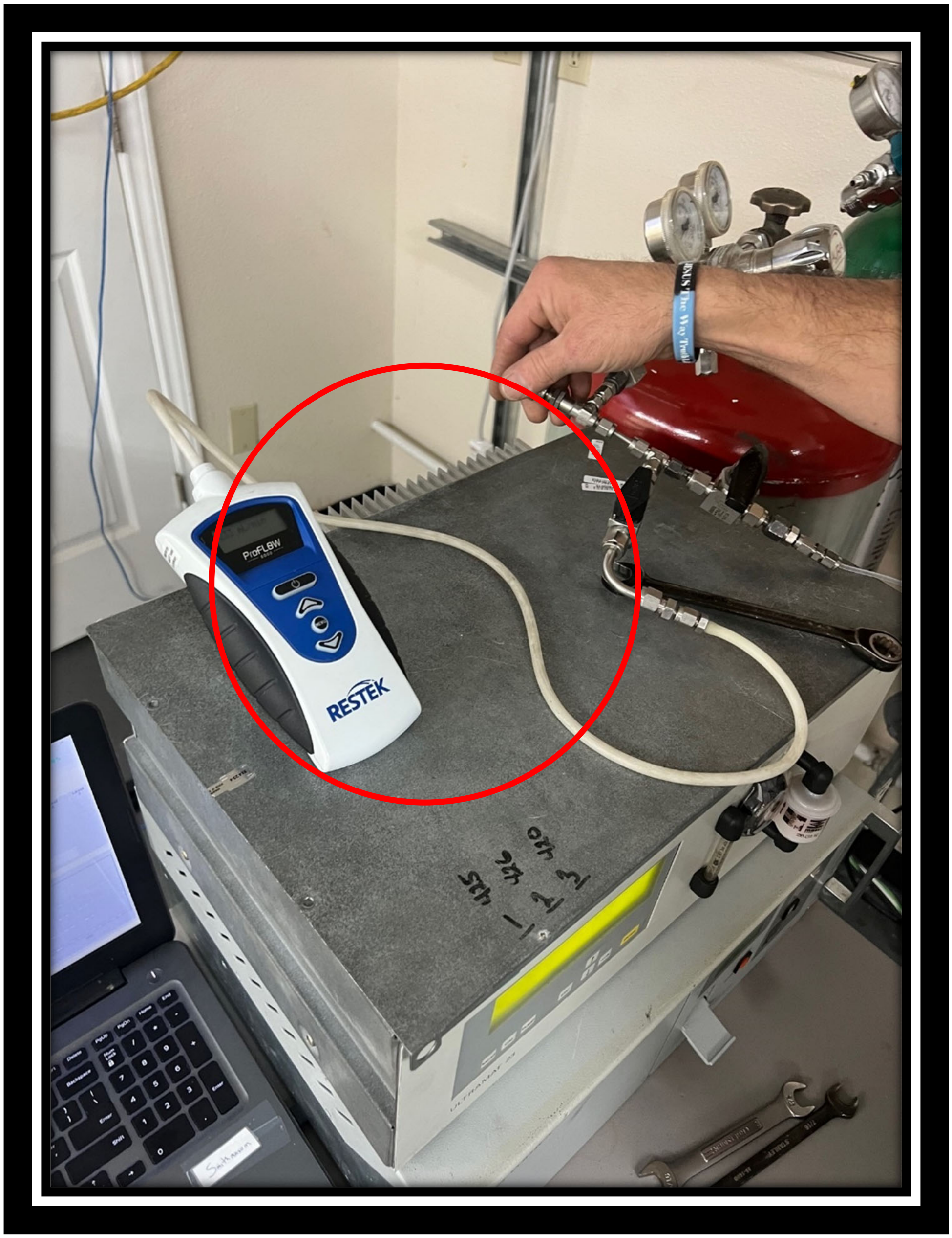


FIGURE A5 - ELECTRONIC FLOW METER USED TO MEASURE TEST GAS SENT TO TRACE TECHNOLOGIES CATALYTIC DEVICE

FIGURE A6 - ELECTRONIC FLOW METER USED TO MEASURE TEST GAS SENT TO TRACE TECHNOLOGIES CATALYTIC DEVICE

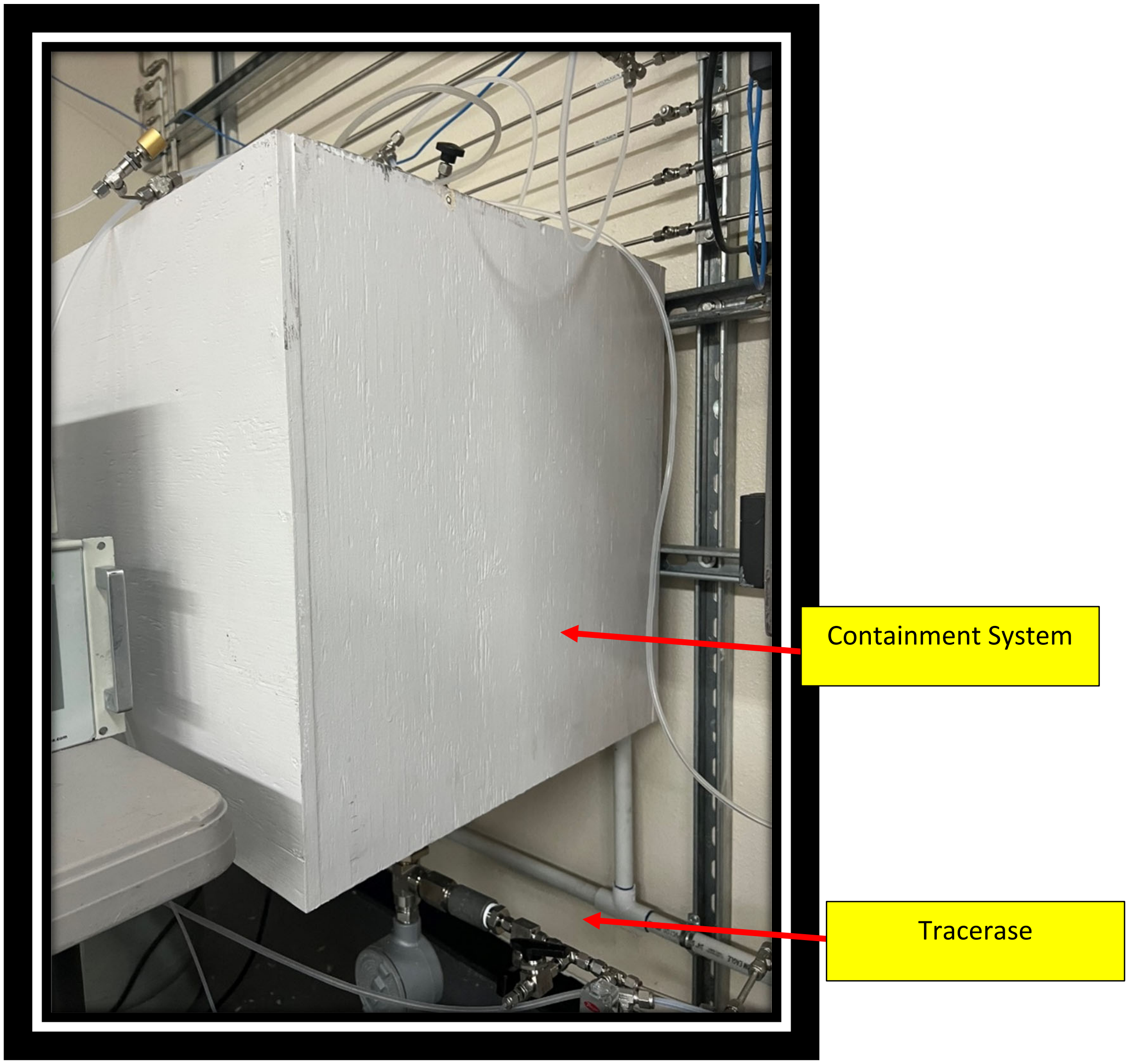


FIGURE A7 - 2’ X 2’ X 2’ CONTAINMENT SYSTEM FOR TESTING OF TRACE TECHNOLOGIES CATALYTIC DEVICE

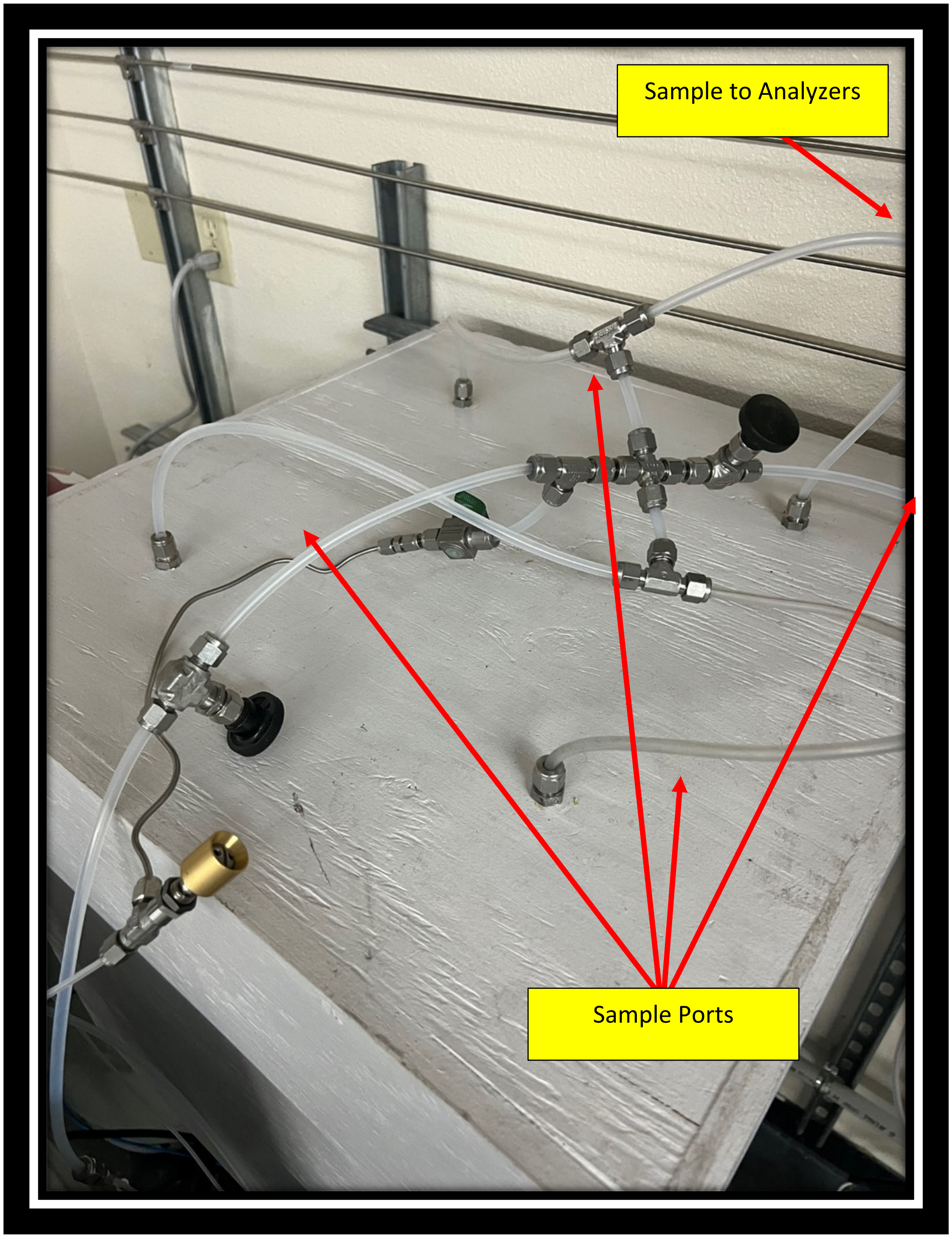


FIGURE A8 - CONTAINMENT SYSTEM FOR TESTING OF TRACE TECHNOLOGIES CATALYTIC DEVICE

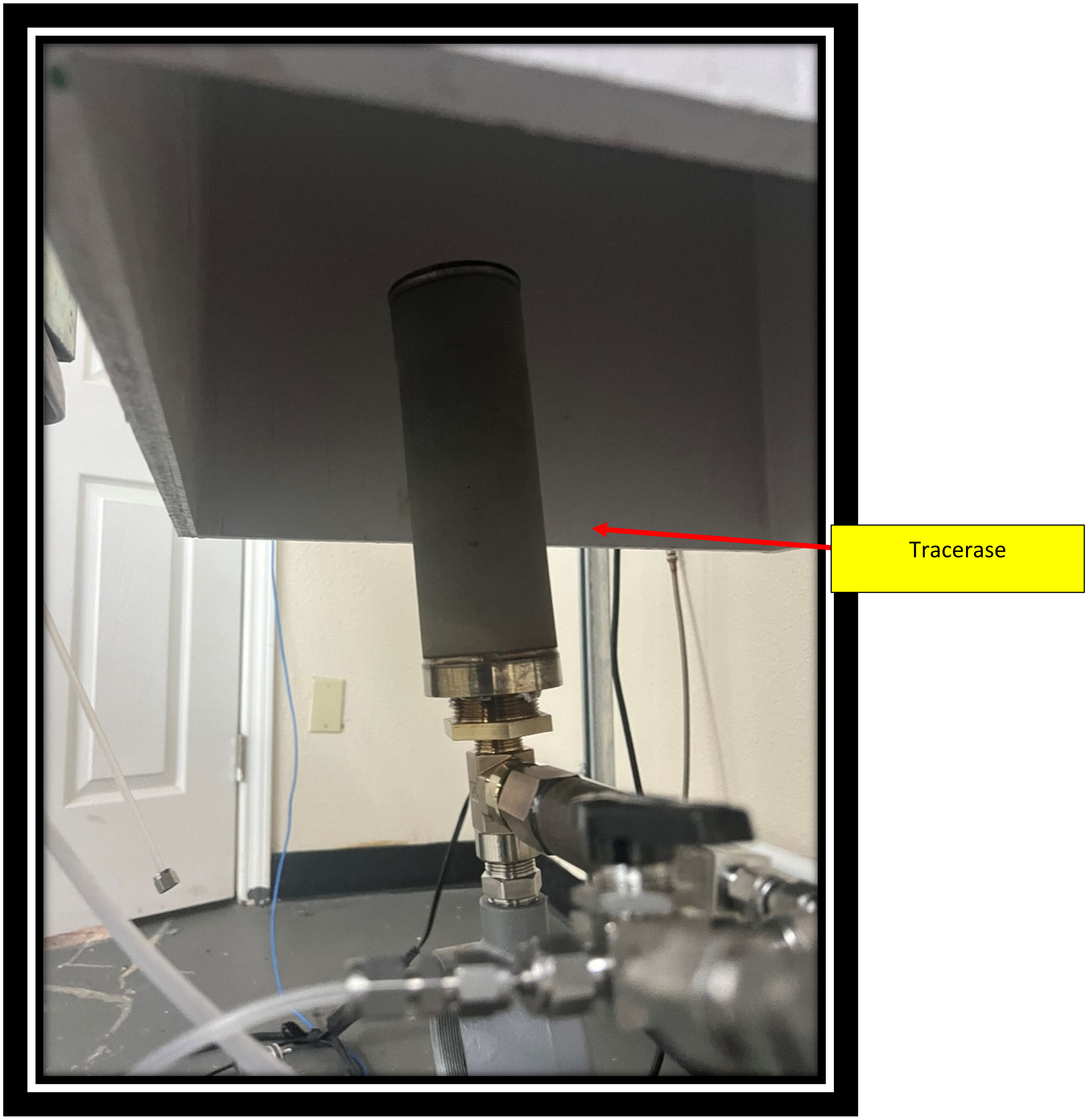


FIGURE A9 - CONTAINMENT SYSTEM FOR TESTING OF TRACE TECHNOLOGIES CATALYTIC DEVICE

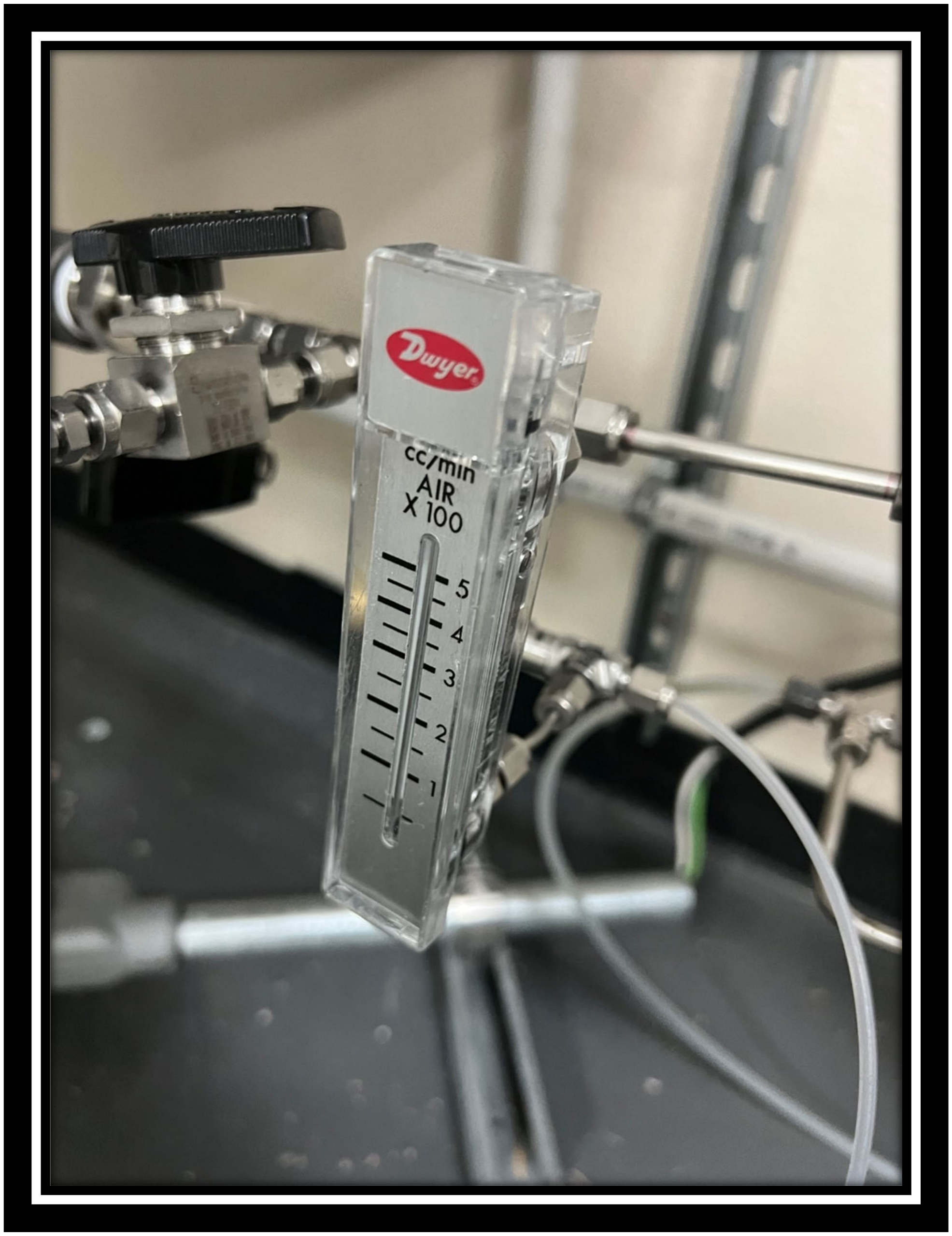
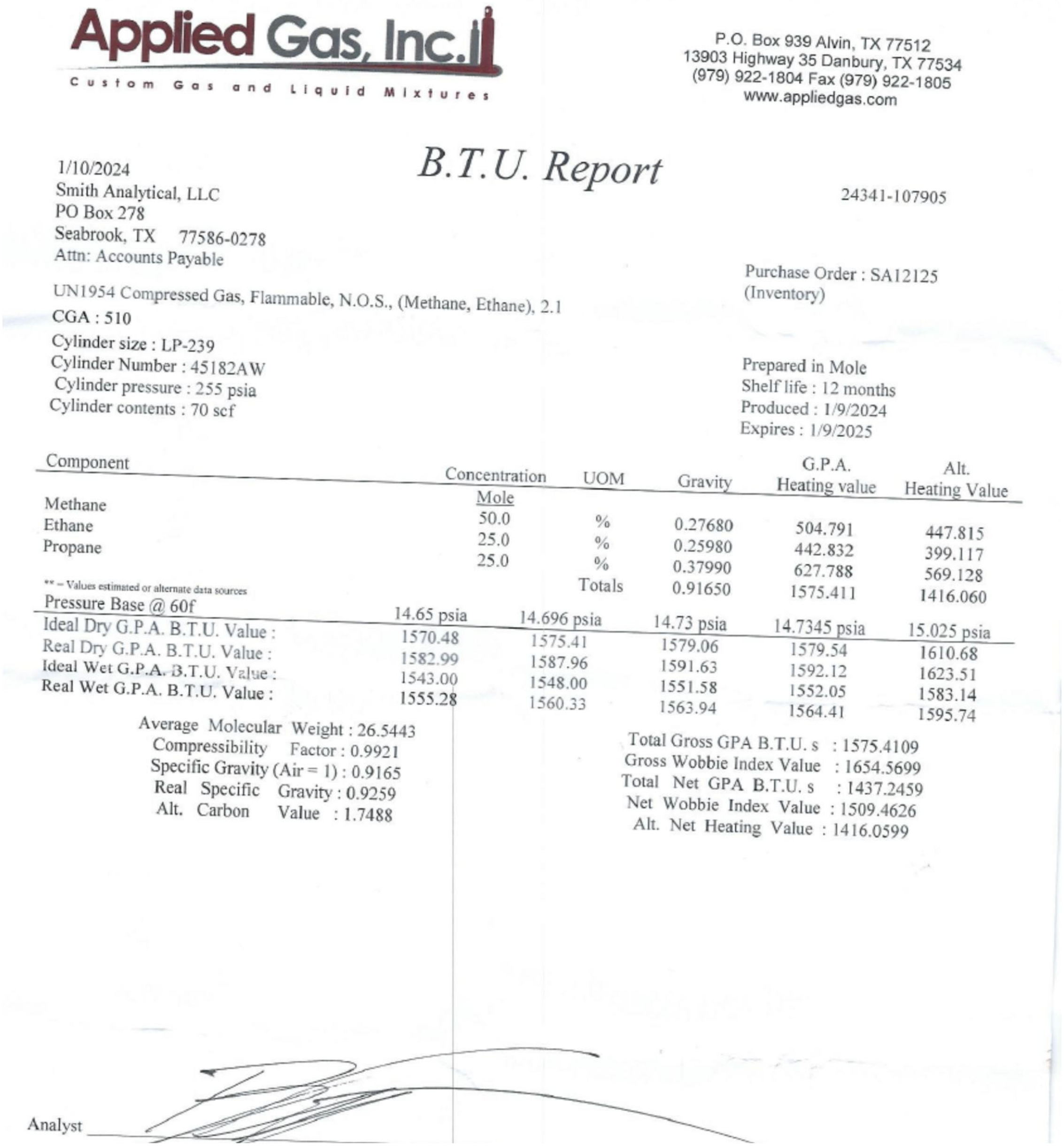


FIGURE A10 - TEST GAS FLOW METER TO TRACE TECHNOLOGIES DEVICE

FIGURE A11 - ASPIRATOR AND SUPPLEMENT AIR FLOW METERS FOR CONTROL PANEL TO ALLOW FOR PROPER OPERATION OF THE TRACE TECHNOLOGIES DEVICE



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B.T.U. Report

1/10/2024
Smith Analytical, LLC
PO Box 278
Seabrook, TX 77586-0278
Attn: Accounts Payable

24341-107905

Purchase Order : SA12125
(Inventory)

UN1954 Compressed Gas, Flammable, N.O.S., (Methane, Ethane), 2.1
CGA : 510
Cylinder size : LP-239
Cylinder Number : 45182AW
Cylinder pressure : 255 psia
Cylinder contents : 70 scf

Prepared in Mole
Shelf life : 12 months
Produced : 1/9/2024
Expires : 1/9/2025

Component	Concentration	UOM	Gravity	G.P.A. Heating value	Alt. Heating Value
	Mole				
Methane	50.0	%	0.27680	504.791	447.815
Ethane	25.0	%	0.25980	442.832	399.117
Propane	25.0	%	0.37990	627.788	569.128
		Totals	0.91650	1575.411	1416.060

** – Values estimated or alternate data sources

Pressure Base @ 60f	14.65 psia	14.696 psia	14.73 psia	14.7345 psia	15.025 psia
Ideal Dry G.P.A. B.T.U. Value :	1570.48	1575.41	1579.06	1579.54	1610.68
Real Dry G.P.A. B.T.U. Value :	1582.99	1587.96	1591.63	1592.12	1623.51
Ideal Wet G.P.A. B.T.U. Value :	1543.00	1548.00	1551.58	1552.05	1583.14
Real Wet G.P.A. B.T.U. Value :	1555.28	1560.33	1563.94	1564.41	1595.74

Average Molecular Weight : 26.5443
Compressibility Factor : 0.9921
Specific Gravity (Air = 1) : 0.9165
Real Specific Gravity : 0.9259
Alt. Carbon Value : 1.7488

Total Gross GPA B.T.U. s : 1575.4109
Gross Wobbie Index Value : 1654.5699
Total Net GPA B.T.U. s : 1437.2459
Net Wobbie Index Value : 1509.4626
Alt. Net Heating Value : 1416.0599

Analyst

FIGURE A12 - CERTIFICATE OF ANALYSIS FOR METHANE, ETHANE, AND PROPANE GAS USED DURING TESTING

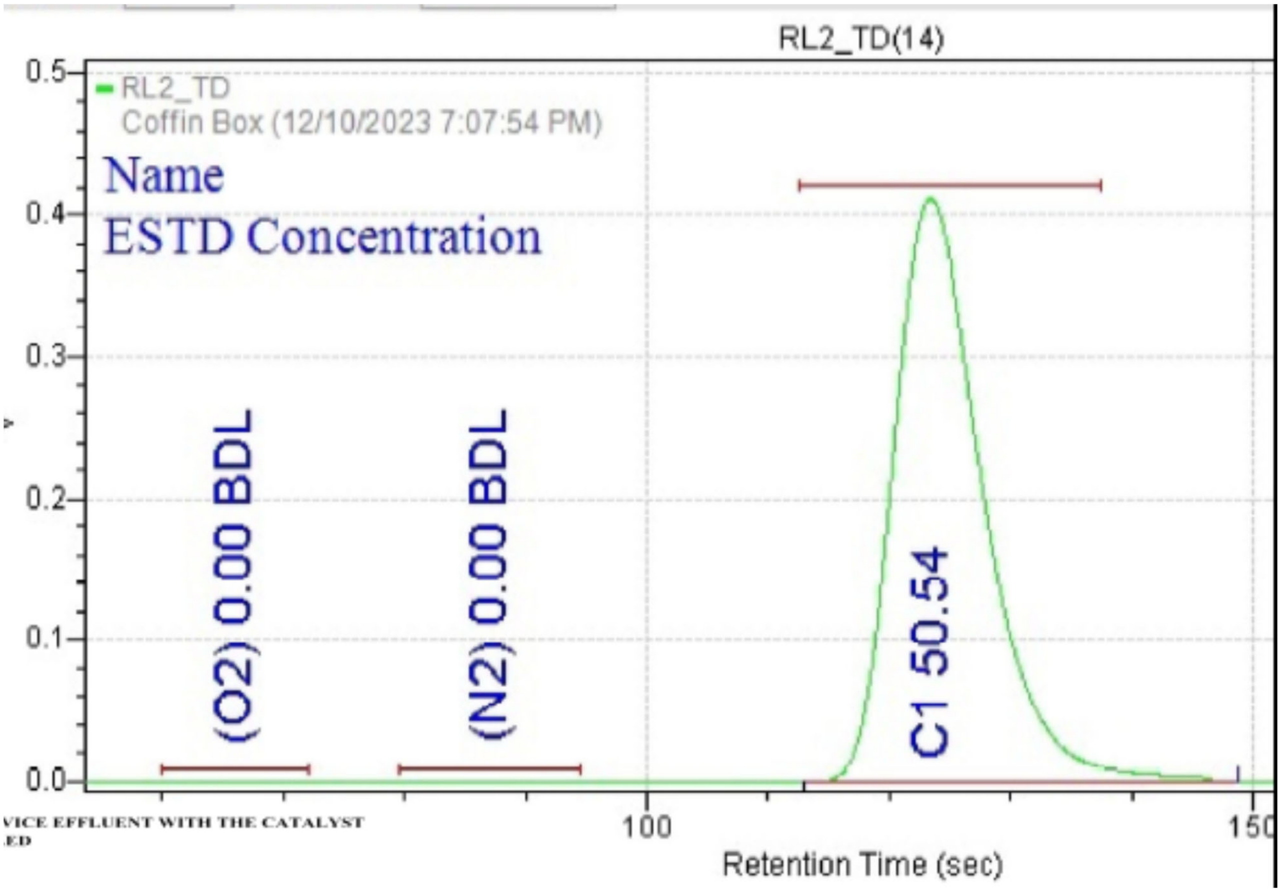


FIGURE A13 - METHANE CALIBRATION CHROMATOGRAM
CAL GAS CONCENTRATION 50%

TRACErase™ is a registered US trademark

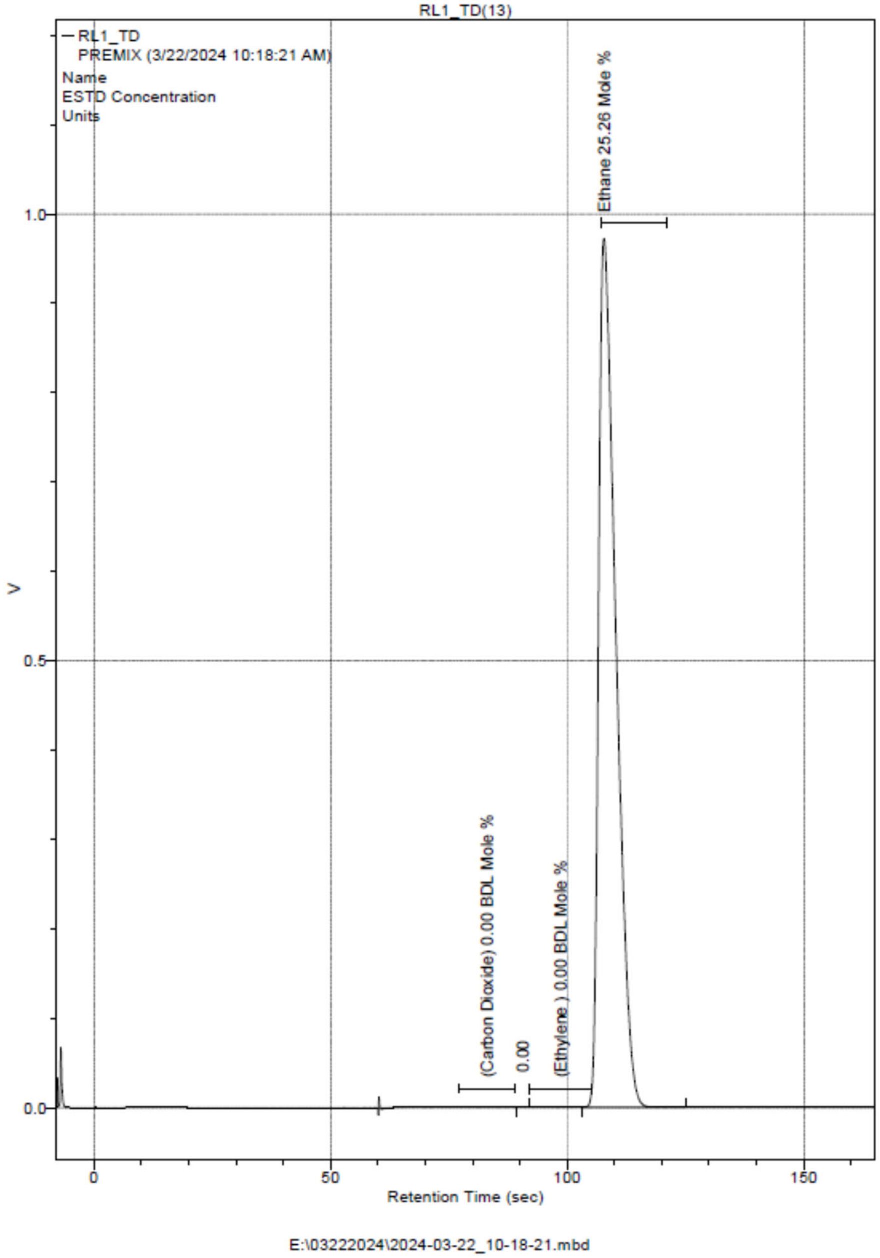


FIGURE A14 - ETHANE CALIBRATION CHROMATOGRAM
CAL GAS CONCENTRATION 25%

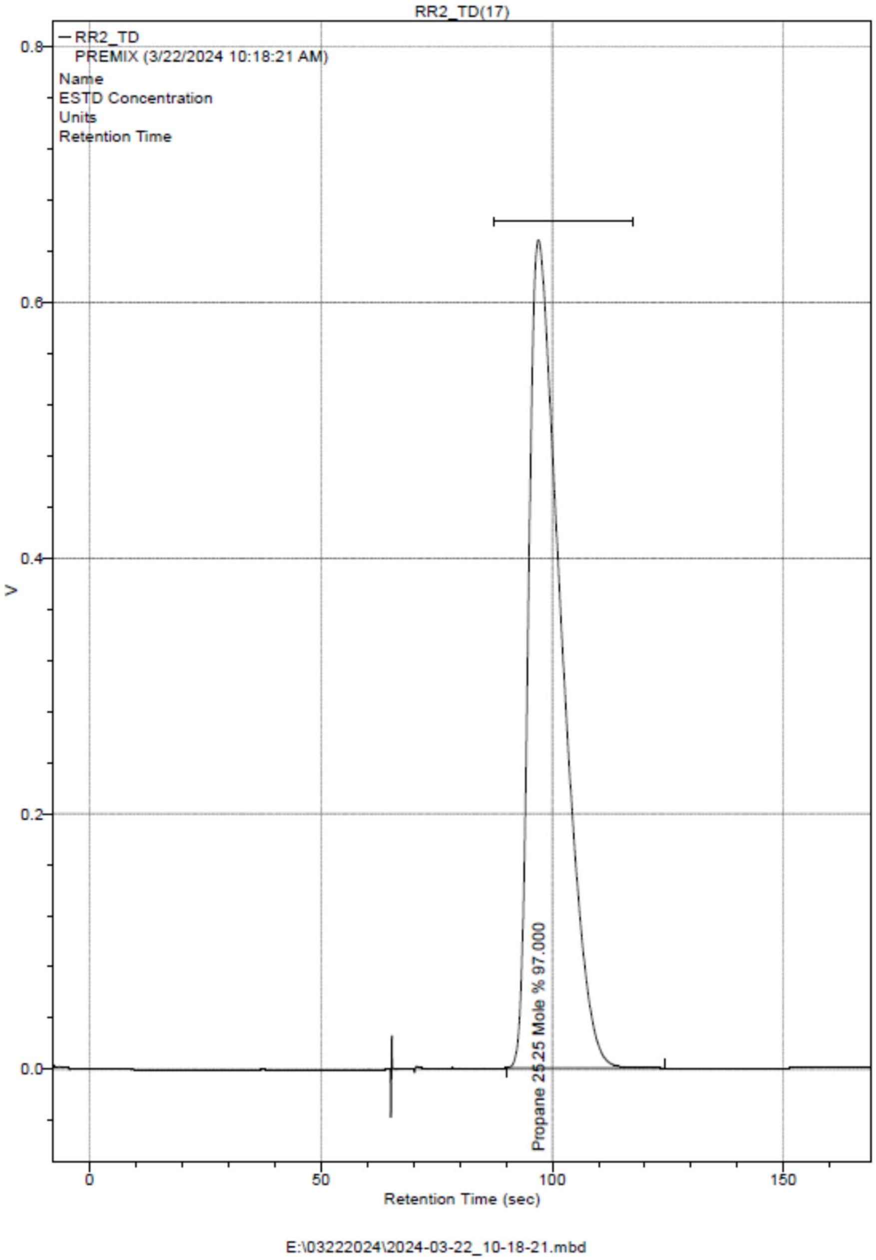


FIGURE A15 - PROPANE CALIBRATION CHROMATOGRAM
CAL GAS CONCENTRATION 25%

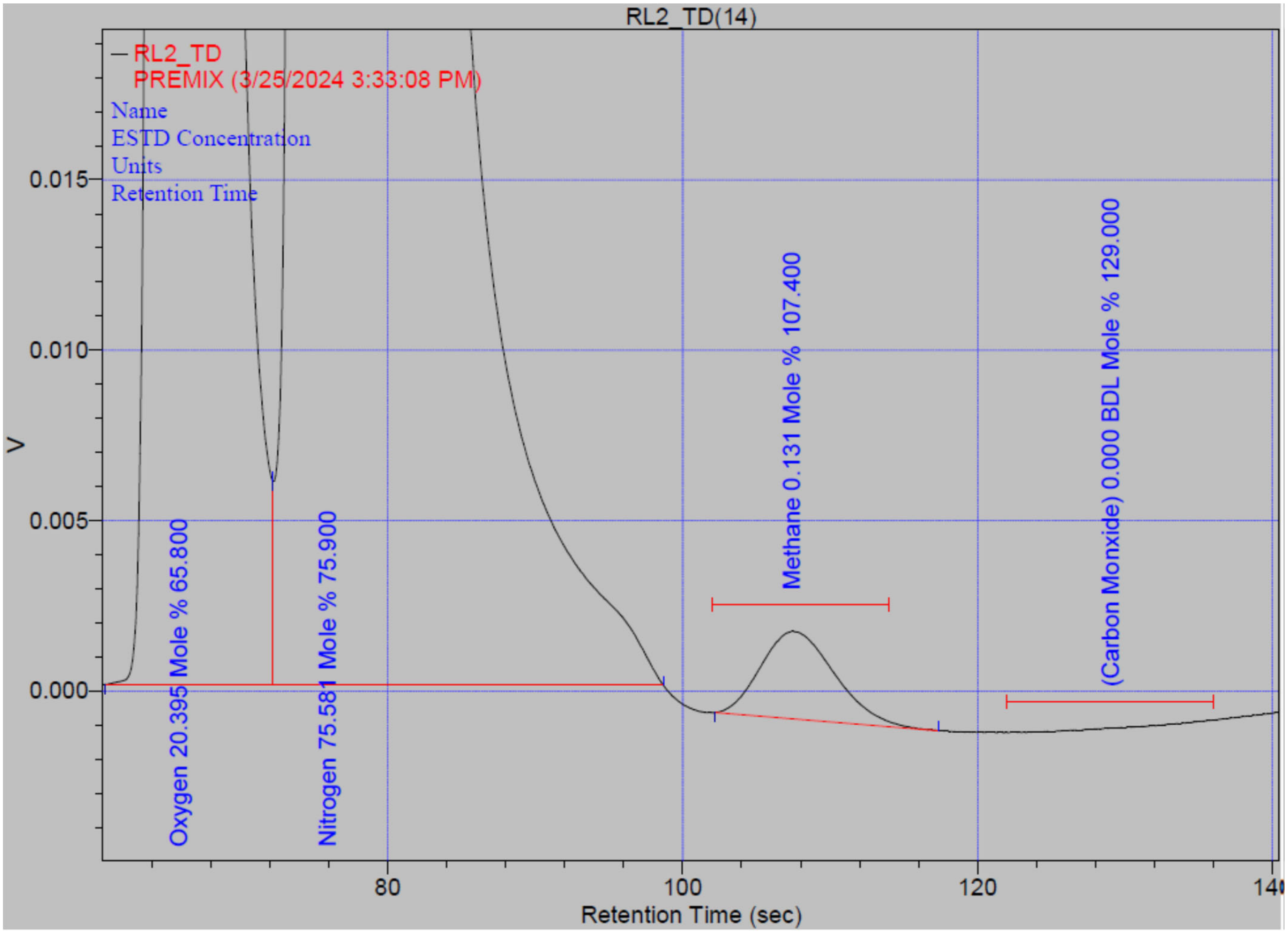


FIGURE A16 - METHANE PRESENT IN THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

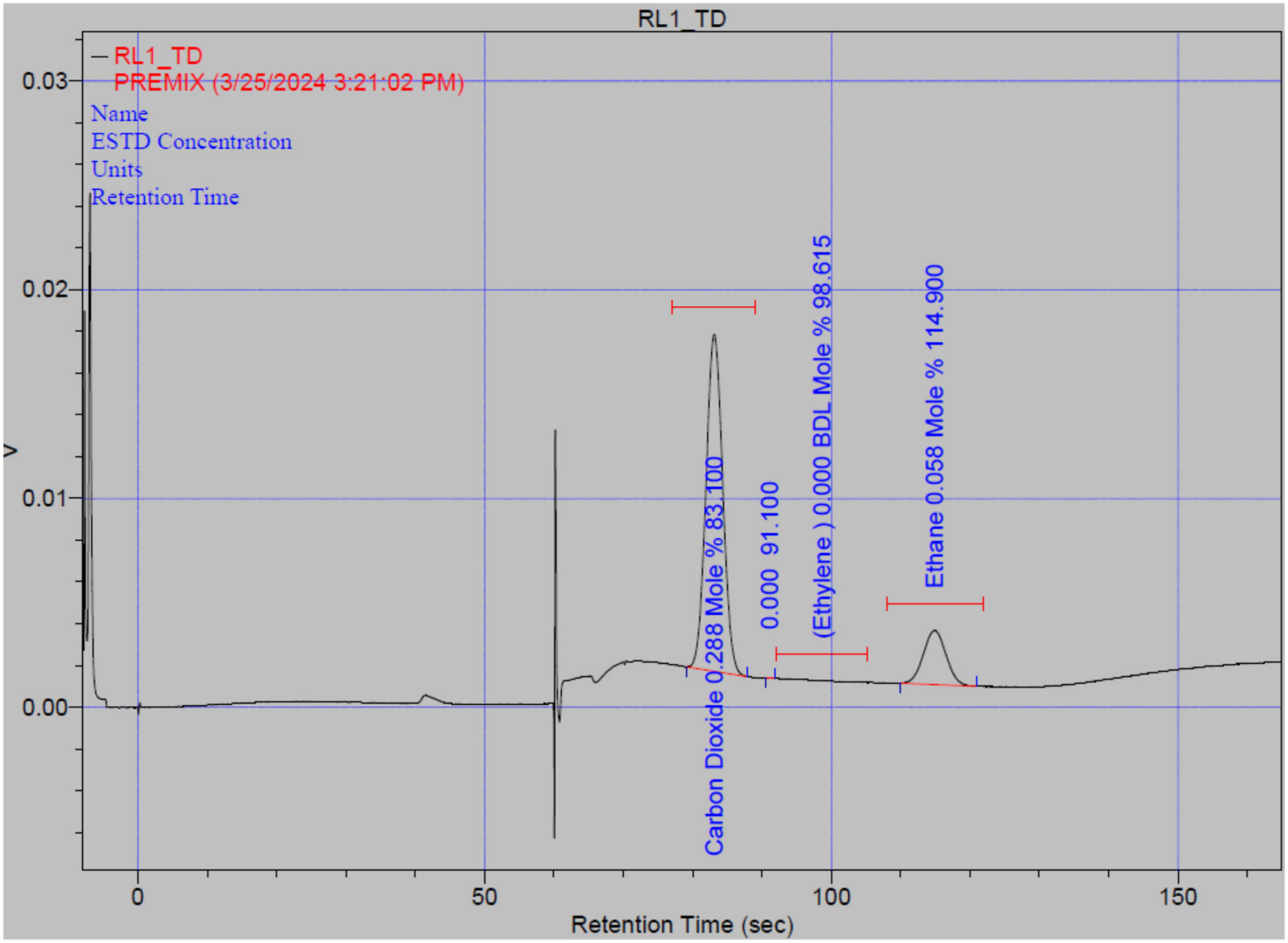


FIGURE A17 - ETHANE PRESENT IN THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

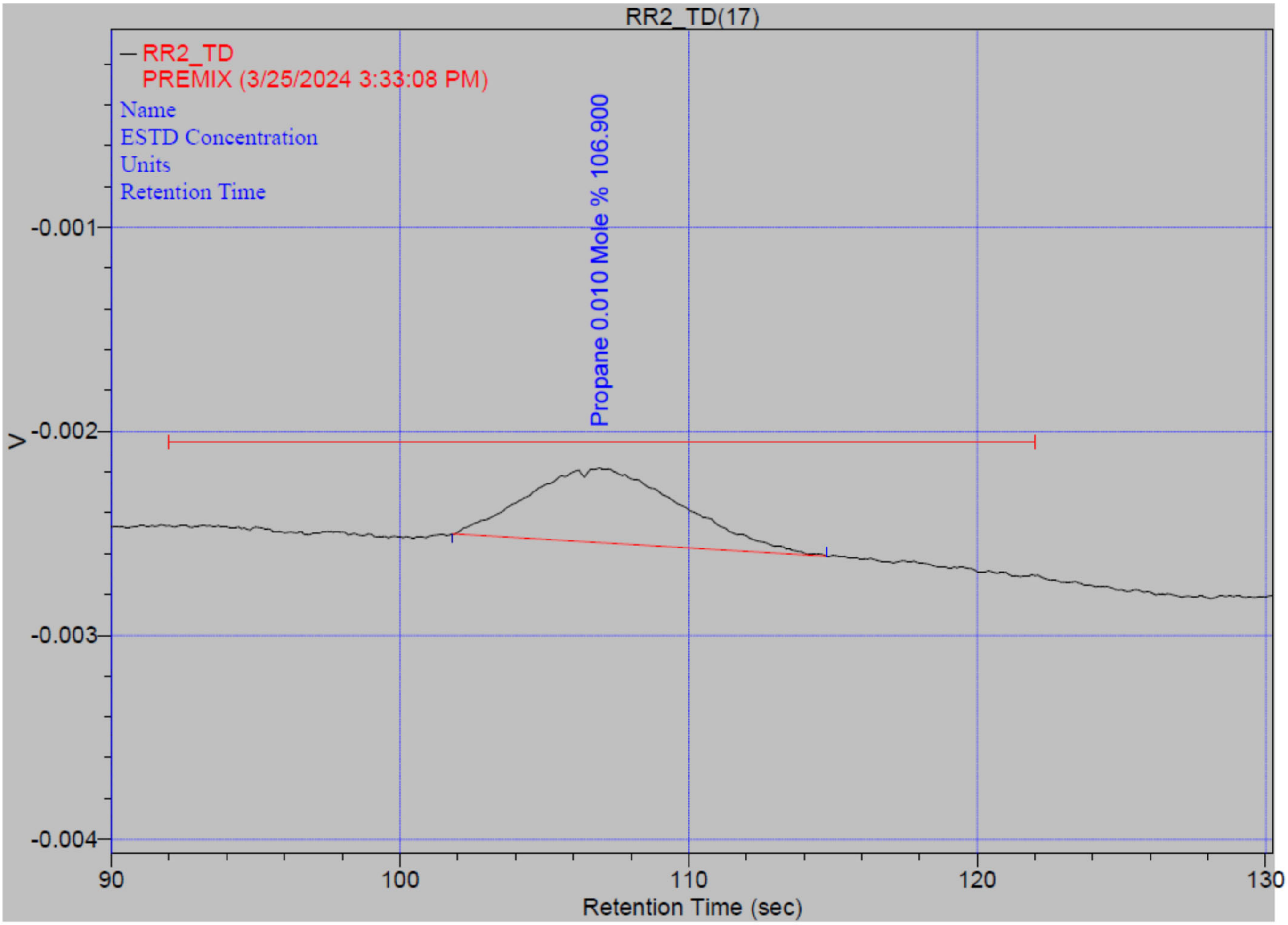


FIGURE A18 -PROPANE PRESENT IN THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

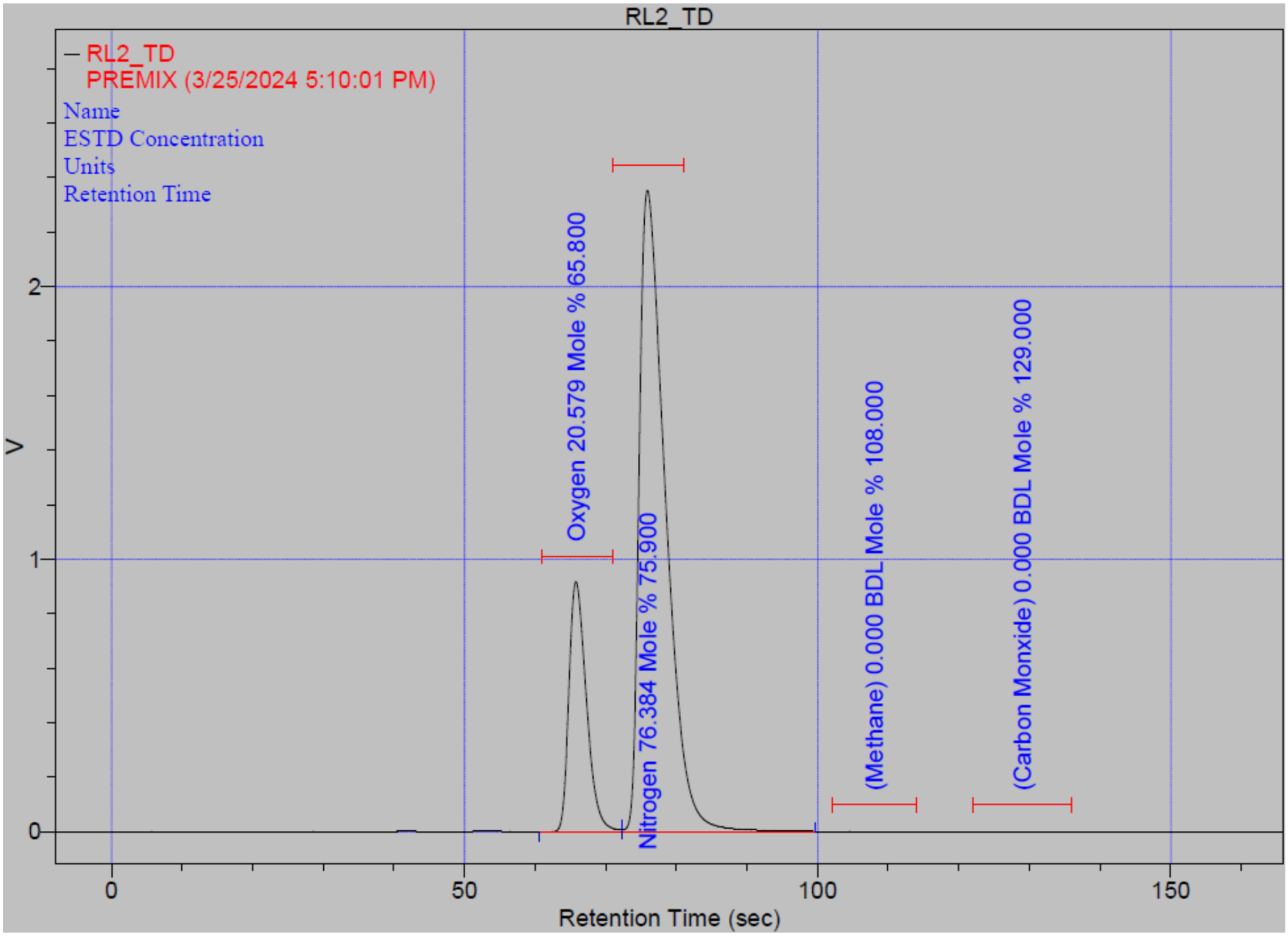


FIGURE A19 - NO METHANE PRESENT THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED AND AIR FROM CONTROL PANEL ADDED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

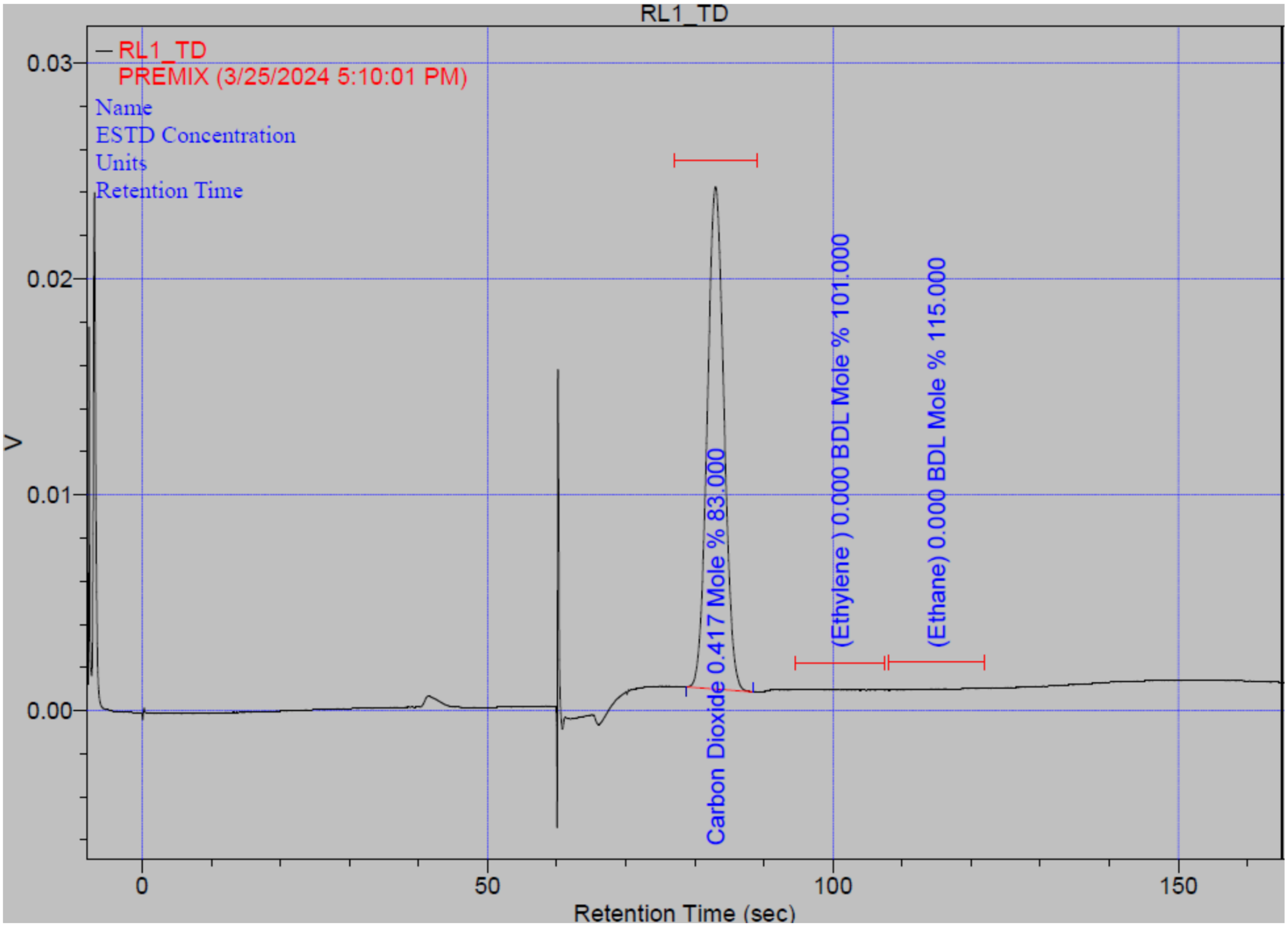


FIGURE A20 - NO ETHANE PRESENT THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED AND AIR FROM CONTROL PANEL ADDED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

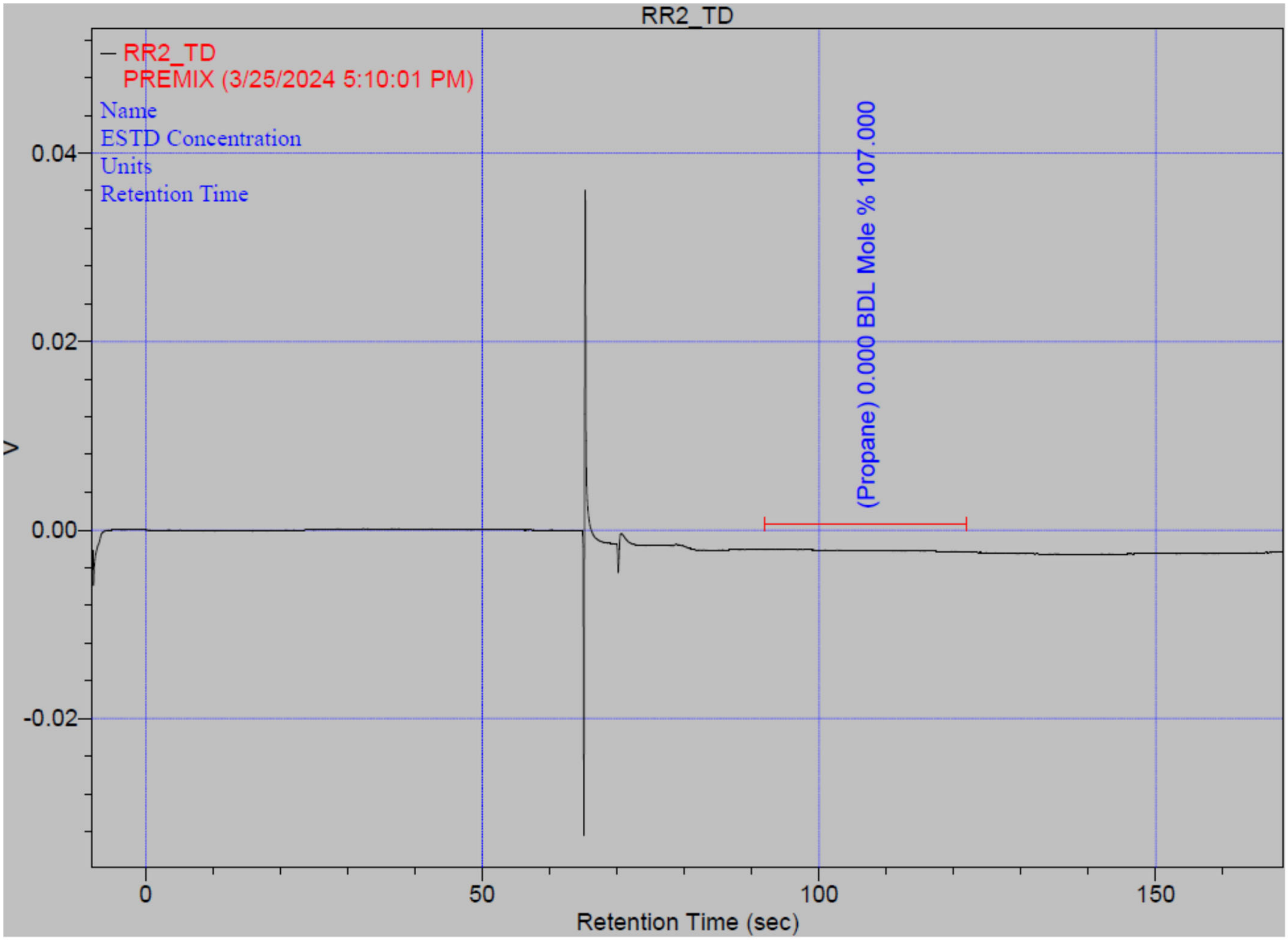


FIGURE A21 - NO PROPANE PRESENT THE TRACE TECHNOLOGIES DEVICE EFFLUENT WITH THE CATALYST INSTALLED AND AIR FROM CONTROL PANEL ADDED – 8 STANDARD CUBIC FOOT CONTAINMENT DEVICE RESULTING IN AIR DILUTED SAMPLE

APPENDIX B – VENDOR DATA IN THE PUBLIC DOMAIN

The following documents are in the public domain regarding the conversion performance of Trace Technology's catalytic device. Note the information provided is sourced from both the manufacturer and distributors of this device. The manufacturer, on their website, makes no performance claims regarding the catalytic device. See "Trace Technology – TRACErase™" below.

1. Trace Technology - TRACErase – Manufacturer Data
2. Cherokee-Trace Technology- Distributor Data
3. Keco Fugitive-Emission-Control-Unit – Distributor Data
4. MTI-270650121-TRACEraseM-IManualMTIAT Ver 12.06 – Distributor Data
5. MTI Data V-15.08 – Distributor Data
6. MTI TRACErasePetro May 2024-Ver 17.06
7. MTI-Catalytic-Convertor-MIManualMTIAT-19.02 – Distributor Data
8. MTI ATEX Trace Erase Ver 23.06 – Distributor Data
9. US Patent for Monolithic ceramic filter Patent (Patent # 5,855,781 issued January 5, 1999) - Justia Patents Search
10. Chain of Custody Paperwork for EPA TO-14A Samples
11. Tracerase with 50% C1 , 25% C2 and 25% C3 - NO Catalyst Installed Test Results
12. Tracerase with 50% C1 , 25% C2 and 25% C3 - WITH Catalyst Installed Test Results
13. Tracerase with 50% C1 , 25% C2 and 25% C3 – WITH Catalyst Installed and Air Added Test Results
14. Enthalpy Analytical Lab QC Data
15. Enthalpy-Houston_TCEQ_T104704226_Certificate exp-2025-0630
16. Smith Analytical Maxum II Gas Chromatograph Application Data
17. Air required for complete conversion for 100% hydrogen, 100% methane, 30%ethylen and 70% propylene and mixed gas containing methane, ethane and propane

TRACErase™ is a registered US trademark

TRACE
TECHNOLOGY

Home TRACErase Contact Quote Request

TRACERASE

1. Trace Technology - TRACErase - Manufacturer Data

TRACE TECHNOLOGY

FUGITIVE EMISSIONS ELIMINATOR

Home TRACErase Contact Quote Request

The patented TRACErase technology uses a catalytic combustion process to oxidize the vented sample wile maintaining the atmospheric pressure reference.

THE PROBLEM

Operation of chemical and gas processing plants and transportation pipelines often requires the use of chemical analysis instrumentation. These instruments frequently require a pressure reference to atmospheric pressure for proper operation. This reference can be achieved by venting the sample to the atmosphere. These vented samples, generally called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

THE FOCUS

The focus of TRACErase technology is the use of a catalytic combustion process to oxidize the vented sample while maintaining the atmospheric pressure reference. The TRACErase utilizes a continuous heat source to allow the oxidation process to be effective on intermittent fugitive emission streams.

THE PACKAGING

The packaging of the system is designed to provide explosion proof protection, thus allowing the application of this technology in hazardous locations.

Part Number: 1211-010

Stainless Steel 120VAC 50/60 Hz

Part Number: 1211-010-220

Stainless Steel 220VAC 50/60 Hz

Part Number: 1211-021

Stainless Steel 120VAC 50/60 Hz CSA Certified

Part Number: 1211-220

Stainless Steel 220VAC 50/60 Hz CSA Certified

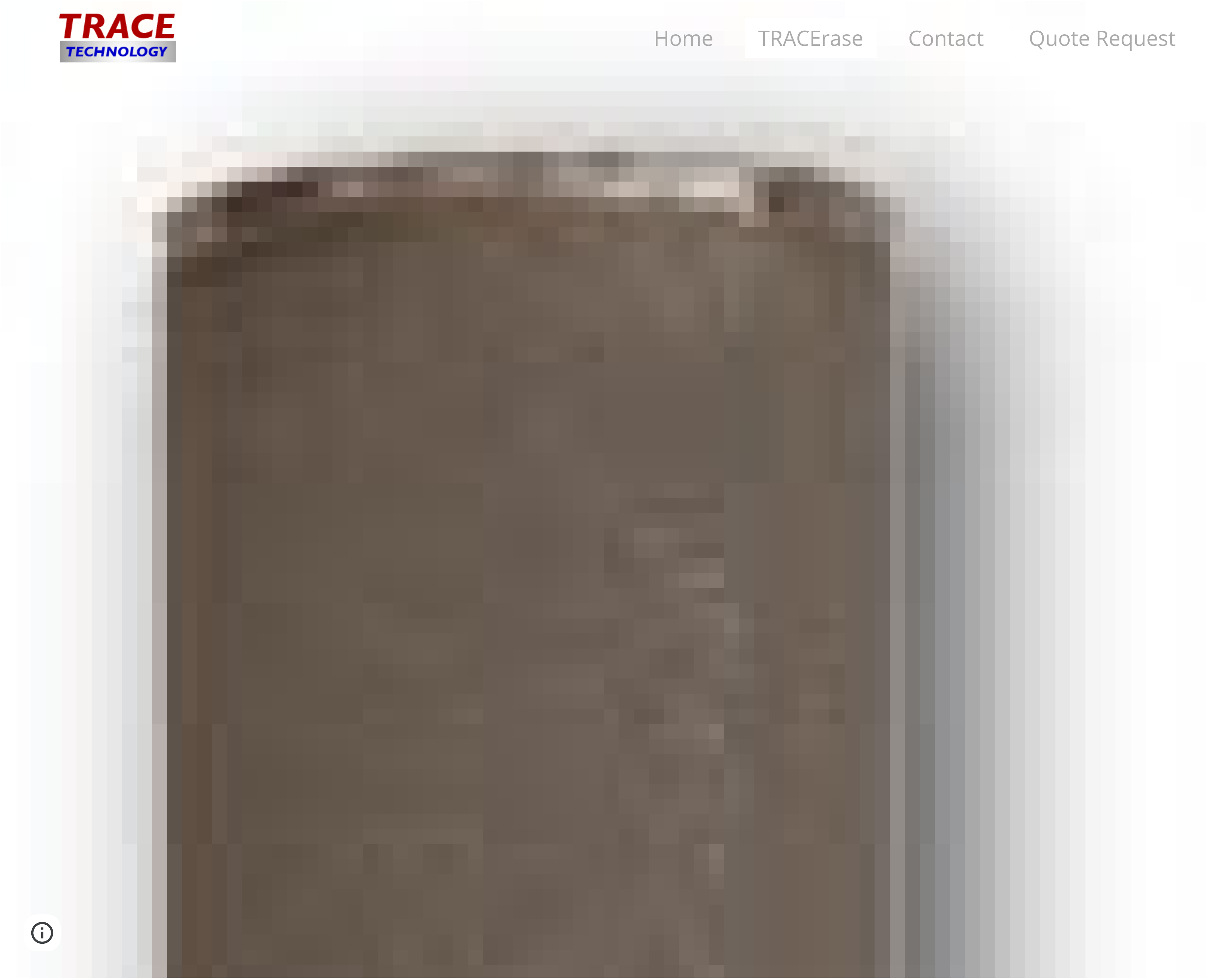
Part Number: 1211-031

Stainless Steel 120VAC 50/60 Hz ATEX/IECEx Certified

Part Number: 1211-320

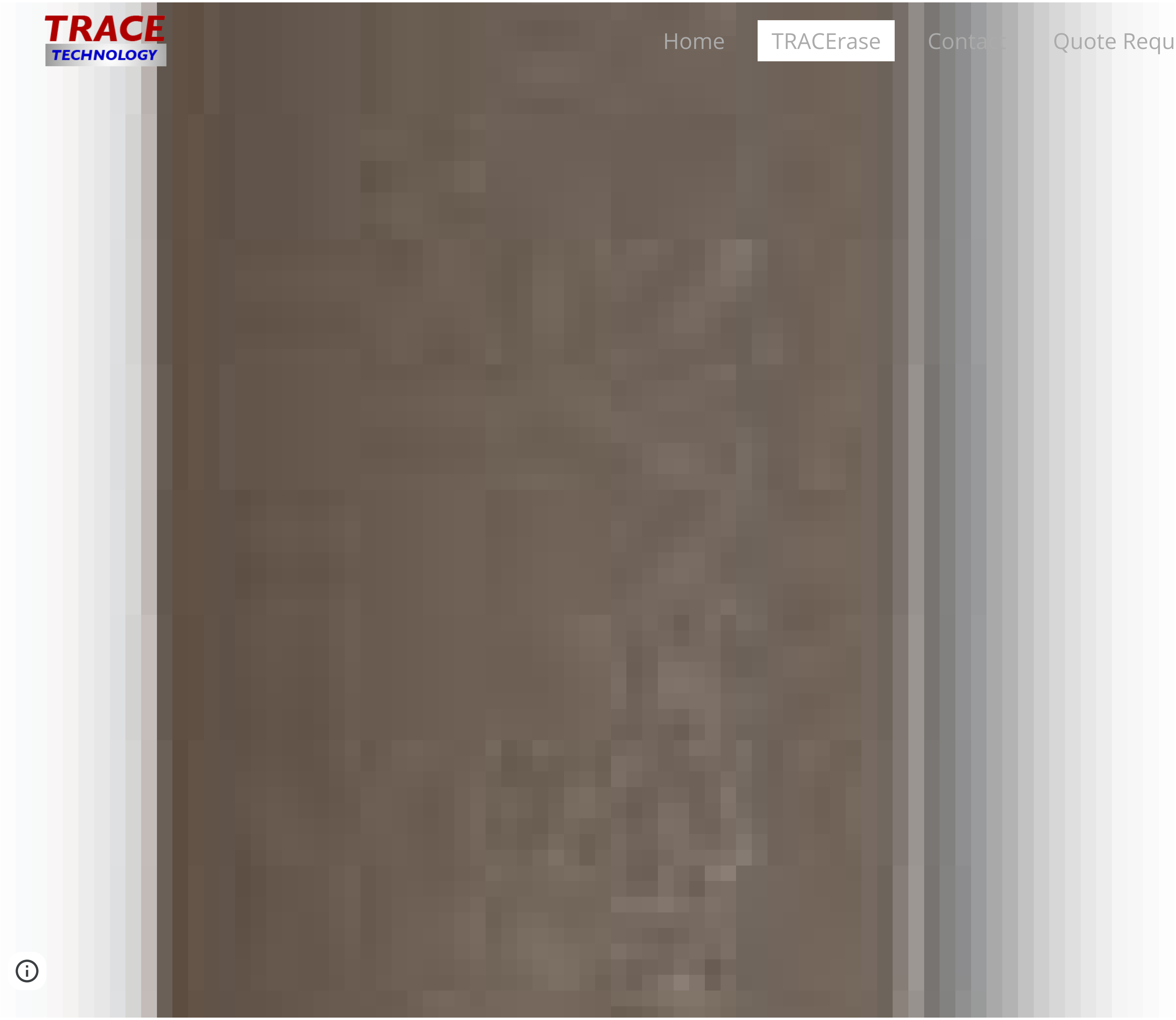
Stainless Steel 220VAC 50/60 Hz ATEX/IECEx Certified

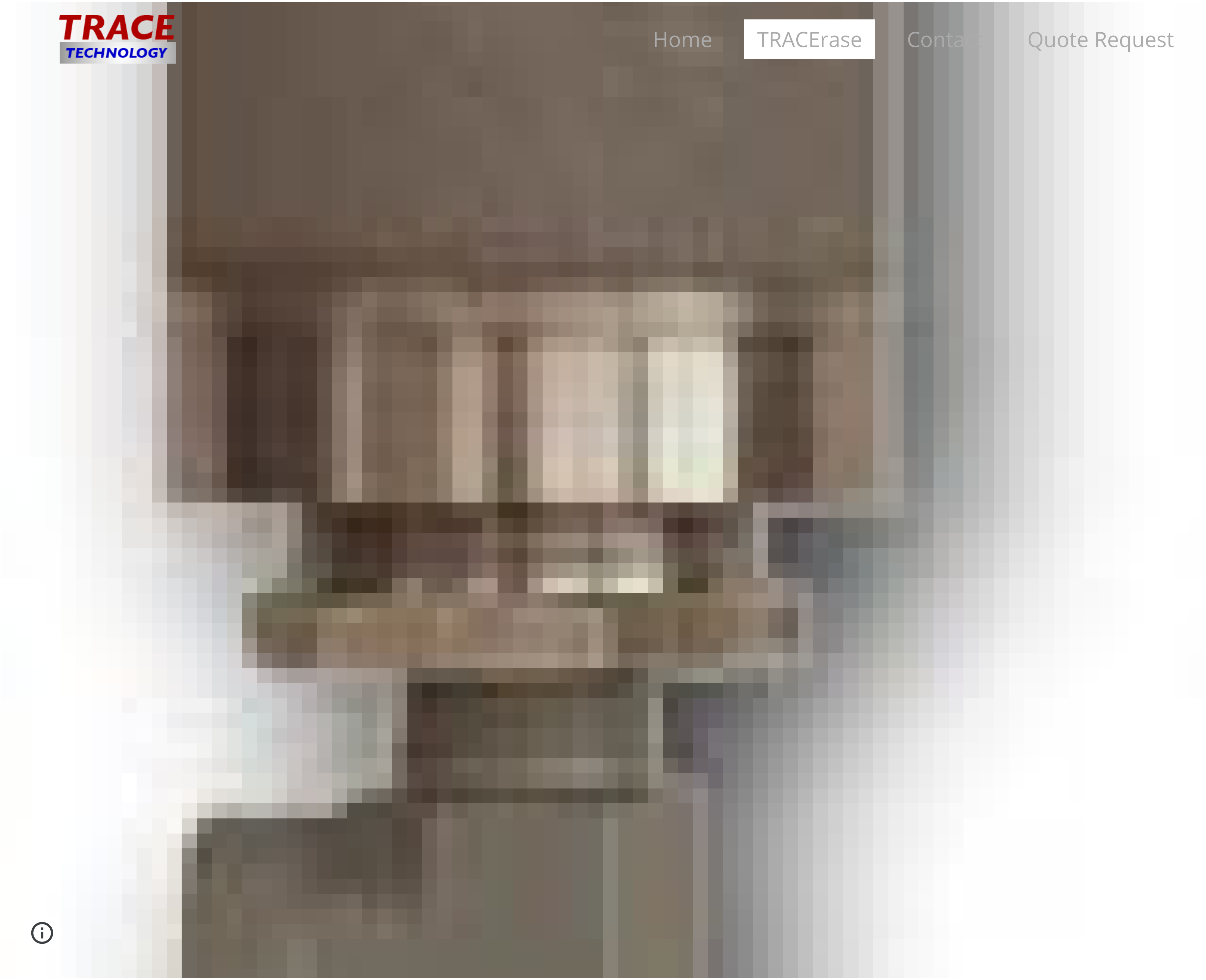
TRACE TECHNOLOGY

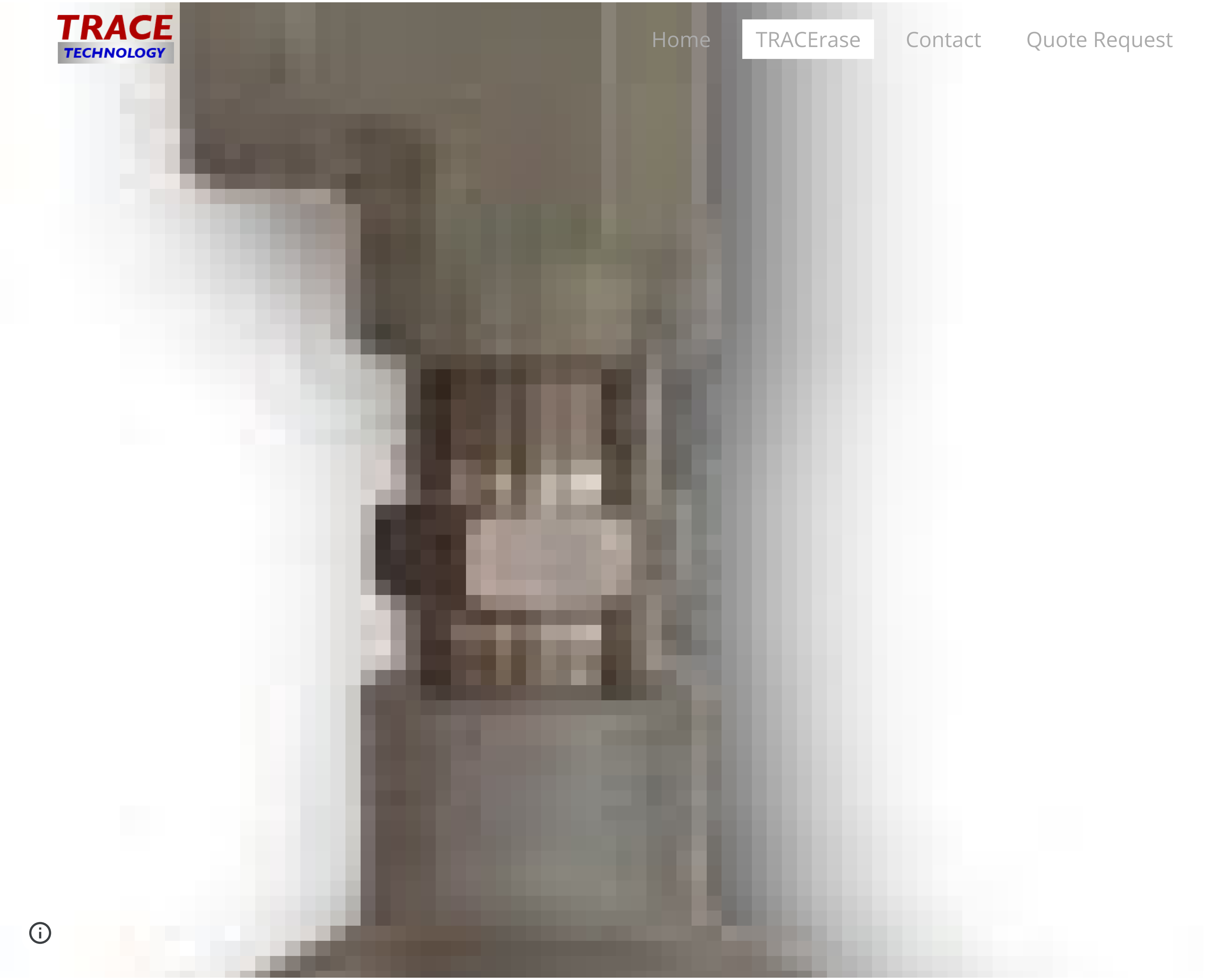


TRACE TECHNOLOGY

Home TRACErase Contact Quote Request







TRACE TECHNOLOGY

Home TRACErase Contact Quote Request

TRACE TECHNOLOGY

2-Cherokee-Trace Technology- Distributor Data

TRACE TECHNOLOGY

Trace Technology redefines the standards of environmental responsibility and operational efficiency for chemical processing, manufacturing facilities, gas processing facilities, refineries, and transportation pipelines. With our cutting-edge product, TRACErase, we address a critical challenge faced by industries worldwide: fugitive emissions elimination.

TRACE TECHNOLOGY

(https://bruestcatalyticheaters.com/)

Trace Technology - Featured Product

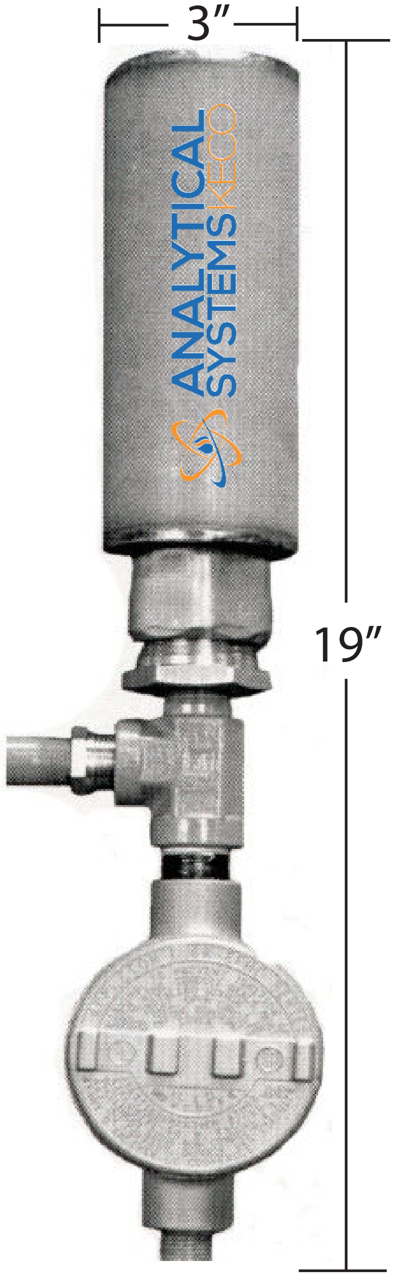
3. Keco Fugitive-Emission-Control-Unit - Distributor Data

Fugitive Emission Control Unit

Eliminates harmful emissions from exiting analyzer and GC vents

Product Features

- Eliminates need for flare
- Easily connects to analyzer and GC vents
- Small package (19” high, 3” dia.)
- Ensures no back-pressure on analyzer vents
- Explosion proof packaging for hazardous areas
- Provides stable outlet vent pressure to atmosphere



Product Description

Operation of chemical, refineries, gas processing plants, and pipelines often requires the use of chemical analysis instrumentation. These instruments frequently require a pressure reference to atmospheric pressure for operation. This reference is frequently achieved by venting the sample to the atmosphere. These vented samples, generally called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

The focus of this technology is the use of a catalytic combustion process to oxidize the vented sample while maintaining the atmospheric pressure reference. The unit utilizes a continuous heat source to allow the oxidation process to be effective on 99% of fugitive emissions. Hydrocarbons are converted to CO2 & water vapor.

The packaging of the system is designed to provide explosion proof protection (Class I Div. I Grp. B, C, & D). This allows application of the technology in hazardous locations.

ANALYTICAL SYSTEMSKECO

Phone (281) 516-3950 or (281) 664-2890
Sales@asikeco.com | support@asikeco.com

Typical Specifications

FLOW RATE
- 1 liter / min (0.035 SCFM maximum OR
- 750 BTU / hour maximum

ANALYTICAL PERFORMANCE
- End product: water vapor, CO2 (Nil NOx formation due to low temp. operation)

- Backpressure: nil @ 1 liter/min. (<0.1” H20 @ 3 liters/min.)

- Catalyst life: >2 years (for preventative maintenance we recommend catalyst replacement each year of operation to ensure efficiency of operation)

PACKAGING
- Electrical class.: Designed for Class 1, Division 1 Groups B, C, & D; Zone 1 Temp T3B, Ex Group IIB & H2

- Materials of construction: Stainless steel, Aluminum, Platinum Catalyst

- Sample inlet connection: 3/4” NPT-F

TEMPERATURE RANGES
- Surface Temp. Class: T6-185°F (T4 - 275° F maximum operation)

WEIGHT
- Approx. 10 lbs; 4.5 kg

DIMENSIONS
- 19" X 3" dia.

POWER CONSUMPTION
- PN: Fugitive Emission Control 24
  24 VDC @ 100 watts (max.)

- PN: Fugitive Emission Control 110
  110-120VAC

- PN: Fugitive Emission Control 110
  210-220VAC

Replacement catalyst cartridge PN: T0146-900

Analytical Systems Keco provides design and application engineering assistance for the User’s analyzer requirements. For a quotation, please complete Analyzer Quote Request Form at **www.LiquidGasAnalyzers.com/quote**

4- MTI-270650121-TRACEraseM-IManualMTIAT Ver 12.06

Operating and Instruction Manual

TRACErase™

Analyzer Catalytic Fugitive Emissions Eliminator

The ***TRACErase***™ hydrocarbon emission eliminator is designed to eliminate fugitive emissions exiting analyzer sample vents, without producing backpressure which will upset the calibration of the analyzer. The products of this hydrocarbon elimination process are CO_2 and water vapor. The unit has a maximum capacity of one liter per minute or 1,000 BTU/HR while producing negligible backpressure.

Utilizing tees and other piping connections, any number of analyzers may be vented to the ***TRACErase***™ unit provided the total flow rate is not greater than one liter per minute and the maximum heat throughput does not exceed 1,000 BTU/HR. A method of preventing cross flow between the analyzers is recommended, such as rotometers on each input. Mounting of the ***TRACErase***™ may be in accomplished by numerous means, but it is recommended the cylindrical outer housing be at the top, with the junction box at the bottom.

Initial efficiency of the ***TRACErase***™ is 99.9% hydrocarbon elimination. Aging of the catalyst and contamination decrease the efficiency, with rating decreasing to approximately 96% after one year of operation. The catalyst is rated for two years of continuous use; however, to maintain optimum efficiency, it is recommended changing the catalyst cartridge every 12 months.

Oxygen for the combustion of hydrocarbon products is provided by ambient air and additional oxygen or air is not required.

Following are instructions for installing the ***TRACErase***™:

(1) Determine a position for mounting the ***TRACErase***™. Metal clamps, brackets, or piping may be utilized. The outer surface of the housing may reach a temperature of 135° C. (depending on stream composition and the amount of hydrocarbons present). The unit should be placed 12” from any walls or other flammable materials to avoid combustion. If mounted in high traffic areas, a shield may be utilized to reduce the risks of accidental burns.

(2) Following mounting of the ***TRACErase***™, remove the junction box cover and the protective cap from the bottom port of the junction box. Power connection wires should be routed through the open bottom port. The 120 VAC power leads connect to the two open screw terminal posts in the junction box. Connect the ground wire to the grounding screw in the junction box. The heating element must be inserted into the thermowell housing until it contacts the upper end. The element is held in place with the leads. Excess lead length should be wound inside the junction box, assuring the heating element is in place. If marks are on the leads of the heating element, insert the element until the marks are at the bottom of the thermowell housing. Replace the cover of the junction box.

(3) Remove the protective cap from the port of the street tee on the ***TRACErase***™ unit. Connect the analyzer sample vent to the open port (3/4” NPT) of the street tee on the ***TRACErase***™ unit. Reducers or adapters may be required to complete this connection, depending on the type of vent tubing. If multiple analyzers are connected to the ***TRACErase***™, tees will be required to provide the required number of

connections. Check valves between analyzers may be used to prevent cross-flow between connected units.

(4) Apply power to the ***TRACErase*™**. Power should be supplied to the unit at all times to provide heating in the event of intermittent analyzer flow or intermittent hydrocarbon presence in the sample. Approximately twenty minutes to one hour are required for the unit to reach optimum efficiency.

Exercise care when attaching or removing the outer housing of the ***TRACErase*™** unit and the body. The stainless steel threads are susceptible to nicking and cross-threading, rendering the unit difficult or impossible to disassemble and reassemble. This junction is not a gas-proof connection. Avoid over-tightening of threads. A Teflon® compound may be used on threads to enhance outer housing removal.

Streams containing hydrogen require caution. Concentrations above 4% hydrogen in the vent stream will lead to excessively high temperatures and cause malfunctioning of the ***TRACErase*™** unit and a potentially hazardous condition. Use of the ***TRACErase*™** for vent streams containing greater than 2% hydrogen is not recommended and will void the device warranty.

TRACErase™ Warranty

***TRACErase*™** units shall be free from defects in workmanship and materials, when used in accordance with applicable specifications and with appropriate maintenance, for a period of one year from the date of shipment to customer, unless otherwise specified in writing.

***TRACErase*™** products which malfunction may be returned, shipment prepaid, for test and evaluation. Products determined to be defective, and in warranty, will be repaired or replaced at no charge to customer. Products out of warranty will be tested and evaluated. If the product does not meet original specifications, the customer will be notified of cost before repairs/replacement. Repaired products will be warranted for 90 days from date of shipment to customer or for the balance of the original warranty, whichever is longer.

Failures due to shipping damage, accident, misuse, improper installation, or operation are excluded from warranty coverage.

No other statement or claim by any employee, agent, or representative shall constitute a warranty or give rise to any liability or obligation of ***MTI Analytical Technology***.

MTI

Applications

Chemical Processing & Manufacturing Plants

Gas Processing Plants

Transportation Pipelines

……

Specifications

Dimensions:
13” high
3” diameter
(19” h with junction box; junction box 3.75” diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(1,000 btu / hour maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(120 vac, 60 hz)

End Products:
Water Vapor, CO_2

Fugitive Emissions Eliminator

TRACErase™

P/N 1211-010-120

Most chemical and gas processing plants and transportation pipelines require the use of chemical analysis instrumentation. These instruments frequently require a stable pressure reference to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. These vented samples, called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

The focus of *TRACErase™* technology is the use of a catalytic combustion process to oxidize vented samples while maintaining an atmospheric pressure reference. The TRACErase™ Hydrocarbon Emission Eliminator utilizes a continuous heat source to allow effective oxidation of intermittent fugitive emission streams as well as continuous source streams.

In hazardous locations, the *TRACErase™* unit is designed to provide explosion resistant ratings. CSA approval ratings are available.

MTI Analytical Technology
P.O. Box 571866
Houston, TX 77257-1866 USA
Tel: 713.978.7765
Fax: 713.978.6230
www.mertechinc.com

Analytical Instrumentation

MTI **Analytical Technology**
A Division of MerTech Incorporated

TRACErase™ Hydrocarbon Emission Eliminator Specifications *(ver 11.01)*

PART NUMBER: 1211-010-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1" H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T4 - 275° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 1,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Designed for Class 1, Division 1, Groups B, C, & D (Canadian Standards Association (CSA) Approval Available for Class 1, Division 1, Groups B, C and D, T3B – Specify P/N 1211-021-120)

MATERIALS of CONSTRUCTION: Stainless steel, Carbon steel, Aluminum, Catalyst (Monel available as option)

SAMPLE INLET CONNECTION: ¾" FPT

AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-010TCJ-120

MTI Analytical Technology is available to assist with **Analyzers**, **Calibration / Validation Standards**, **CEM Data Acquisition and Reporting Software**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, **Maintenance Management Software**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

MTI

Fugitive Emissions Eliminator

TRACErase™

P/N 1211-021-120

Most chemical and gas processing plants and transportation pipelines require the use of chemical analysis instrumentation. These instruments frequently require a stable pressure reference to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. These vented samples, called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

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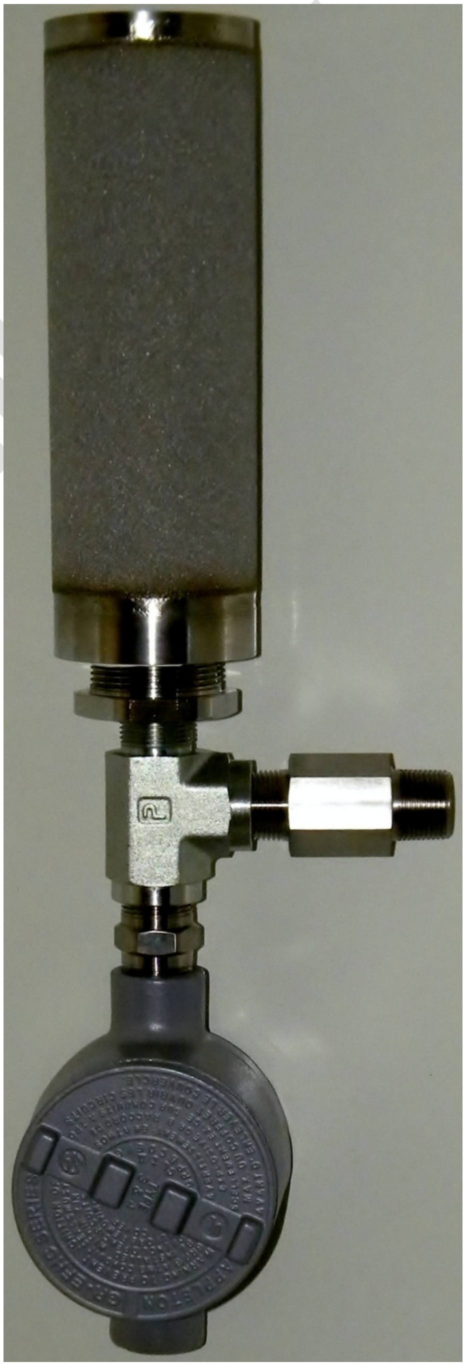
In hazardous locations, the *TRACErase™* unit is designed to provide explosion resistant ratings. CSA approval ratings are available.



Applications

Chemical Processing &
Manufacturing Plants

Gas Processing Plants

Transportation Pipelines

……

Specifications

Dimensions:
13” high
3” diameter
(19” h with junction box;
junction box 3.75”
diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(1,000 btu / hour
maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(120 vac, 60 hz)

End Products:
Water Vapor, CO_2

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Fax: 713.978.6230
www.mertechinc.com

Analytical Instrumentation

MTI **Analytical Technology**

A Division of MerTech Incorporated

TRACErase™ Hydrocarbon Emission Eliminator Specifications *(ver 12.03)*

PART NUMBER: 1211-021-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1” H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T4 - 275° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 1,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Canadian Standards Association (CSA) Approval Available for Class 1, Division 1, Groups B, C and D, T3B

MATERIALS of CONSTRUCTION: Stainless steel, Carbon steel, Aluminum, Catalyst (Monel available as option)

SAMPLE INLET CONNECTION: ¾” FPT

AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-010TCJ-120

MTI Analytical Technology is available to assist with **Analyzers**, **Calibration / Validation Standards**, **CEM Data Acquisition and Reporting Software**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, **Maintenance Management Software**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

MTI

Fugitive Emissions Eliminator

Applications

Chemical Processing &
Manufacturing Plants

Gas Processing Plants

Transportation Pipelines

……

Specifications

Dimensions:
13" high
3" diameter
(19" h with junction box;
junction box 3.75"
diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(1,000 btu / hour
maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(120 vac, 60 hz)
(optional 240 vac, 50-60
hz)

End Products:
Water Vapor, CO_2

TRACErase™

P/N 1211-010TCJ-120

Most chemical and gas processing plants and transportation pipelines require the use of chemical analysis instrumentation. These instruments frequently require a stable pressure reference to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. These vented samples, called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

The focus of *TRACErase™* technology is the use of a catalytic combustion process to oxidize vented samples while maintaining an atmospheric pressure reference. The TRACErase™ Hydrocarbon Emission Eliminator utilizes a continuous heat source to allow effective oxidation of intermittent fugitive emission streams as well as continuous source streams.

In hazardous locations, the *TRACErase™* unit is designed to provide explosion resistant ratings.

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Fax: 713.978.6230
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Analytical Instrumentation

MTI **Analytical Technology**

A Division of MerTech Incorporated

TRACErase™ Hydrocarbon Emission Eliminator Specifications *(ver 11.01)*

PART NUMBER: 1211-010TCJ-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1” H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T4 - 275° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 1,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Designed for Class 1, Division 1, Groups B, C, & D

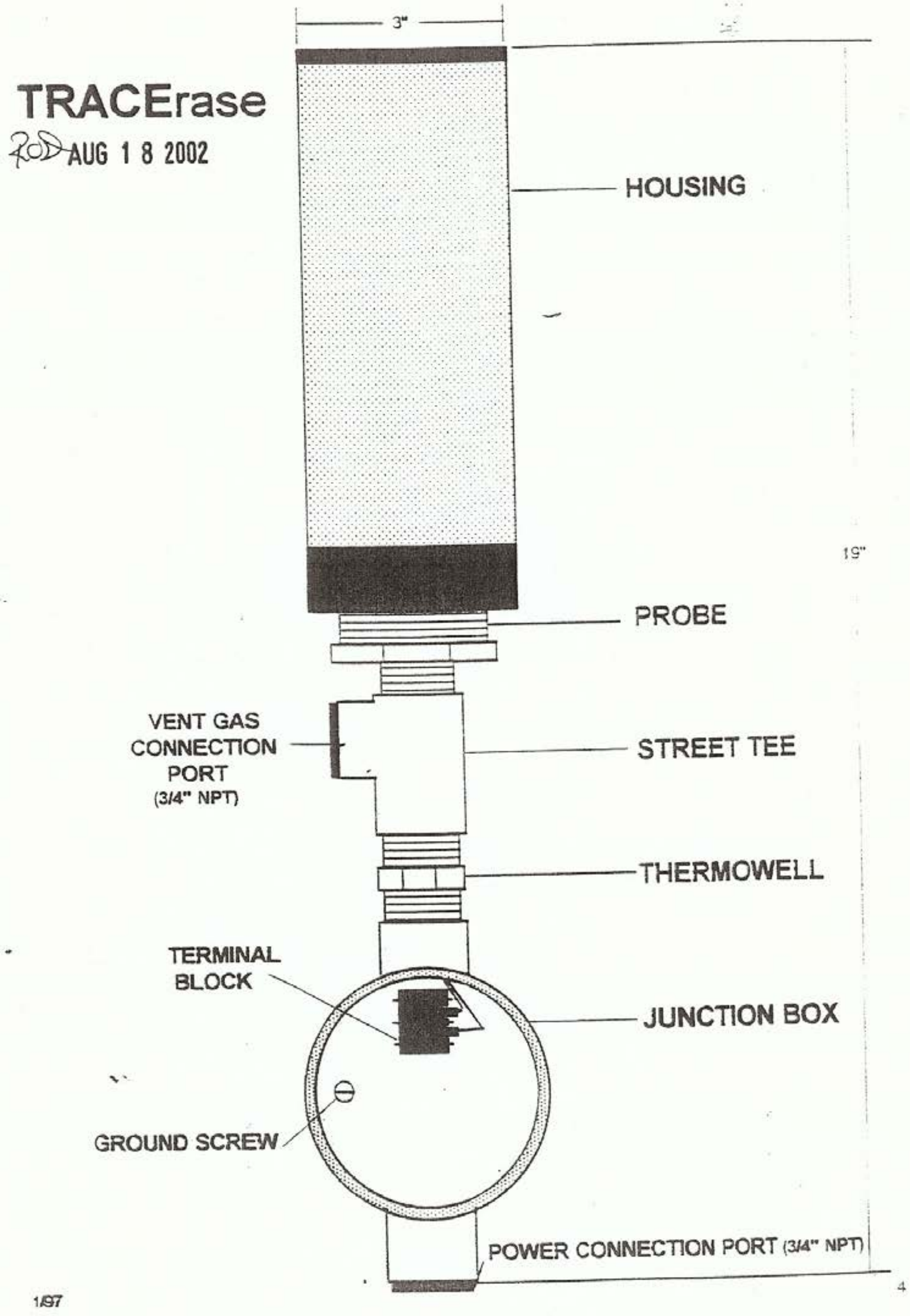
MATERIALS of CONSTRUCTION: Stainless steel, Carbon steel, Aluminum, Catalyst (Monel available as option)

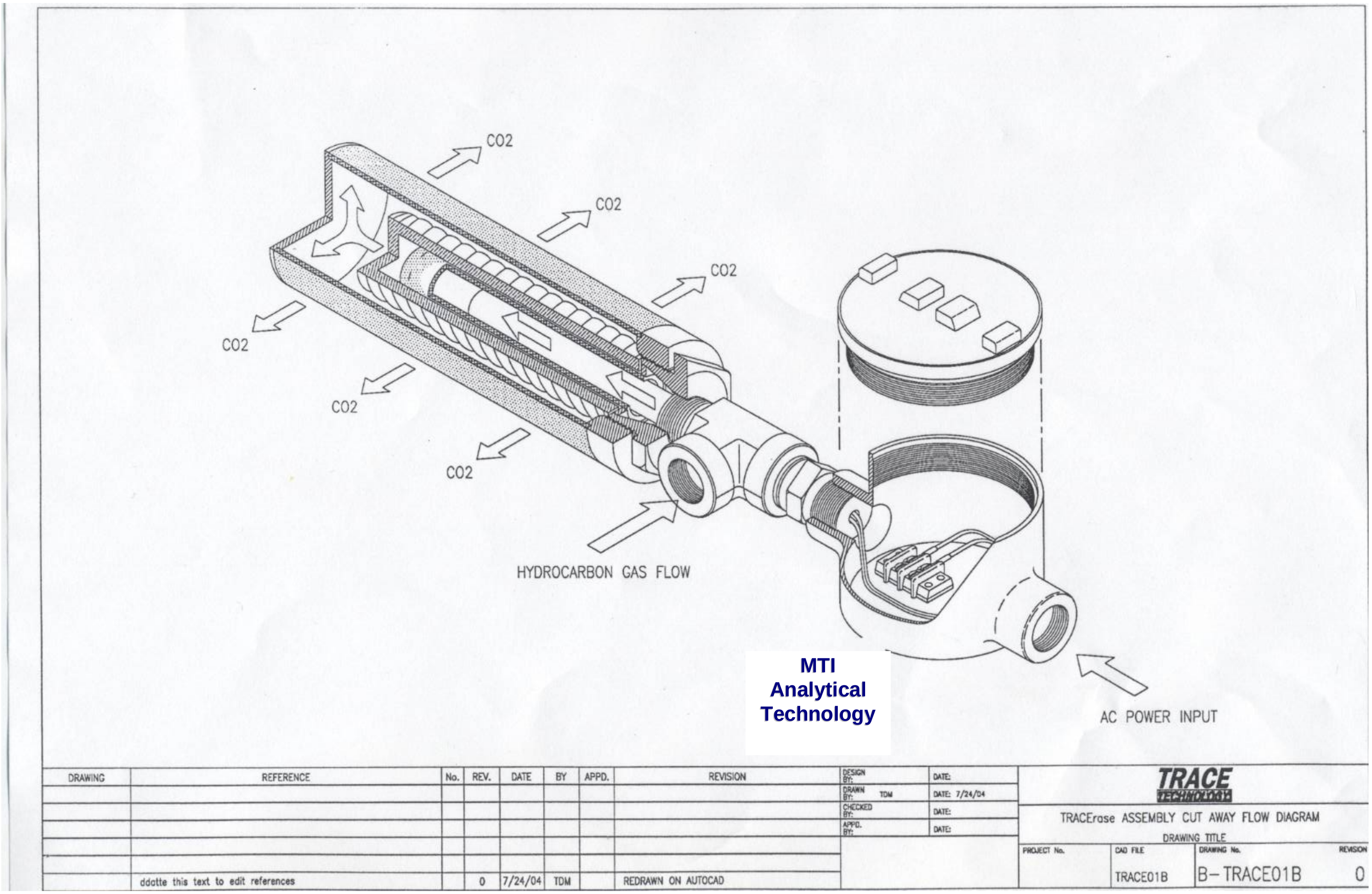
SAMPLE INLET CONNECTION: ¾” FPT

TYPE J THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Integral with internal heating element

MTI Analytical Technology is available to assist with **Analyzers**, **Calibration / Validation Standards**, **CEM Data Acquisition and Reporting Software**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, **Maintenance Management Software**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com


TRACErase
ROD AUG 1 8 2002
3"
19"
HOUSING
PROBE
VENT GAS CONNECTION PORT (3/4" NPT)
STREET TEE
THERMOWELL
TERMINAL BLOCK
JUNCTION BOX
GROUND SCREW
POWER CONNECTION PORT (3/4" NPT)
1/97
4


CO2
CO2
CO2
CO2
CO2
CO2
HYDROCARBON GAS FLOW
AC POWER INPUT
MTI
Analytical
Technology
DRAWING
REFERENCE
No.
REV.
DATE
BY
APPD.
REVISION
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7/24/04
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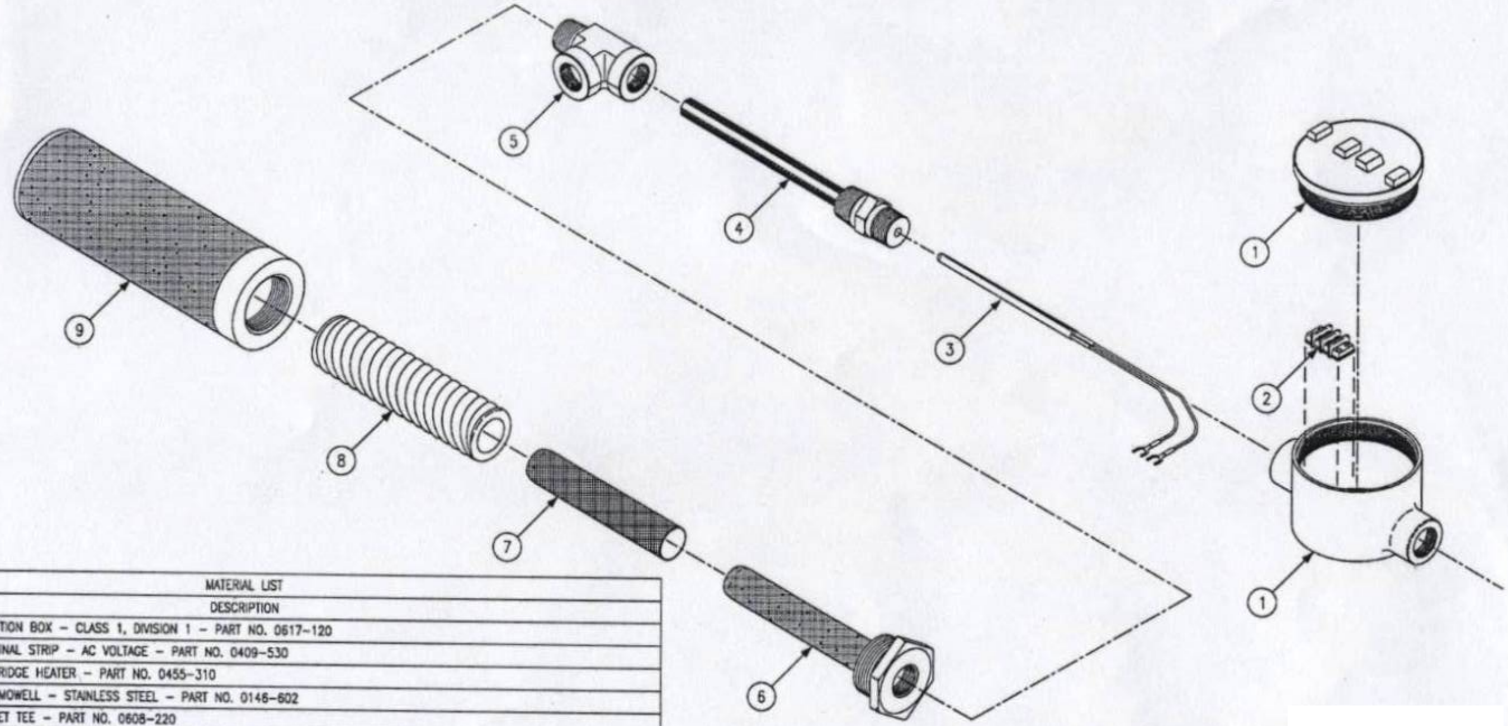
TRACE TECHNOLOGY
TRACErase ASSEMBLY CUT AWAY FLOW DIAGRAM
DRAWING TITLE
PROJECT No.
CAD FILE
TRACE01B
DRAWING No.
B-TRACE01B
REVISION
0



MATERIAL LIST

ITEM	QUANTITY	DESCRIPTION
1	1	JUNCTION BOX – CLASS 1, DIVISION 1 – PART NO. 0617-120
2	1	TERMINAL STRIP – AC VOLTAGE – PART NO. 0409-530
3	1	CARTRIDGE HEATER – PART NO. 0455-310
4	1	THERMOWELL – STAINLESS STEEL – PART NO. 0146-602
5	1	STREET TEE – PART NO. 0608-220
6	1	SINTERED METAL PROBE – 1" DIA. – 0.040" PORE SIZE – PART NO. 0146-402
7	1	MESH SCREEN – PART NO. 1211-101
8	1	CATALYTIC CARTRIDGE – PART NO. 1211-101
9	1	SINTERED METAL HOUSING – 3" DIA. – 0.040" PORE SIZE – PART NO. 0146-102
10		
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DRAWING	REFERENCE	No.	REV.	DATE	BY	APPD.	REVISION
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TRACE TECHNOLOGIES

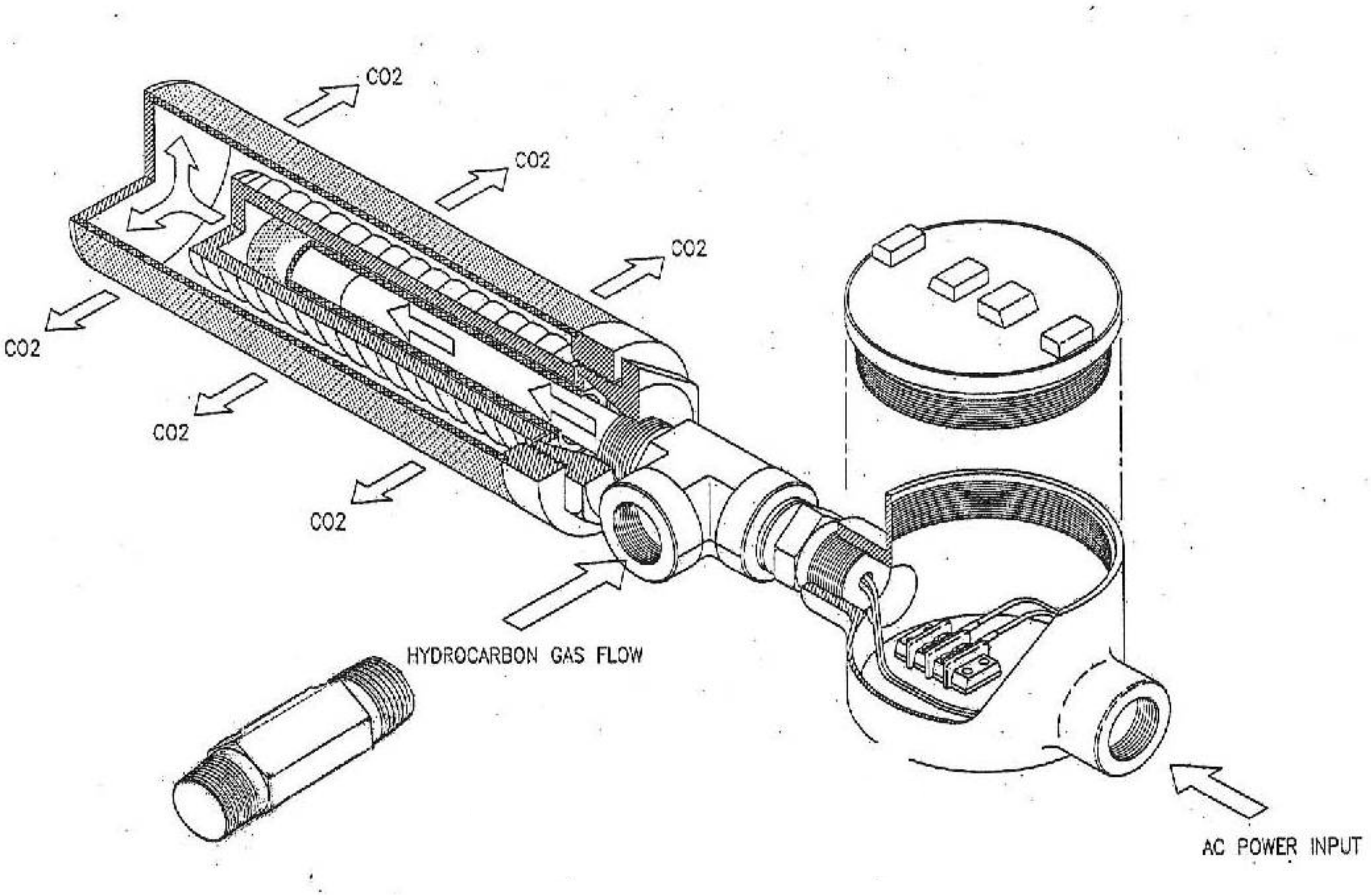
TRACErase EXPLODED ISOMETRIC ASSEMBLY

DRAWING TITLE

PROJECT No.	CAD FILE	DRAWING No.	REVISION
	TRACE01A	B-TRACE01A	0

MTI **Analytical Technology**

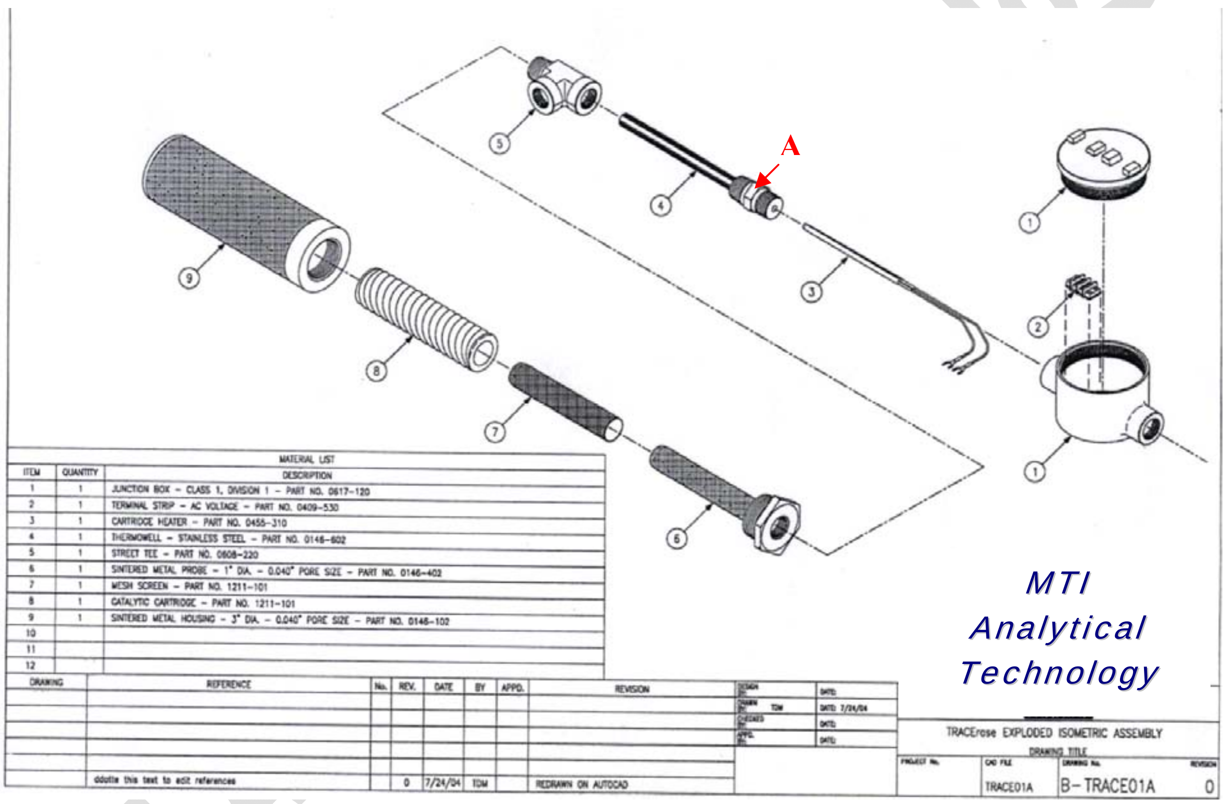
A Division of MerTech Incorporated



TRACErase Hydrocarbon Emission Eliminator
with
Optional P/N 0146-750 Inlet Flame Arrestor

TRACErase Hydrocarbon Emission Eliminator
Replacement Cartridge Heating Element *(ver. 1005)*

1. Remove electrical junction box cover (1) after deenergizing circuit power.
2. Disconnect cartridge heating element leads from terminal strip (2) in electrical junction box.
3. Remove TRACErase upper assembly from the electrical junction box. (Remove at juncture labeled **"A"**)



MATERIAL LIST		
ITEM	QUANTITY	DESCRIPTION
1	1	JUNCTION BOX – CLASS 1, DIVISION 1 – PART NO. 0617-120
2	1	TERMINAL STRIP – AC VOLTAGE – PART NO. 0409-530
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DRAWING	REFERENCE	No.	REV.	DATE	BY	APPD.	REVISION
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TRACErose EXPLODED ISOMETRIC ASSEMBLY
DRAWING TITLE

PROJECT No.	CAD FILE	DRAWING No.	REVISION
	TRACE01A	B-TRACE01A	0

4. Extract cartridge heating element (3) from thermowell housing.
5. Replace cartridge heating element with replacement unit.
6. If integral, optional type J thermocouple is supplied; the red (non-magnetic, negative) and white (magnetic, positive) leads are for the thermocouple.
7. Reassemble the upper assembly onto the electrical junction box ("A").
8. Attach the cartridge heating element to the terminal strip (2) in the electrical junction box.
9. Extend the thermocouple wires, if supplied, to a terminal strip or to a temperature transmitter.
10. Replace the electrical junction box cover (1) and reenergize power to circuit.

Temperatures in excess of 100º F above ambient indicate functioning of the cartridge heater and in excess of 185º F above ambient indicate functioning of the catalyst cartridge. Actual temperatures will depend upon heat content of materials supplied to the TRACErase unit.

TRACErase Hydrocarbon Emission Eliminator

Parts List *(ver. 10.12)*

Complete Assembly (SS, 120 VAC)	**P/N 1211-010-120**
Complete Assembly (SS, 120 VAC w/ integral Type J Thermocouple)	**P/N 1211-010TCJ-120**
Complete Assembly (SS, 120 VAC w/ integral Type T Thermocouple)	**P/N 1211-010TCT-120**
Complete Assembly (SS, 120 VAC, CSA Certified)	**P/N 1211-021-120**
Complete Assembly (SS, 120 VAC, CSA Certified w/integral Type J Thermocouple)	**P/N 1211-021TCJ-120**
Complete Assembly (SS 240 VAC)	**P/N 1211-010-240**
Complete Assembly (Monel, 120 VAC)	**P/N 1211-011-120**
Complete Assembly (Monel, 120 VAC w/ integral Type J Thermocouple)	**P/N 1211-011TCJ-120**
Probe, Sintered Metal (Stainless Steel)	**P/N 0146-402**
Probe, Sintered Metal (Monel)	**P/N 0146-422**
Probe (Inconel)	**P/N 0146-XXX**
Probe (Hast X)	**P/N 0146-XXX**
Thermowell (Stainless Steel)	**P/N 0146-602**
Thermowell (Monel)	**P/N 0146-622**
Outer Housing, Sintered Metal (Stainless Steel)	**P/N 0146-102**
Terminal Block (2 Terminal)	**P/N 0409-530**
Heating Element (120VAC)	**P/N 0455-310**
Heating Element (120VAC w/ integral Type J Thermocouple)	**P/N 0455-310TCJ**
Heating Element (120VAC w/ integral Type T Thermocouple)	**P/N 0455-310TCT**
Heating Element (240 VAC)	**P/N 0455-311**
Tee, ¾" Street	**P/N 0608-220**
Junction Box, ¾" NPT	**P/N 0617-120**
Catalyst Cartridge	**P/N 0146-900**
(Previous Catalyst Cartridge P/N 1211-101)	
Mounting Plate, ¾" NPT	**P/N 0146-702**
Flame Arrestor (Inlet)	**P/N 0146-750**

Prices are in US $ and Subject to Change Without Notice

MTI Analytical Technology

A Division of MerTech Incorporated

ver 13.06

* Analysis Instrumentation *

Foxboro (Invensys) Analytical – pH, ORP, Conductivity Analyzers *www.foxboro.com/echem*
TRACE Technology, Inc. – Lead Acetate H_2S and Total Sulfur Portable & Process Analyzers

* Analyzer Calibration / Validation Standards *

Kin-Tek Laboratories, Inc. – Permeation Calibration / Validation Standards & Instruments, Contract Third Party Validation & Verification Services *www.kin-tek.com*

* Analyzer Sample Handling / Sample Conditioning *

Kin-Tek Laboratories, Inc. – Orbital Tube Welding, Custom Assemblies to ¼" O.D., Permeation Dilution Units *www.kin-tek.com*

* Analyzer Sensors / Electrochemical *

Analytical Sensors, Inc. – Process & Laboratory pH, ORP, & Ion Selective Electrodes & Sensors *www.asi-sensors.com*
Foxboro (Invensys) Analytical – DolpHin pH and ORP Sensors *www.foxboro.com/echem*

* Analyzer Vent Emission Eliminator *

TRACE Technology, Inc. – TRACErase Analyzer Vent Hydrocarbon & H_2S Emission Eliminators

* Gas Detection Sensors & Systems *

Otis Instruments Inc. – WireFree™ Gen^2 Gas Detection Products *www.otisinstruments.com*

* Manufacturers *

Analytical Sensors, Inc.
Foxboro (Invensys) Analytical
Kin-Tek Laboratories, Inc.

Otis Instruments Inc.
TRACE Technology, Inc.

MTI Analytical Technology is available to assist with environmental, laboratory, and process monitoring applications. Design, fabrication, installation, and commissioning may be accomplished, assuring integrity and performance of component units.

Contact **Dale C. Merriman, CSAT** at the address below or email: **dcmerriman@mertechinc.com**

MTI

Analytical Technology

A Division of MerTech Incorporated
ver. 15.08

5-MTI Data V-15.08

Maintenance and Instruction Manual

TRACErase™

Analyzer Catalytic Fugitive Emissions Eliminator

MTI **Analytical Technology**
A Division of MerTech Incorporated

TRACErase™ Hydrocarbon Emission Eliminator Specifications *(ver 15.08)*

PART NUMBER: 1211-010-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1" H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T4 - 275° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 750 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Designed for Class 1, Division 1, Groups B, C, & D (Canadian Standards Association (CSA) Approval Available for Class 1, Division 1, Groups B, C and D, T3B – Specify P/N 1211-021-120)

MATERIALS of CONSTRUCTION: Stainless steel, Aluminum, Platinum Catalyst (Monel available as option)

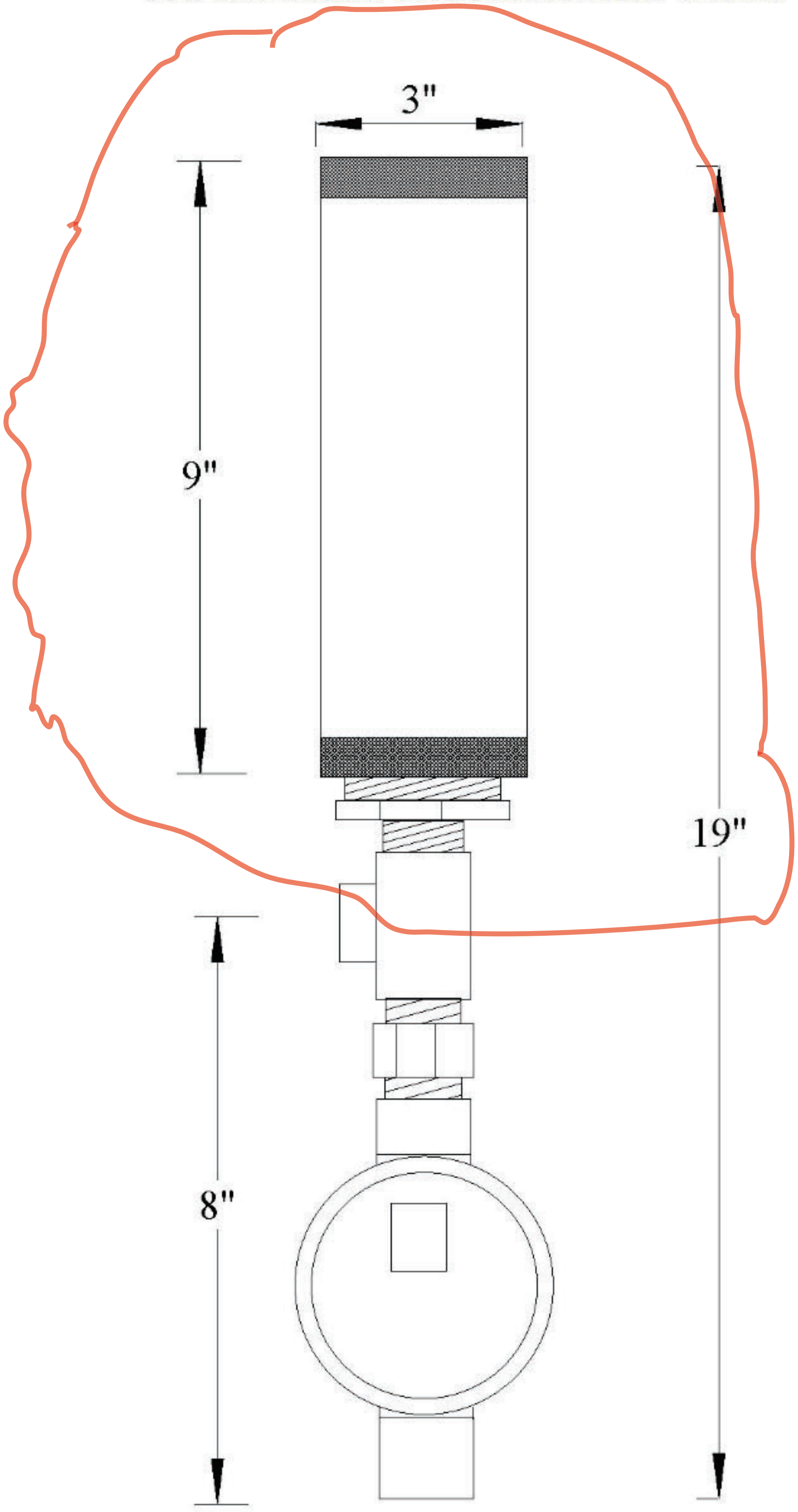
SAMPLE INLET CONNECTION: ¾" FPT

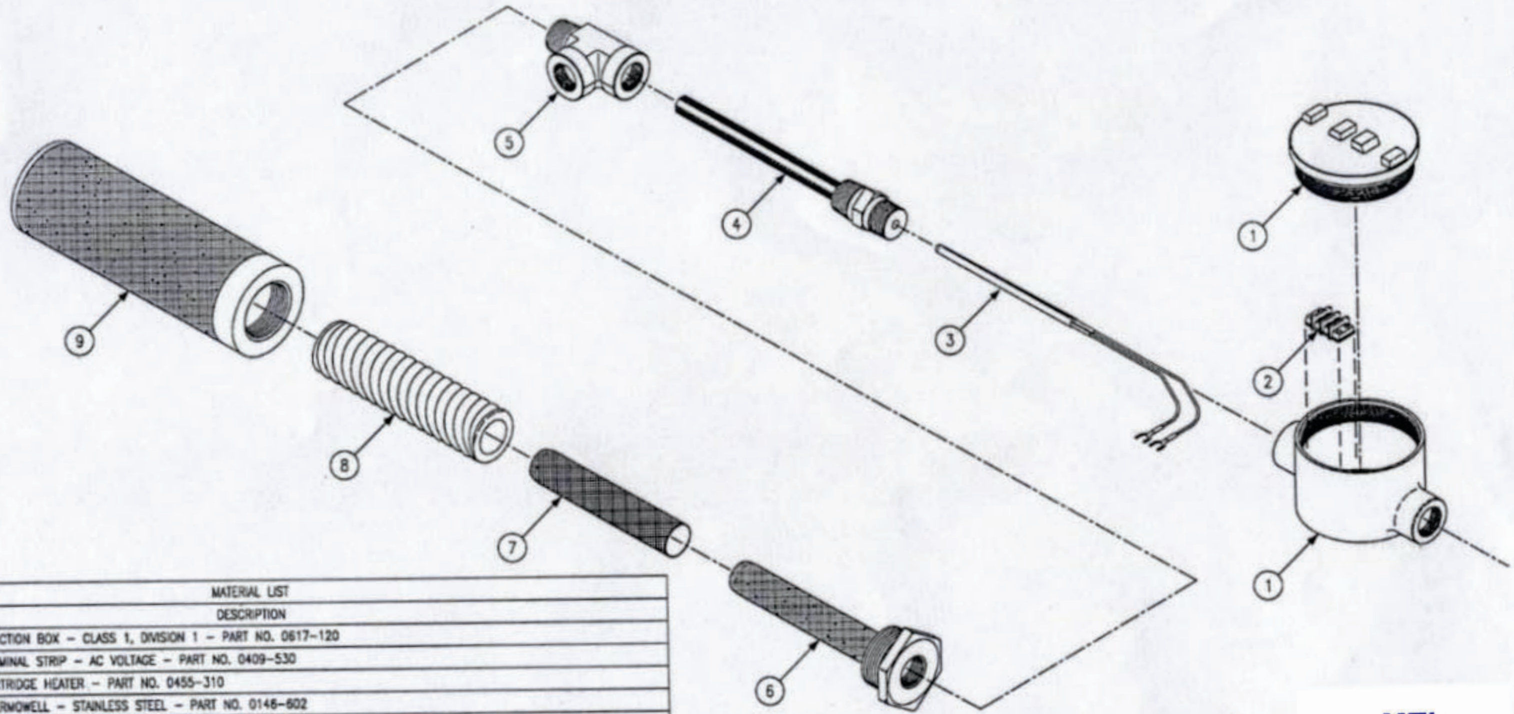
AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-010TCJ-120

MTI Analytical Technology is available to assist with **Analyzers**, **Calibration / Validation Standards**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

TRACErase Dimensional Data





MTI
Analytical
Technology

MATERIAL LIST		
ITEM	QUANTITY	DESCRIPTION
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9	1	SINTERED METAL HOUSING – 3" DIA. – 0.040" PORE SIZE – PART NO. 0146-102
10		
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TRACE
TECHNOLOGIES

TRACErose EXPLODED ISOMETRIC ASSEMBLY
DRAWING TITLE

PROJECT No.	CAD FILE	DRAWING No.	REVISION
	TRACE01A	B-TRACE01A	0

6-TRACErasePetro May 2024-Ver 17.06

Fugitive Emissions Eliminator

MTI

Applications

Chemical Processing & Manufacturing Facilities

Gas Processing Facilities

Refineries

Transportation Pipelines

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Specifications

Dimensions:
13” high
3” diameter
(19” h with junction box; junction box 3.75” diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(750 btu / hour maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(110/120 vac, 50/60 hz)

End Products:
Water Vapor, CO_2

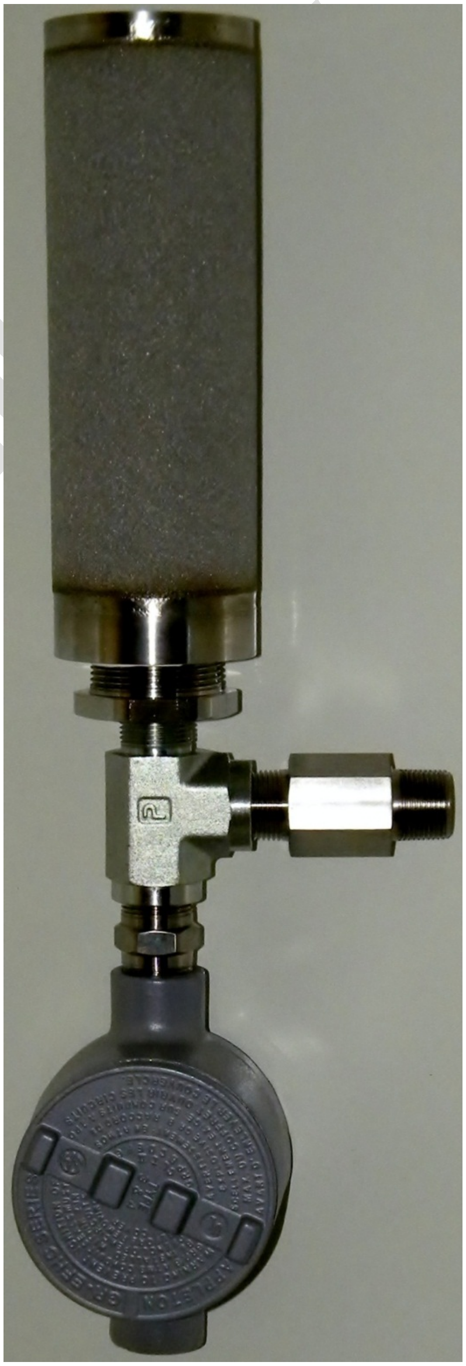
TRACErase™

P/N 1211-021TCJ-120

Most chemical and gas processing plants and transportation pipelines require the use of chemical analysis instrumentation. These instruments require a stable outlet vent pressure referenced to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. These vented samples, called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

The focus of *TRACErase*™ technology is the use of a catalytic combustion process to oxidize vented samples while maintaining an atmospheric pressure reference. The TRACErase™ Hydrocarbon Emission Eliminator utilizes a continuous heat source to allow effective oxidation of intermittent fugitive emission streams as well as continuous source streams.

In hazardous locations, the *TRACErase*™ unit is approved by the Canadian Standards Association for Class 1, Division 1, Group B, C, and D, TB3 classification.



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www.mertechinc.com

Analytical Instrumentation

MTI **Analytical Technology**
A Division of MerTech Incorporated

TRACErase™ Hydrocarbon Emission Eliminator Specifications *(ver 1706)*

PART NUMBER: 1211-021TCJ-120 (Patent #5,846,504)

BACKPRESSURE: Nil @ 1 liter/minute (<0.1" H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T3B – 329° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 750 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Canadian Standards Association (CSA)
Approved for Class 1, Division 1, Groups B, C, and D, T3B
(Suitable for Class 1, Zone 1, Ex Group IIB + H^2)

MATERIALS of CONSTRUCTION: Stainless steel, Aluminum, Platinum Catalyst (Monel available as option)

SAMPLE INLET CONNECTION: ¾" FNPT (with ¾" MNPT Flame Arrestor)

SUPPLIED WITH: Optional Type J Internal Thermocouple Temperature Sensing Element

MTI Analytical Technology is available to assist with **Analyzers**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detectors & Systems**, **Sample Handling and Conditioning Devices**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

MTI **Analytical Technology**

A Division of MerTech Incorporated
ver 1902

7-MTI-Catalytic-Convertor-MIManualMTIAT-19.02

Maintenance and Instruction Manual

Analyzer Catalytic Convertor

Fugitive Emissions Eliminator

The Hydrocarbon Emission Eliminator is designed to eliminate fugitive emissions exiting analyzer sample vents. This is accomplished without producing backpressure excursions, eliminating upsets of the analyzer calibration. The products of this catalytic hydrocarbon elimination process are CO_2 and water vapor. The unit has a maximum capacity of one liter per minute or 2,000 BTU/HR.

Utilizing tees and other piping connections, any number of analyzers may be vented to the unit provided the total flow rate is not greater than one liter per minute and the maximum heat throughput does not exceed 2,000 BTU/HR. A method of preventing cross flow between the analyzers is recommended, such as rotometers for each input. Mounting of the unit may be accomplished by numerous means, but it is recommended the cylindrical outer housing be at the top, with the junction box at the bottom.

Initial efficiency of the catalytic convertor is 99.9% hydrocarbon elimination. Aging of the catalyst and contamination decrease the efficiency, with rating decreasing to approximately 96% after one year of operation. The catalyst is rated for two years of continuous use; however, to maintain optimum efficiency, it is recommended changing the catalyst cartridge annually.

Oxygen for the combustion of hydrocarbon products is provided by ambient air and additional oxygen or air is not required. The products of conversion are emitted through the outer housing.

Following are instructions for installing the catalytic convertor:

(1) Determine a position for mounting the unit. Metal clamps, brackets, or piping may be utilized. The outer surface of the housing may reach a temperature of 300° F. (depending on stream composition and the quantity of hydrocarbons present). The unit should be placed 12” from any walls or other flammable materials to avoid combustion. If mounted in high traffic areas, a shield may be utilized to reduce the risks of accidental burns. Units are to be mounted in an outdoors location.

(2) Following mounting of the device, remove the junction box cover. Power connection wires should be routed through the open bottom port. Conduit seals may be required for the incoming power leads to meet area classifications and to preserve the integrity of the catalytic convertor area classification. The 120 VAC power leads connect to the two open screw terminal posts in the junction box. Connect the ground wire to the grounding screw in the junction box. The heating element must be inserted into the thermowell housing until it contacts the upper end. The element is held in place with the leads. Excess lead length should be wound inside the junction box, assuring the heating element is in place. If marks are on the leads of the heating element, insert the element until the marks are at the bottom of the thermowell housing. Replace the cover of the junction box.

(3) Connect the analyzer sample vent to the open port (¾” FNPT, ¾” MNPT with Flame Arrestor) of the street tee on the unit. Reducers or adapters may be required to complete this connection, depending on the type of piping. If multiple analyzers are connected, tees will be required to provide the required number of connections. Check valves between analyzers may be used to prevent cross-flow between connected units.

(4) Apply power to the unit. Power should always be supplied to the unit to provide heating in the event of intermittent analyzer flow or intermittent hydrocarbon presence in the

sample. Approximately twenty minutes to one hour are required for the unit to reach optimum efficiency.

Exercise care when attaching or removing the outer housing of the unit and the body. The stainless-steel threads are susceptible to nicking and cross-threading, rendering the unit difficult or impossible to disassemble and reassemble. This junction is not intended as a gas-tight connection. Avoid over-tightening of threads. A Teflon® compound may be used on threads to enhance outer housing removal.

Streams containing % concentrations of hydrogen require caution. Concentrations above 10% hydrogen in the vent stream will lead to excessively high temperatures and cause malfunctioning of the unit, leading to replacement of internal parts. Use of the standard unit for vent streams containing greater than 10% hydrogen is not recommended and will require the use of a modified internal probe. Contact ***MTI Analytical Technology*** (***MerTech Incorporated***) for additional information on the modified internal probe for use with high concentrations of hydrogen. Most gas chromatographs are now utilizing hydrogen as the carrier gas causing premature failure of the standard sintered stainless-steel inner probe.

Changing the Catalyst Cartridge

Remove power and flow from the unit and allow the device to cool. This may require several minutes. When the unit is cool enough to handle, remove the upper, outer housing. The catalyst cartridge will then be exposed and appears as a wool-like material. Slide the catalyst cartridge from the inner probe. The new, replacement catalyst cartridge can then be installed in place of the previous unit.

Power and flow may then be restored. Efficiency of the unit will also be restored once the internal heating element has heated the internals and has reached operating temperature.

Warranty

The units shall be free from defects in workmanship and materials, when used in accordance with applicable specifications and with appropriate maintenance, for a period of one year from the date of shipment to customer, unless otherwise specified in writing.

MTI Analytical Technology products which malfunction may be returned, shipment prepaid, for test and evaluation. Products determined to be defective, and in warranty, will be repaired or replaced at no charge to customer. Products out of warranty will be tested and evaluated. If the product does not meet original specifications, the customer will be notified of cost before repairs/replacement. Repaired products will be warranted for 90 days from date of shipment to customer or for the balance of the original warranty, whichever is longer.

Failures due to shipping damage, accident, misuse, improper installation, or operation are excluded from warranty coverage.

No other statement or claim by any employee, agent, or representative shall constitute a warranty or give rise to any liability or obligation of ***MTI Analytical Technology***.

MTI

Fugitive Emissions Eliminator

Applications

Chemical Processing & Manufacturing Facilities

Gas Processing Facilities

Refineries

Transportation Pipelines

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Specifications

Dimensions:
13” high
3” diameter
(19” h with junction box; junction box 3.75” diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(2,000 btu / hour maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(110/120 vac, 50/60 hz)

End Products:
Water Vapor, CO_2

P/N 1211-010-120

Most hydrocarbon processing plants and transportation pipelines require the use of chemical analysis instrumentation. These analytical instruments require a stable outlet vent pressure to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. Some of the vented samples contain hydrocarbons, referred to as fugitive emissions. Fugitive emissions are air pollutants and contribute to worldwide environmental concerns.

The focus of the Fugitive Emissions Eliminator is the use of a catalytic conversion process to oxidize vented samples while maintaining an atmospheric pressure reference. The Hydrocarbon Emission Eliminator utilizes a continuous heat source to allow effective conversion of intermittent as well as continuous vent streams.

In hazardous locations, the unit is designed, not certified, to provide explosion resistance. Canadian Standards Association (CSA) approval ratings are available, specify P/N 1211-021-120.

MTI Analytical Technology
P.O. Box 571866
Houston, TX 77257-1866 USA
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Fax: +1 713.523.94623
www.mertechinc.com

Analytical Instrumentation

MTI **Analytical Technology**

A Division of MerTech Incorporated

Analyzer Hydrocarbon Emission Eliminator Specifications *(ver 1902)*

PART NUMBER: 1211-010-120

BACKPRESSURE: Nil @ 1 liter/minute

HYDROCARBON EMISSION PRODUCTS: Water Vapor, Carbon Dioxide (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T3B - 330° F maximum operation)

CATALYST LIFE: Recommend catalyst replacement each year of operation to ensure efficiency of operation

MAXIMUM CONCENTRATION: 2,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Designed, not certified, for Class 1, Division 2, Groups B, C, & D. (Approval available for Class 1, Division 1, Groups B, C and D, T3B – Specify P/N 1211-021-120)

MATERIALS of CONSTRUCTION: Stainless Steel, Aluminum, Platinum Catalyst

SAMPLE INLET CONNECTION: ¾" FNPT

AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-010TCJ-120

MTI Analytical Technology is available to assist with **Analyzers**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

MTI

Applications

Chemical Processing &
Manufacturing Facilities

Gas Processing Facilities

Refineries

Transportation Pipelines

……

Specifications

Dimensions:
13” high
3” diameter
(19” h with junction box;
junction box 3.75”
diameter)

Weight:
10 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(2,000 btu / hour
maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(110/120 vac, 50/60 hz)

End Products:
Water Vapor, CO_2

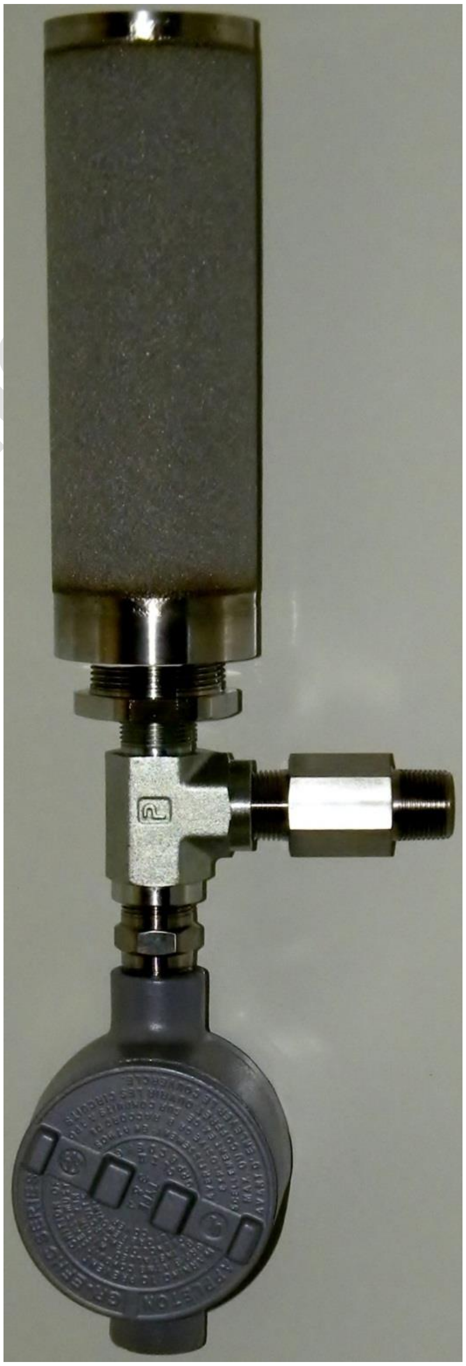
Fugitive Emissions Eliminator

P/N 1211-021-120

Most chemical and gas processing plants and transportation pipelines require the use of chemical analysis instrumentation. These instruments require a stable outlet vent pressure referenced to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. These vented samples, called fugitive emissions, are air pollutants and contribute to worldwide pollution problems.

The focus of technology is the use of a catalytic combustion process to oxidize vented samples while maintaining an atmospheric pressure reference. The Hydrocarbon Emission Eliminator utilizes a continuous heat source to allow effective oxidation of intermittent fugitive emission streams as well as continuous source streams.

In hazardous locations, the unit is approved by the Canadian Standards Association for Class 1, Division 1, Group B, C, and D, TB3 classification.



MTI Analytical Technology
P.O. Box 571866
Houston, TX 77257-1866 USA
Tel: +1 713.978.7765
Fax: +1 713.583.9423
www.mertechinc.com

Analytical Instrumentation

Analyzer Hydrocarbon Emission Eliminator Specifications *(ver 1902)*

PART NUMBER: 1211-021-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1” H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, CO_2, (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T3B – 329° F maximum operation)

CATALYST LIFE: >2 years (Recommend preventative maintenance catalyst replacement each year of operation to ensure efficiency of operation)

MAXIMUM CONCENTRATION: 2,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Canadian Standards Association (CSA)
Approved for Class 1, Division 1, Groups B, C, and D, T3B
(Suitable for Class 1, Zone 1, Ex Group IIB + H^2)

MATERIALS of CONSTRUCTION: Stainless steel, Aluminum, Platinum Catalyst (Other materials available as options)

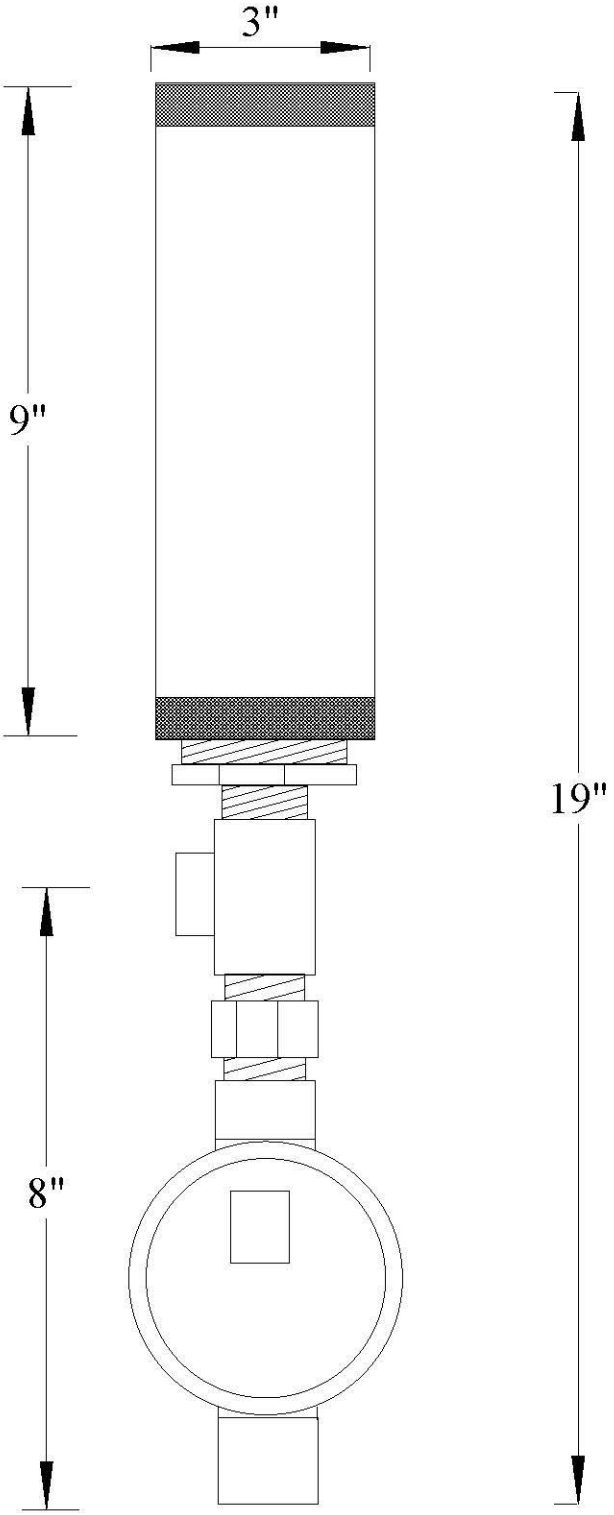
SAMPLE INLET CONNECTION: ¾” MNPT (with Flame Arrestor)

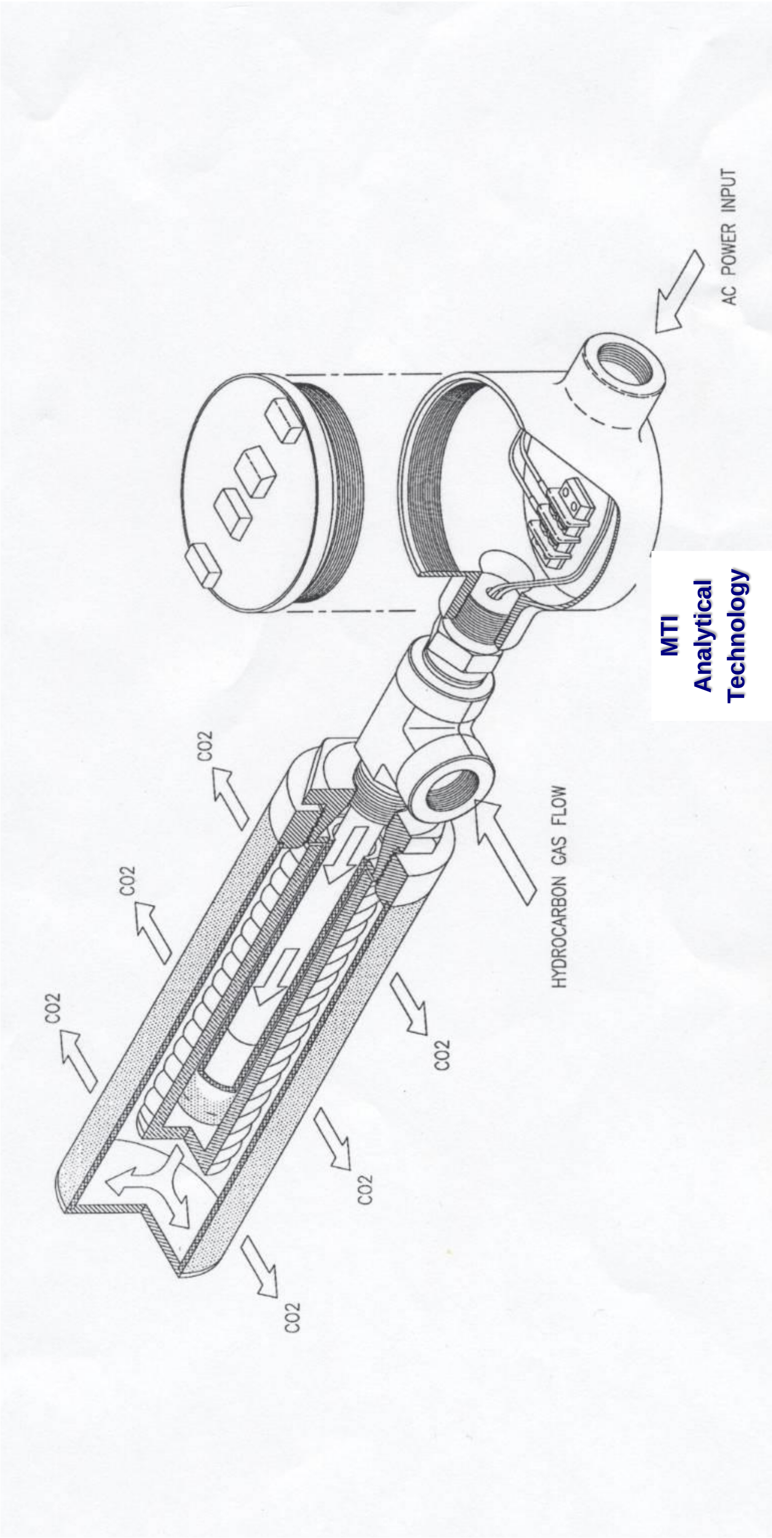
AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-021TCJ-120

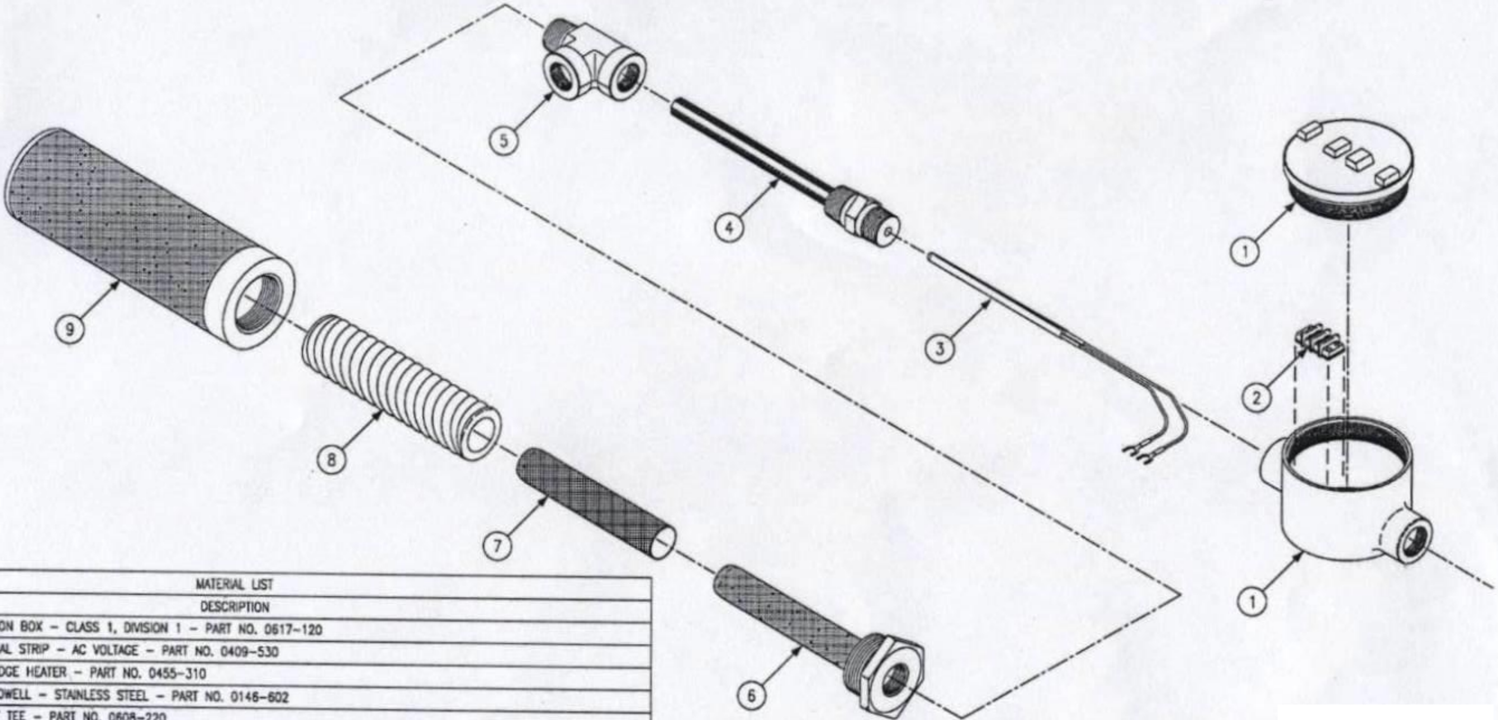
MTI Analytical Technology is available to assist with **Analyzers**, **Electrochemical Sensors**, **Emission Eliminators**, **Gas Detection & Systems**, **Sample Handling and Conditioning Devices**, and **Packaged Analytical Systems** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

Catalytic Convertor Dimensional Data

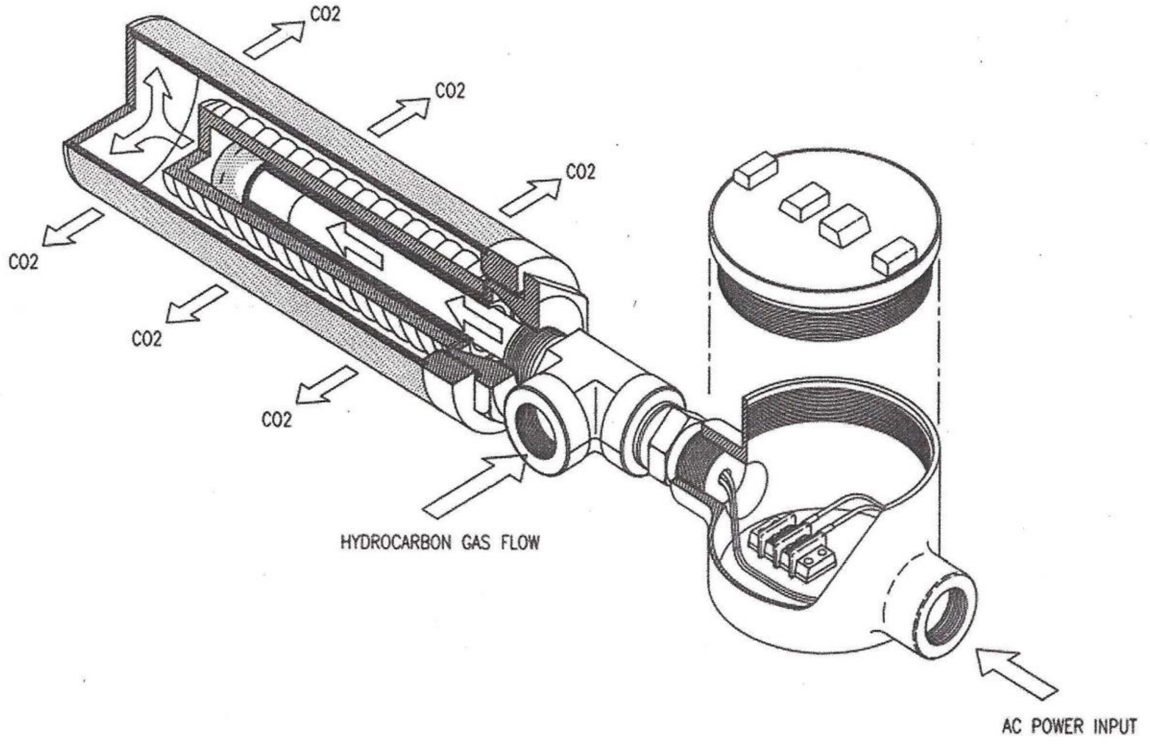


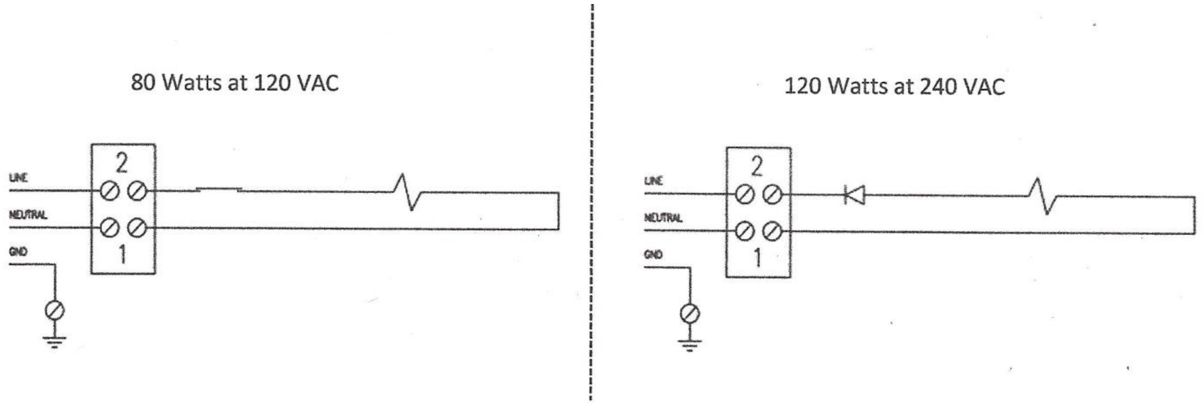

AC POWER INPUT
HYDROCARBON GAS FLOW
CO2
CO2
CO2
CO2
CO2
CO2
CO2



MATERIAL LIST		
ITEM	QUANTITY	DESCRIPTION
1	1	JUNCTION BOX – CLASS 1, DIVISION 1 – PART NO. 0617-120
2	1	TERMINAL STRIP – AC VOLTAGE – PART NO. 0409-530
3	1	CARTRIDGE HEATER – PART NO. 0455-310
4	1	THERMOWELL – STAINLESS STEEL – PART NO. 0146-602
5	1	STREET TEE – PART NO. 0608-220
6	1	SINTERED METAL PROBE – 1" DIA. – 0.040" PORE SIZE – PART NO. 0146-402
7	1	MESH SCREEN – PART NO. 1211-101
8	1	CATALYTIC CARTRIDGE – PART NO. 1211-101
9	1	SINTERED METAL HOUSING – 3" DIA. – 0.040" PORE SIZE – PART NO. 0146-102
10		
11		

Catalytic Convertor Wiring Diagram





A two terminal strip is provided in the junction box for power wiring of the cartridge heating element. If an optional integral temperature detector is included, the 14” leads from the temperature detector will be coiled in the junction box for termination by the user.

Catalytic Convertor Integral Temperature Sensor Option

Ver. 1902

APPLICATION

The ***Hydrocarbon Emission Eliminator*** is a catalytic convertor to eliminate fugitive emissions from analyzer vents and sample systems. Samples have historically been vented to flare headers which resulted in fluctuating backpressures and possible reflux into and through the analyzer. Backpressure fluctuations can produce thousands of dollars in lost performance due to analyzer calibration shifts. Reflux of process into the analyzer can result in expensive repairs and/or complete analyzer replacement.

Fugitive emissions from analyzers pose a problem from an environmental standpoint. By converting the hydrocarbons to CO_2 and water vapor, the emissions are eliminated.

The ***Hydrocarbon Emission Eliminator*** heats the incoming sample to initialize a catalytic reaction. Should intermittent hydrocarbons be present in the sample or flow interruptions, the heating element will re-initialize the reaction.

Determining proper operation of the ***Hydrocarbon Emission Eliminator*** unit may be monitored by an integral temperature sensor. Use of an integral temperature sensor eliminates ambient condition errors experienced with externally mounted sensing devices. The sensor will indicate functioning of the cartridge heater and operation of the catalyst, assuring complete destruction. Part Number 0455-310TCJ-120 or 0455-031TCK-120 replaces the existing heating element with one containing an integral Type J or K, respectively, thermocouple.

Temperature indications of 500-1200º F assure the heating element is operating in a normal range. Temperatures greater than the established baseline indicate operation of the catalyst cartridge.

MTI Analytical Technology offers a retrofit for existing ***Hydrocarbon Emission Eliminator*** units and an option to add an internal temperature sensor prior to delivery of new units. A type J or K thermocouple is provided within the heating element cartridge and terminates in the existing junction box of the ***Hydrocarbon Emission Eliminator***. Temperature indication may then be displayed locally or remotely.

Routine maintenance of the ***Hydrocarbon Emission Eliminator*** requires periodic replacement of the catalyst cartridge. Cost of the cartridge is less than $450 and is recommended on a twelve-month interval.

MTI Analytical Technology is available to assist with environmental and process monitoring applications. Design, engineering, fabrication, installation, and commissioning may be accomplished, thus assuring integrity and performance of component units.

MTI Analytical Technology Products

Analyzers
Electrochemical Sensors
Hydrocarbon Emission Eliminators
Packaged Analytical Systems
Sample Handling / Conditioning Devices

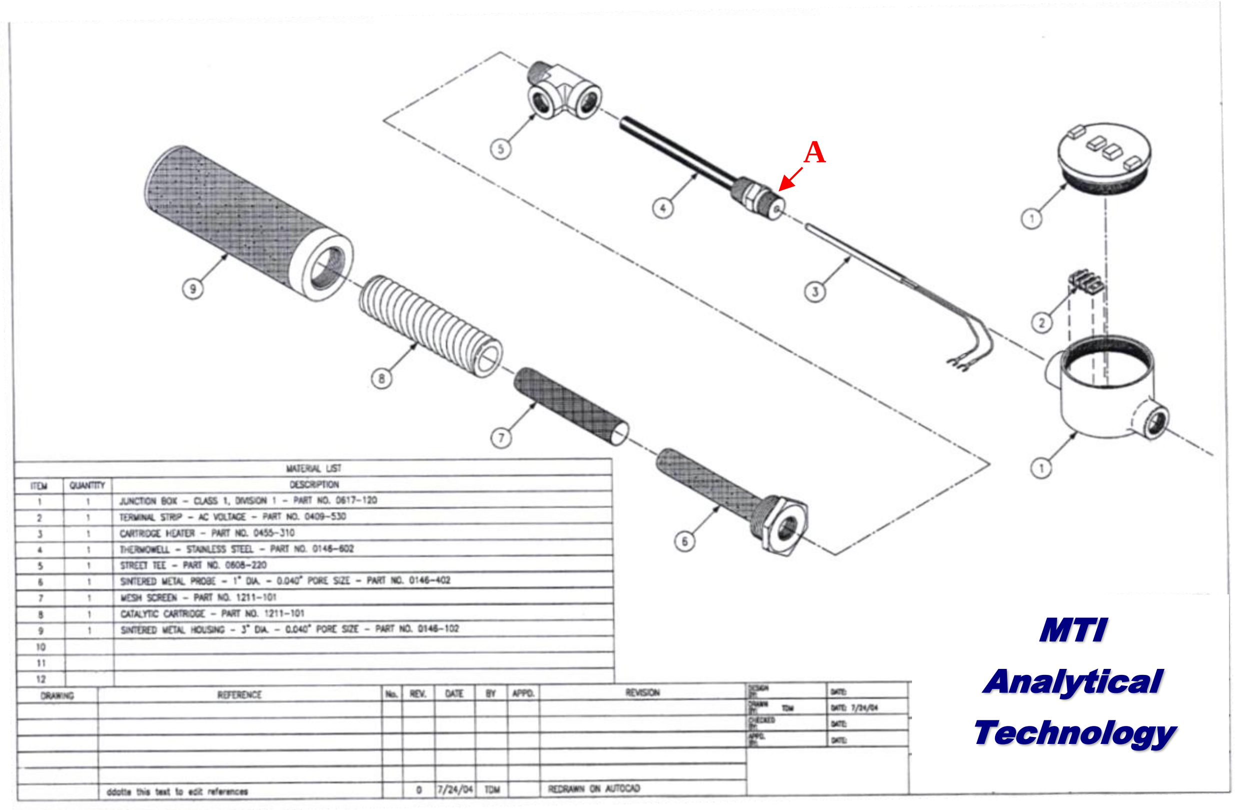
Call, Fax, or E-mail for Additional Information

E-mail: dcmerriman@mertechinc.com

Catalytic Convertor

Replacement of Cartridge Heating Element *(ver 1902)*

1. Remove electrical junction box cover (1) after deenergizing circuit power.
2. Disconnect cartridge heating element leads from terminal strip (2) in electrical junction box.
3. Remove Emission Eliminator upper assembly from the electrical junction box. (Remove at juncture labeled **"A"**)



MATERIAL LIST		
ITEM	QUANTITY	DESCRIPTION
1	1	JUNCTION BOX – CLASS 1, DIVISION 1 – PART NO. 0617-120
2	1	TERMINAL STRIP – AC VOLTAGE – PART NO. 0409-530
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7	1	MESH SCREEN – PART NO. 1211-101
8	1	CATALYTIC CARTRIDGE – PART NO. 1211-101
9	1	SINTERED METAL HOUSING – 3" DIA. – 0.040" PORE SIZE – PART NO. 0146-102
10		
11		
12		

DRAWING	REFERENCE	No.	REV.	DATE	BY	APPD.	REVISION
	ddotte this text to edit references		0	7/24/04	TDM		REDRAWN ON AUTOCAD

DESIGN BY:	DATE:
DRAWN BY: TDM	DATE: 7/24/04
CHECKED BY:	DATE:
APPD. BY:	DATE:

4. Extract cartridge heating element (3) from thermowell housing and replace with new unit.
5. If integral, optional type J Thermocouple (P/N 0455-310TCJ-120) is supplied; the red (non-magnetic, negative) and white (magnetic, positive) leads are for the thermocouple.
   If integral, optional Type K Thermocouple (P/N 0455-310TCK-120) is supplied, the red (non-magnetic, negative) and yellow (magnetic, positive) leads are for the thermocouple.
6. Reassemble the upper assembly onto the electrical junction box ("A").
7. Attach the cartridge heating element to the terminal strip (2) in the electrical junction box.
8. Extend the thermocouple wires, if supplied, to customer supplied terminal.
9. Replace the electrical junction box cover (1) and reenergize power to circuit.

Temperatures more than 500º F above ambient indicate functioning of the cartridge heater and greater than the base temperature above ambient indicate functioning of the catalyst cartridge. Actual temperatures above base will depend upon heat content of gases exhausted to the Catalytic Convertor unit.

MTI **Analytical Technology**
A Division of MerTech Incorporated

Use of an MTI Analytical Technology Modified Probe in Catalytic Convertors

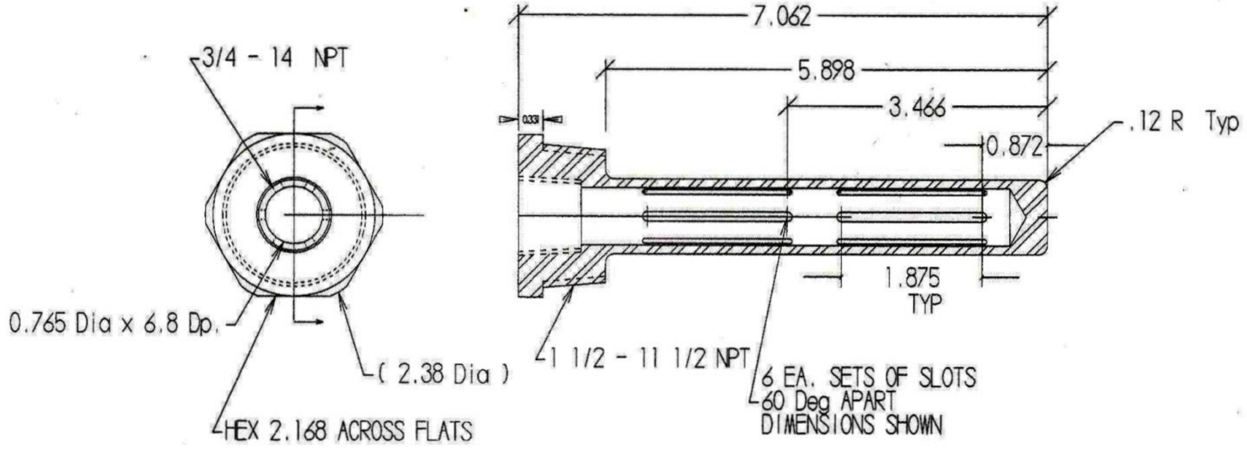
v1902

Analyzer manufacturers have historically utilized inert gases as the carrier gas in gas chromatography for analyzing chemical properties. This practice is now changing, with manufacturers now using hydrogen as the carrier.

The standard ***TRACErase Hydrocarbon Emission Eliminator*** employs a sintered (porous) stainless steel probe through which the gases from the analyzer are diffused into the catalyst cartridge. As hydrogen is very volatile and flammable, deterioration of the standard internal probe in catalytic convertor units has been reported.

MTI Analytical Technology designed and manufactures a patented probe machined of Alloy 20 bar stock to provide a more robust configuration with numerous perforations providing vent gas exposure to the catalyst cartridge. The modified probe has been evaluated by petrochemical companies and has greatly increased operational life with no significant deterioration from exposure to the higher temperatures and flammability of the hydrogen carrier gas. The modified probe is easily and quickly changed in existing units. Catalytic Convertor units may also be ordered from ***MTI Analytical Technology*** with the modified probe installed.

Dimensional information for the modified probe is indicated below. Production dimensions and details may have been modified.



Patent #9,162,181 B1

MTI **Analytical Technology**

A Division of MerTech Incorporated

Analyzer Hydrocarbon Catalytic Convertor

Parts List *(ver 1902)*

Complete Assembly (SS, 110/120 VAC)	P/N 1211-010-120
Complete Assembly (SS, 220/240 VAC)	P/N 1211-010-220
Complete Assembly (SS, 24 VDC)	P/N 1211-010-24VDC
Complete Assembly (SS, 110/120 VAC, Modified A20 Inner Probe)	P/N 1211-010MA20-120
Complete Assembly (SS, 110/120 VAC, Modified A20 Inner Probe w/ Integral Type J Thermocouple)	P/N 1211-010MA20TCJ-120
Complete Assembly (SS, 110/120 VAC w/ Integral Type J Thermocouple)	P/N 1211-010TCJ-120
Complete Assembly (SS, 110/120 VAC w/ Integral Type K Thermocouple)	P/N 1211-010TCK-120
Complete Assembly (SS, 110/120 VAC w/ Integral Type T Thermocouple)	P/N 1211-010TCT-120
Complete Assembly (Monel, 110/120 VAC)	P/N 1211-011M-120
Complete Assembly (SS, 110/120 VAC, CSA Certified)	P/N 1211-021-120
Complete Assembly (SS, 220/240 VAC, CSA Certified)	P/N 1211-021-220
Complete Assembly (Monel, 110/120 VAC, CSA Certified)	P/N 1211-025M-120
Complete Assembly (SS, 110/120 VAC, CSA Certified w/integral Type J Thermocouple)	P/N 1211-021TCJ-120
Complete Assembly (SS, 110/120 VAC, CSA Certified w/ Modified Internal Probe)	P/N 1211-021MA20-120
Complete Assembly (SS, 110/120 VAC, CSA Certified w/ Modified Internal Probe & Integral Type J Thermocouple)	P/N 1211-021MA20TCJ-120
Probe, Sintered Metal (Stainless Steel)	P/N 0146-402
Probe, Sintered Metal (Monel)	P/N 0146-422
Probe (Inconel)	P/N 0146-XXX
Probe (Hast X)	P/N 0146-XXX
Probe, Machined (A20)	P/N 0146MA20-402
Thermowell (Stainless Steel)	P/N 0146-602
Thermowell (Monel)	P/N 0146-622
Outer Housing, Sintered Metal (Stainless Steel)	P/N 0146-102
Terminal Block (2 Terminal)	P/N 0409-530
Heating Element (110/120VAC)	P/N 0455-310-120
Heating Element (110/120VAC w/ integral Type J Thermocouple)	P/N 0455-310TCJ-120
Heating Element (110/120 VAC w/integral Type K Thermocouple)	P/N 0455-310TCK-120
Heating Element (110/120VAC w/ integral Type T Thermocouple)	P/N 0455-310TCT-120
Heating Element (220/240 VAC)	P/N 0455-311-220
Tee, ¾” Street (Stainless Steel)	P/N 0608-220
Junction Box, ¾” NPT	P/N 0617-120
Catalyst Cartridge (Includes Mesh Screen, Item #7) (Previous Catalyst Cartridge P/N 1211-101)	P/N 0146-900
Mounting Plate, ¾” NPT	P/N 0146-702
Flame Arrestor (Inlet)	P/N 0146-750

* Analysis Instrumentation *

Foxboro (Invensys) Analytical – pH, ORP, Conductivity Analyzers *www.foxboro.com/echem*
TRACE Technology, Inc. – Lead Acetate H_2S and Total Sulfur Portable & Process Analyzers

* Analyzer Sensors / Electrochemical *

Analytical Sensors, Inc. – Process & Laboratory pH, ORP, & Ion Selective Electrodes & Sensors
www.asi-sensors.com
Foxboro (Invensys) Analytical – DolpHin pH and ORP Sensors *www.foxboro.com/echem*

* Analyzer Vent Catalytic Convertor *

TRACE Technology, Inc. – TRACErase Analyzer Vent Hydrocarbon Emission Eliminators

* Gas Detection Sensors & Systems *

Otis Instruments Inc. – WireFree™ Gen^2 Gas Detection Products *www.otisinstruments.com*

* Manufacturers *

Analytical Sensors, Inc.
Foxboro (Invensys) Analytical

Otis Instruments Inc.
TRACE Technology, Inc.

MTI Analytical Technology is available to assist with environmental, laboratory, and process monitoring applications. Design, fabrication, installation, and commissioning may be accomplished, assuring integrity and performance of component parts.

Contact **Dale C. Merriman** at the address below or email: **dcmerriman@mertechinc.com**

Analyzer Hydrocarbon Catalytic Convertor

P/N 1211-031-120

Most hydrocarbon processing plants and transportation pipelines require the use of chemical analysis instrumentation. These analytical instruments require a stable outlet vent pressure referenced to atmospheric pressure for proper operation. This reference may be achieved by venting the sample to atmosphere. Some of the vented samples contain hydrocarbons, referred to as fugitive emissions. Fugitive emissions are air pollutants and contribute to worldwide environmental concerns.

The focus of the Analyzer Hydrocarbon Catalytic Convertor is the use of a catalytic conversion process to oxidize vented samples while maintaining an atmospheric pressure reference. The Catalytic Convertor utilizes a continuous heat source to allow effective conversion of intermittent as well as continuous vent streams.

In hazardous locations, the unit is approved for IEC 60079-0:2017 and IEC 60079-1:2014-06 classifications.

MTI

Applications

Chemical Processing & Manufacturing Facilities

Gas Processing Facilities

Refineries

Transportation Pipelines

……

Specifications

Dimensions:
13” high
3” diameter
(21” h with junction box; junction box 4” x 4“)

Weight:
12 pounds
(4.5 kilograms)

Flow Rate:
1 liter / minute
(0.035 scfm)
(2,000 btu / hour maximum)

Back Pressure:
nil

Power Consumption:
100 watts (max)
(110/120 vac, 50/60 hz)

End Products:
Water Vapor, Carbon Dioxide

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Houston, TX 77057-3117 USA
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Fax: +1 713.583.9423
www.mertechinc.com

Analytical Instrumentation

Analyzer Hydrocarbon Catalytic Convertor
Data Sheet *(ver 2306)*

PART NUMBER: 1211-031-120

BACKPRESSURE: Nil @ 1 liter/minute (<0.1" H_2O @ 3 liters/minute)

HYDROCARBON EMISSION PRODUCTS: Water Vapor, Carbon Dioxide (Nil NO_x formation due to low temperature operation)

SURFACE TEMPERATURE CLASSIFICATION: T6 – 185° F (T3B – 330° F maximum operation)

CATALYST LIFE: Recommend catalyst replacement each year of operation to ensure efficiency of operation (P/N CBC5571HF)

MAXIMUM CONCENTRATION: 2,000 BTU/HR and/or 1 liter per minute

ELECTRICAL CLASSIFICATION: Approved for IEC 60079-0:2017 and IEC 60079-1:2014-6 classifications

MATERIALS of CONSTRUCTION: Stainless steel and Aluminum with a Platinum Catalyst (Other materials available as options)

SAMPLE INLET CONNECTION: ¾" MNPT (with Flame Arrestor)

AVAILABLE WITH OPTIONAL TYPE J INTERNAL THERMOCOUPLE TEMPERATURE SENSING ELEMENT: Specify Part Number 1211-031TCJ-120

MTI Analytical Technology is available to assist with **Analytical Application** requirements. Should there be questions or additional information required, please advise.

Email: dcmerriman@mertechinc.com

JUSTIA

Monolithic ceramic filter

May 13, 1997 - Noritake Co., Ltd.

A monolithic ceramic filter having a portion of the partition wall of a honeycomb structure exposed with its end face on an outer wall surface of the structure and increased in thickness as compared to the remaining portion of the partition wall to form a flow resistance relaxing portion is disclosed. The monolithic ceramic filter may also have a groove-shaped recess which is separated via a partition from a liquid supply passage of a honeycomb structure and is in communication with the outside of the structure. The flow resistance of the filtrate within the partition walls may be diminished to enable efficient filtration. The filter is produced simply by extrusion molding. There is no necessity of forming holes for discharging the filtrate in some cases.

Latest Noritake Co., Ltd. Patents:

- Catalyst carrying fine metal particles and use thereof
- Electronic component and method for producing same
- Paste composition for solar cell, manufacturing method therefor and solar cell
- Ceramic product and ceramic member bonding method
- Solar cell and composition used for manufacturing solar cell

Skip to: Description · Claims · References Cited · Patent History · Patent History

Description

FIELD OF THE INVENTION

This invention relates to a monolithic ceramic filter which has a honeycomb structure capable of achieving a high filtration area and a low filtration resistance and which may be employed for microfiltration, ultrafiltration and reverse osmosis.

BACKGROUND

Heretofore, a number of researches have been conducted for achieving a compact ceramic filter with a high filtration area, and proposals have been made of monolithic ceramic filters having a honeycomb structure.

With the monolithic ceramic filters, the filtrate produced on filtration by a filtration membrane formed on the surface of the supply liquid passages flows within the partition walls towards an outer wall of the filter before being discharged out of the filter at the outer wall of the filter. Thus the flow volume of the filtrate within the partition wall becomes larger as the outer wall is approached.

With conventional ceramic filters, having the honeycomb structure, the partition wall has a constant wall thickness. Consequently, the flow rate of the filtrate within the partition wall is increased significantly at a region close to the outer wall, so that the flow resistance to the filtrate is increased significantly to limit the speed of filtration. Consequently, a ceramic filter having a larger filtration area has been difficult to put into practice on the industrial scale.

As solutions to this problem, crossflow ceramic filters having filtrate conduits as disclosed in JP Patent KOHYO Publication (National laying-open of PCT international application) Nos. 01-501534 (WO 88/07398) or 03-500386 (WO 90/03831), have been proposed.

SUMMARY OF THE INVENTION

Problem to be Solved by the Invention

The above-mentioned ceramic filters having filtrate conduits are complicated in structure and are in need of highly complex manufacture techniques. For instance, these ceramic filters require either additional complicated processing and machining on a monolith honeycomb structure, or complicated work for assembling a number of honeycomb members (slabs), in order to produce flow out channels of the filtrate.

Objects of the Invention

It is an object of the present invention to provide a ceramic filter of a high filtration area which is free of the above-mentioned problems and with which it becomes possible to inhibit increase in the flow resistance to the filtrate within the partition wall without limitation imposed on the filtration speed.

Other objects will become apparent from the entire dislosure.

According to the first aspect of the present invention, the above object may be achieved by a monolithic ceramic filter, wherein a portion of partition wall of a honeycomb structure of the filter has its end face exposed on an outer wall surface of the honeycomb structure and has an increased thickness as compared to the remaining portion of the partition wall to constitute a flow resistance relaxing portion. It is most advantageous that this monolithic ceramic filter be produced simply by the extrusion technology.

According to the second aspect of the present invention, the flow resistance relaxing portion (i.e., thick wall portion) has a filtrate discharging conduit opening reaching an outer wall surface of the honeycomb structure. According to the second aspect the production is also simple and easy since the filtrate discharging conduit openings can be produced within the thick wall portion additional to the first aspect.

With such flow resistance relaxing portion, the flow resistance offered to the filtrate may be prevented from being increased.

Besides, with the above-mentioned filtrate discharging conduit opening, the flow resistance imposed to the filtrate may be additionally prevented from being increased.

According to the third aspect of the present invention, the above object may be achieved by a monolithic ceramic filter defined as follows.

A monolithic ceramic filter comprising communication voids separated from cells of a honeycomb structure of the filter by cell partition walls, with the voids being in communication with the lateral outside of the honeycomb structure and continuously extending axially through the honeycomb structure.

According to the fourth aspect of the present invention, based on the monolithic ceramic filter by the third aspect, an end frame is fitted on the end of said ceramic filter, preferably on both the ends.

Preferably, the communication voids are groove-shaped recesses formed in the outer peripheral wall of the honeycomb structure.

Preferably, the ceramic filters are of such a shape as to permit production thereof by extrusion molding, which simplifies the production significantly.

Preferably, the end frames are each provided with protrusions engaged in the communication voids or the groove-shaped recesses to close the communication voids at the ends of the honeycomb structure.

The communication voids may extend from the inside of the honeycomb structure except the central part of the honeycomb structure in the transverse direction thereof. The communication voids may extend from the outer peripheral wall toward the inside, ending at an intermediate position. Also the communication voids may extend alternately from one side of the outer peripheral wall and from the opposite side thereof as viewed in the cross section of the honeycomb structure. This arrangement is possible particularly in the case where the honeycomb structure has a square-shaped cross section.

Further arrangement of the communication voids (groove-shaped recesses) or the flow resistance relaxing portions are exemplified in FIGS. 8 to 9.

Concept Underlying the Invention

Although the honeycomb type filter is effective as a ceramic filter having a high filtration area, the filtration speed is limited due to the significantly increased flow resistance presented to the filtrate, with the consequence that it is difficult to utilize the honeycomb ceramic filter of a high filtration area on an industrial scale. The present invention provides a monolithic ceramic filter having a high filtration area in which limitations on the filtration speed are resolved by preventing increase in the flow resistance imposed on the filtrate.

The flow resistance offered to the filtrate within the partition wall (pressure loss .DELTA.P) is represented by Kozeny-Carmen's formula ##EQU1## Since ##EQU2## the following formula (3) ##EQU3## holds. In the above formulas (1) to (3), Q denotes the flow volume, A the cross-sectional area, .epsilon. the pore ratio, .DELTA.P pressure loss, .kappa. a constant, L a distance, .mu. the viscosity, S the surface area and D the pore diameter.

The above formula demonstrates that the flow resistance to the filtrate may be diminished such as by increasing the cross-sectional area A, increasing the pore diameter D, decreasing the distance L or by increasing the pore ratio .epsilon.. The present invention has been accomplished on the basis of the above finding.

According to the first aspect of the present invention, as shown in FIGS. 1 to 3, the cross-sectional area A is increased by having a thick wall portion (12), increased in thickness, of a partition wall connecting to an outer wall (13) so as to serve as a filtrate passage (flow resistance relaxing portion), whereas according to the second aspect, the distance L is decreased by the filtrate discharging conduit opening (14) connecting to the outer wall surface.

According to the third aspect of the present invention, by providing communication voids separated from the cells of the honeycomb structure by means of partition walls (cell partition walls) for communication with the outside of the honeycomb structure, the flow distance L which is traversed by the filtrate resulting from filtration through the filtration membrane before the filtrate is discharged out of an outer wall of the filter after flowing through the inside of the partition walls is diminished. In this manner, a monolithic ceramic filter is realized in which the flow resistance presented to the filtrate is suppressed to a smaller value and in which limitation imposed on the filtration speed has been significantly eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view showing a supporting member of a honeycomb structure according to Example 1 of the present invention.

FIG. 2 is a side elevational view showing a supporting member of a honeycomb structure according to Example 2 of the present invention.

FIG. 3 is a cross-sectional view taken along line A-A' of FIG. 2.

FIG. 4 is a perspective view of a supporting member of a honeycomb structure according to a comparative example.

FIG. 5 is a perspective view showing a supporting member of a honeycomb structure according to Example 3 of the present invention.

FIG. 6 is a perspective view showing the ceramic filter of Example 3 of the present invention, when fitted with end frames.

FIG. 7 is a perspective view showing a honeycomb supporting member according to a modified embodiment.

FIGS. 8 and 9 show further arrangements of flow resistance relaxing portions or communication voids as viewed in the cross section of the honeycomb structure.

FIG. 10 is a cross-sectional view of a honeycomb structure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Throughout all the aspects, the shape which permits production of the filter by extrusion molding may be exemplified by a shape such that a number of thick wall portions or voids are formed uninterruptedly from one to the other end face of the honeycomb structure in the same direction as the direction of extrusion of the open cells of the honeycomb structure.

As regards the second aspect, the discharging conduit openings could be formed axially of the honeycomb structure within the thick wall portions, which allows advantageous extrusion molding. However, this arrangement would require additional measures at both the ends for separating the filtrate from the in and out flow fluids. Throughout the first to fourth aspects, the filtrate can be discharged laterally out of the outer peripheral wall, and the separating conduits for the filtrate at both the honeycomb ends is either dispensed of or significantly simplified.

With the monolithic ceramic filter according to the first aspect of the present invention, a part of the partition wall of the honeycomb structure is thickened and designed as a flow resistance relaxing portion. For instance, the thickened walls can be arranged at an interval of a certain number of cells. A simple example is a parallel arrangement as shown in FIG. 1. In FIG. 1 additional thick walls may be disposed across (e.g., vertically) the horizontal thick walls.

The flow resistance relaxing portion comprises a portion of partition wall of the honeycomb structure, which portion has a thickness larger than that of the remaining portion of the partition wall and has its end face exposed in the outer (lateral) wall surface of the honeycomb structure. Preferably, the partition wall of the flow resistance relaxing portion has a thickness two to five times that of the remaining portion of the partition wall.

It is noted that, if the thickness is less than doubled, the effects of the flow resistance relaxing portion would be lowered, whereas, if the thickness is more than five times, the filtration area is decreased, to lower the entire filtration capacity of the filter.

With reference to FIG. 10, it is preferred that the honeycomb structure comprises a supporting member or substrate of the honeycomb structure 12, formed of porous ceramics having a mean pore diameter preferably in a range of from 1 .mu.m to 100 .mu.m, more preferably in a range of 5 .mu.m to 20 .mu.m, and a filtration membrane 17, (preferably of porous ceramics) with a mean pore diameter in a range of from 5 nm to 5 .mu.m, formed on the above-mentioned supporting member. The filtration membrane may be of any suitable material other than ceramics as a filtration membrane.

The honeycomb structure may also comprise an intermediate layer 18 formed between the supporting member of the honeycomb structure and the filtration membrane. This optional intermediate layer has a mean pore diameter intermediate between the mean pore diameter of the supporting member and that of the filtration membrane. However, the supporting member for the honeycomb structure devoid of the filtration membrane also suffices, depending on the desired filtration accuracy.

The following is a typical method or producing the supporting member for the honeycomb structure.

The ceramic starting material having a suitable particle diameter is mixed with an organic binder and water, and the resulting mixture is kneaded and extruded to a body having plastic moldability. Sintering aids such as clay, glass etc. may also be added as inorganic binders, if desired. The body is further extrusion molded by an extrusion molding machine having a predetermined die lip. The molded product is dried and sintered to complete a supporting member, that is, a honeycomb skelton.

According to the second aspect filtrate discharging conduit openings (14) which open in the outer peripheral surface, preferably after drying, are formed at a predetermined pitch. The conduit openings (14) are disposed, preferably at right angles to the honeycomb axis for a better distribution and ease in manufacture.

According to the third aspect, a green molded product is extrusion molded by an extrusion molding machine having a corresponding die lip. This produces a supporting member of a honeycomb structure having groove-shaped peripheral recesses (15) on the outer periphery (FIGS. 5 and 7).

The porous ceramics may be of any material such as alumina, silica, zirconia, mullite, spinel, cordierite, carbon, silicon carbide, silicon nitride or the like.

On the surface of a raw fluid supply passage (11) of a supporting member having a honeycomb structure shown in FIGS. 1, 3 or FIGS. 5, 7, a filtration membrane formed of porous ceramics having a mean pore size of 5 nm to 5 .mu.m is formed to produce a ceramic filter. The following is a typical method for producing such filtration membrane.

To a ceramic starting material in the form of powders or colloidal solution, having a suitable particle size, a solvent such as water, an organic binder, deflocculating agent, a pH adjustment agent, etc. are added and mixed together to produce a slip. This slip is coated on the surfaces of raw fluid supply passages (11) of a supporting member having a honeycomb structure. The resulting product is dried and sintered to produce a filtration membrane. The materials of the filtration membrane embrace alumina, zirconia, titania etc.

According to the fourth aspect, the ceramic filter, produced in this matter, is fitted on its both ends with end frames (16). As shown in FIG. 6, each end frame (16) preferably comprises a rim portion (16a) and a plurality of protrusions 16b arranged for stopping up the groove-shaped recesses of the ceramic filter at the honeycomb ends. The end frame (16) is formed of stainless steel, ceramics, resins or the like and sealed or fused by an organic or inorganic adhesive or glasses. By mounting the end frame (16) in this manner, it becomes possible to prevent a raw fluid from being mixed into a filtrate, as well as to facilitate setting of the ceramic filter on a housing, not shown. The frames can also serve to strengthen the ceramic honeycomb structure.

The ceramic filter may also be used under such a condition in which both ends of the groove-shaped recesses are sealed with an organic material, such as epoxy resin, or with an inorganic material, such as cement or glass sealing paste, thus without using the end frames. In addition, the ceramic filter may be used under such a condition in which end frame devoid of protrusions are affixed to the filter having both ends of the grooved recesses thereof sealed as described above.

Although the cross-sectional profile of each supply fluid passage (cell) is square in FIGS. 1 to 3, and FIGS. 5 to 7, it may also be other shapes of polygon such as triangle, hexagon etc. circle and others. Besides although the supply fluid passages (cells) are arranged in a pattern of square meshes at the honeycomb ends and assume an outer profile of circular or square shape, they may also be arranged in any other patterns, such as patterns of hexagons, concentric circles, etc. in which the thick wall portions and grooved recesses may be arranged radially.

Further possible arrangements of the flow resistance relaxing portions (12) or communication voids (15) are illustrated in FIGS. 8 and 9, each for the square cells (11). FIG. 8 represents a round profile of outer wall 13, while FIG. 9 represents a square profile thereof. Although not illustrated, concentric arrangement of cells (11) is possible in which the flow resistance relaxing portions (12) or the communication voids (15) may be disposed radially. As is apparent from these figures, a combination of the flow resistance relaxing portion(s) (12') and the communication void(s) (15) is also possible. The former (12') is shown in FIG. 9 in an intersecting fashion. Such combination would serve to strengthen the honeycomb structure provided with the communication voids (15).

EXAMPLES

Example 1

First Aspect

To 100 parts by weight of alumina, having a mean particle size of 40 .mu.m, 8 parts by weight of glass powders having a mean particle size of 5 .mu.m as an inorganic binder, and 7 parts by weight of methyl cellulose as an organic binder, and a predetermined amount of water, were added and kneaded to form a plastic body for extrusion. Using an extrusion molding machine, having a die lip which will produce a cross-sectional shape as shown in FIG. 1, the body for extrusion was extrusion-molded and dried to a sufficiently dried supporting member. The resulting supporting member was sintered in a sintering furnace at 1250.degree. C. to produce a supporting member having a honeycomb structure shown in FIG. 1. The supporting member had a diameter and a length of 150 mm and 1000 mm, respectively, a mean pore size of 10 .mu.m, a thickness of partition wall of 2 mm, a thickness of a portion of the partition wall connecting to an outer wall thickened so as to be used as a filtrate passage (flow resistance relaxing portion) (12) of 8 mm, and a size of the supply liquid passage of the size of a side equal to 4 mm of a square.

100 parts by weight of fine alumina powders having a mean particle size of 0.6 .mu.m, 75 parts by weight of water and 40 parts by weight of an organic binder (a water-soluble acrylic resin having a solid content of 30%) were charged into a container of a synthetic material and stirred and mixed with alumina pebbles for 24 hours in a ball mill to produce a slip for forming a filtration membrane. This slip for forming the filtration membrane was adsorbed to the surface of supply liquid passages of the supporting member of the honeycomb structure to form a (green) filtration membrane. The supporting member with the (green) filtration membrane thereon was then dried and sintered at 1250.degree. C. The filtration membrane thus produced had a mean pore size of 0.2 .mu.m.

The ceramic filter thus produced had a pure water transmission flow velocity at a differential pressure of 1 kg/cm.sup.2 equal to 2.5 m.sup.3 /m.sup.2 hr.

Example 2

Second Aspect

As shown in FIGS. 2 and 3, a ceramic filter was produced in the same way as in Example 1, except that a plurality of conduit openings (through-holes) (14) for discharging the filtrate were formed transverse to the honeycomb structure in the flow resistance relaxing portions (12) of the supporting member of the honeycomb structure to reach the outer wall surface of the supporting member throughout the flow resistance relaxing portion. The conduit openings (14) for discharging the filtrate were 4 mm in diameter, while the distance between neighboring through-holes in the flow resistance relaxing portion was 10 cm in a parallel arrangement.

The ceramic filter thus produced had a pure water transmission flow velocity at a differential pressure of 1 kg/cm.sup.2 equal to 2.7 m.sup.3 /m.sup.2 hr.

Note, however, the conduit openings for discharging need not be a through-hole, but can be open at only one end thereof, while in this case, alternate arrangement of openings to right and left (or up and down) surfaces of the outer wall is preferred.

Comparative Example 1

As shown in FIG. 4, a ceramic filter was produced in the same way as in Example 1, except that the portion of the partition wall connecting to the outer wall which was thickened so as to be used as a filtrate passage (flow resistance relaxing portion) (12) was not formed in the supporting member having the honeycomb structure. The ceramic filter thus produced had a pure water transmission flow velocity at a differential pressure of 1 kg/cm.sup.2 equal to 1.9 m.sup.3 /m.sup.2 hr.

Examples 3

Third and Fourth Aspects

Using a die lip having a corresponding cross-section, a supporting member of a honeycomb structure as shown in FIG. 5 having a cross section with the groove-shaped peripheral recess 15 formed in the outer peripheral wall was produced otherwise in the same manner as in Example 1.

The supporting member had a mean pore size of 10 .mu.m, a diameter and a length of 150 mm and 1000 mm, respectively, a thickness of a partition wall of 2 mm, a width of the groove-shaped peripheral straight recess of 4 mm and a size of each side of a square of a liquid supply passage (cell) of 4 mm.

Subsequently, a slip was prepared as in Example 1. This slip for forming the filtration membrane was adsorbed to the surface of supply liquid passages of the supporting member of the honeycomb structure to form a (green) filtration membrane. The supporting member with the (green) filtration membrane thereon was then dried and sintered at 1250.degree. C. The filtration membrane thus produced had a mean pore size of 0.2 .mu.m.

The ceramic filter, produced in this manner, was fitted with end frames as shown in FIG. 6, and the pure water filtration flow rate at a differential pressure of 1 kg/cm.sup.2 was measured and found to be 2.9 m.sup.3 /m.sup.2 h.

Comparative Example 2

As shown in FIG. 4, a ceramic filter was produced in the same way as in Example 3 except not forming peripheral groove-shaped recesses in the supporting member of the honeycomb structure and not fitting the end frames on the ends of the supporting member. Namely, this produced the same filter as Comparative Example 3 and the result was the same.

Meritorious Effect of the Invention

The monolithic ceramic filter according to the present invention, generally, is of the honeycomb structure capable of being produced by extrusion molding and hence is compact and easy for industrial mass production, and may have its filtration area increased. In addition, according to the first aspect, by designing a part of the partition wall of the honeycomb structure as the flow resistance relaxing portion comprising a part of the partition wall of the honeycomb structure which is exposed with its end face on the outer wall surface of the honeycomb structure and which is larger in thickness than the remaining portion of the partition wall, the flow resistance presented to the filtrate within the partition wall is decreased, as shown by pure water transmission flow velocity data given in the above Examples, with the result that the filtration may be carried out efficiently. Besides, with the monolithic ceramic filter according to the first aspect of the present invention, the complicated production process of stopping up both ends of the filtrate discharging passages (cells) or the supply liquid passages may be eliminated to enable less costly manufacture.

According to the second aspect, the thick wall portion which constitutes the flow resistance relaxing portion has conduit openings for discharging the filtrate, and thus a still improved filtration rate is achieved.

The monolithic ceramic filter according to the third aspect of the present invention is compact in size and simple in the structure, and have an increased filtration area. In addition, since the filter includes communication voids separated from the cells of the honeycomb structure via cell partition walls and communicating with the outside of the honeycomb structure, the flow resistance presented to the filtrate within the partition walls (cell walls) is diminished, as shown by pure water filtration flow rate data of the illustrative Example, thus enabling the filtration to be performed efficiently. Besides, the monolithic ceramic filter of such a shape as to permit production thereof by extrusion molding, according to the third aspect, which can be produced at low costs because there is no necessity of boring openings for discharging the filtrate in the honeycomb structure.

According to the fourth aspect, the unit according to the third aspect can be assembled into a filter casing without difficulty and with an improved strength.

It should be noted that modifications apparent in the art can be made within the gist and concept of the invention as disclosed herein, without departing from the scope as claimed by the appended claims.

Claims

1. An extruded monolithic ceramic filter having an axial length, said monolithic ceramic filter comprising:

(a) an outer peripheral wall (i) extending along said axial length and (ii) enclosing said monolithic ceramic filter, and
(b) a monolithic honeycomb structure within said outer peripheral wall, the honeycomb structure comprising cell passages along said axial length, a first partition wall and a second partition wall,
the first partition wall (i) extending along said axial length of the honeycomb structure, and (ii) extending from an interior of the honeycomb structure towards said outer peripheral wall; and
the second partition wall at least partially surrounding said cell passages;
wherein the first partition wall has an increased thickness compared to the second partition wall,
wherein within the first partition wall there is at least one filtrate discharge conduit extending to the outer peripheral wall, and
wherein the monolithic ceramic filter is produced by a single extrusion process.

2. The ceramic filter as defined in claim 1, wherein said first partition wall extends over the entire axial length of the honeycomb structure.

3. The ceramic filter as defined in claim 2, wherein said first partition wall comprises a plurality of wall portions of increased thickness which extend parallel to each other.

4. The ceramic filter as defined in 1, wherein said first partition wall comprises a plurality of wall portions of increased thickness which extend throughout, from one side to the other side of the honeycomb structure.

5. The ceramic filter as defined in claim 1, wherein the filtrate discharge conduit opening comprises bores extending transverse of the honeycomb structure.

6. The ceramic filter as defined in claim 5, wherein the said bores are disposed parallel to each other.

7. The ceramic filter as defined in claim 1, wherein said first partition wall has a thickness of about 2 to 5 times of the thickness of the second partition wall of the honeycomb structure.

8. The ceramic filter as defined in claim 1, wherein the honeycomb structure comprises a porous ceramic material and has a filtration membrane on a surface facing each of the cell passage of the honeycomb structure.

9. The ceramic filter as defined in claim 8, wherein an intermediate porous layer is disposed between the honeycomb structure and the filter membrane.

10. The ceramic filter as defined in claim 8, wherein said filter membrane is a porous ceramic having a smaller pore size than that of honeycomb structure.

11. A monolithic ceramic filter having an axial length, said monolithic ceramic filter comprising:

> a monolithic honeycomb structure which comprises cell passages along said axial length and communication voids separated from said cell passages, said voids extending to and communicating with an outer peripheral wall over an entire axial length of the monolithic ceramic filter, said outer peripheral wall enclosing said monolithic ceramic filter and extending over the entire axial length thereof;
> wherein the honeycomb structure has a shape having the same transverse cross section along a longitudinal axis of the honeycomb structure so as to permit production thereof solely by extrusion molding,
> wherein said communication voids extend from the outer peripheral wall toward an interior of the honeycomb structure, ending at an intermediate position between said outer peripheral wall and said longitudinal axis, and
> wherein said communication voids extend alternately from one side of the outer peripheral wall and from an opposite side of said outer peripheral wall as viewed in the cross section of the honeycomb structure.

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Patent History

Patent number: 5855781
Type: Grant
Filed: May 13, 1997
Date of Patent: Jan 5, 1999
Assignee: Noritake Co., Ltd. (Nagoya)
Inventors: Hiroshi Yorita (Toyoake), Hisatomi Taguchi (Aichi-gun), Yuji Kamei (Nagoya)
Primary Examiner: Robert J. Popovics
Law Firm: Morrison & Foerster
Application Number: 8/855,034

Classifications

Current U.S. Class: **210/32182;** Filtrate Splash Plate And/or Deflector (210/247); 210/32189; Spaced Wall Type, E.g., Hollow Leaf (210/486); Bound, Fused Or Matted, E.g., Porous Shapes, Sponges, Etc. (210/496); 210/5101; Ceramic Or Sintered (55/523); Exhaust Treatment (55/DIG30); Unitary (i.e., Nonparticulate) Contact Bed (e.g., Monolithic Catalyst Bed, Etc.) (422/180); 502/52718; 502/52719
International Classification: B01D 6300;

0724-902_100758

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ANALYTICAL

Chain of Custody Record

Page____of____

Special Handling:

☑ Standard Turn Around Time (10 business days)

☐ Rush Turn Around Time -- Date Needed: __________

- All TATs Subject to Approval by Enthalpy Analytical, Inc.
- All Bag/Can Samples Disposed of 1 Month from Receipt.
- All Other Samples Disposed of 4 Months from Receipt.

Client Name: Smith Analytical

Project Manager: Steve Smith

Report To:

Project Number:

Site Name:

Location: Alvin, TX

PO#:

Telephone#: 832-738-1841

Email: emalie@smithanalytical.com

For spiked or duplicate samples: please provide sample volumes for recovery calculations. For Particulates: please provide tare weights and/or condensed water volumes.

Special Instructions:

A=Air 1=H2SO4 2=NaOH W=Water O=Other
X=XAD C=Charcoal SG=Silica Gel

G=Grab C=Composite Q=Quality Control O=Other

							Sample Containers							Analyses:								
	Sample ID	Date	Time	Sample Volume	Type	Matrix	# of VOA Vials	# of Glass	# of Plastic	# of Bags	# of Canisters	# of Tubes	# Other	TO-14A								Notes:
1	C1 C2 C3 NO CAT	6/29/24	1729	-30 -22										X								001 - (C50177)
2	C1 C2 C3 CAT	6/29/24	2016	-30 -22										X								002 - (C50167)
3	C1 C2 C3 CAT + AIR	6/29/24	2121	-30 -22										X								003 - (C50165)
4	C2 C3 NO CAT	6/29/24	1819	-30 -24										X								004 - (C50141)
5	C1 + CAT + AIR	6/30/24	0014	-30 -22																		005 - (C50117)
																						JUL 1'24 PM12:33
																						+1 Canister
																						(C50170)
																						+1 FC

Relinquished By:	Date:	Received By:	Date:	Time:	Sample Condition Upon Receipt:
	7/1/24	Elijah Sub	07-01-24	12:33	☐ Iced ☒ Ambient ☐ °C 24.6 Fluke Gun
					☐ Iced ☐ Ambient ☐ °C______
					☐ Iced ☐ Ambient ☐ °C______

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EAH-DR1001-001, Revision 2019-01, Effective 03/18/19

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Analysis Results for 100758

Steve Smith
Smith Analytical
5318 FM 517 West, Bldg A
Alvin, TX 77511

Lab Job #: 100758
Location: Alvin, TX
Date Received: 07/01/24

Sample ID: C1 C2 C3 - NO CAT **Lab ID: 100758-001** **Collected: 06/29/24 17:29**
Matrix: Air

100758-001 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-14A									
1,2,3-Trimethylbenzene	ND	b	ppmv	0.090	390	100715	07/17/24	07/17/24	KKR
1,2,4-Trimethylbenzene	**0.22**	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
1,3,5-Trimethylbenzene	ND	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
1,3-Butadiene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
1,3-Diethylbenzene	ND	b	ppmv	0.086	390	100715	07/17/24	07/17/24	KKR
1,4-Diethylbenzene	ND	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
1-Butene	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
1-Hexene	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
1-Pentene	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
2,2,4-Trimethylpentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
2,2-Dimethylbutane	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
2,3,4-Trimethylpentane	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
2,3-Dimethylbutane	**0.12**	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
2,3-Dimethylpentane	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
2,4-Dimethylpentane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
2-Ethyltoluene	ND	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
2-Methylheptane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
2-Methylhexane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
2-Methylpentane	**1.0**	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
3-Methylheptane	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
3-Methylhexane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
3-Methylpentane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
4-Ethyltoluene	ND	b	ppmv	0.091	390	100715	07/17/24	07/17/24	KKR
Acetylene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
Alpha pinene	**0.12**	b	ppmv	0.086	390	100715	07/17/24	07/17/24	KKR
Benzene	**0.44**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Butane	**0.15**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
cis-2-Butene	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
cis-2-Pentene	ND	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
Cyclohexane	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
Cyclopentane	ND	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
Ethane	**670**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Ethene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
Ethylbenzene	ND	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
Isobutane	**0.87**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Isobutylene	**0.32**	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
Isopentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Isoprene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
Isopropylbenzene	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
m-Ethyltoluene	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
m-Xylene	**0.080**	b	ppmv	0.048	390	100715	07/17/24	07/17/24	KKR

Analysis Results for 100758

100758-001 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
Methane	**1,400**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Methylcyclohexane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
Methylcyclopentane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
n-Decane	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
n-Dodecane	ND	b	ppmv	1.8	390	100715	07/17/24	07/17/24	KKR
n-Heptane	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
n-Hexane	**0.25**	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
n-Nonane	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
n-Octane	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
n-Pentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
n-Undecane	ND	b	ppmv	0.19	390	100715	07/17/24	07/17/24	KKR
o-Xylene	ND	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
p-Xylene	ND	b	ppmv	0.049	390	100715	07/17/24	07/17/24	KKR
Propane	**670**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Propylbenzene	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
Propylene	**0.93**	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
Styrene	**0.20**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
Toluene	**0.20**	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
trans-2-Butene	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
trans-2-Pentene	**0.41**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR

Results for any subcontracted analyses are not included in this section.

Analysis Results for 100758

Sample ID: C1 C2 C3 - CAT **Lab ID: 100758-002** **Collected: 06/29/24 20:16**
Matrix: Air

100758-002 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-14A									
1,2,3-Trimethylbenzene	**0.21**	b	ppmv	0.089	390	100715	07/17/24	07/17/24	KKR
1,2,4-Trimethylbenzene	**0.73**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
1,3,5-Trimethylbenzene	**0.36**	b	ppmv	0.091	390	100715	07/17/24	07/17/24	KKR
1,3-Butadiene	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
1,3-Diethylbenzene	ND	b	ppmv	0.086	390	100715	07/17/24	07/17/24	KKR
1,4-Diethylbenzene	**0.22**	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
1-Butene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
1-Hexene	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
1-Pentene	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
2,2,4-Trimethylpentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
2,2-Dimethylbutane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
2,3,4-Trimethylpentane	**0.12**	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
2,3-Dimethylbutane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
2,3-Dimethylpentane	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
2,4-Dimethylpentane	**0.18**	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
2-Ethyltoluene	**0.19**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
2-Methylheptane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
2-Methylhexane	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
2-Methylpentane	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
3-Methylheptane	**0.12**	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
3-Methylhexane	**0.12**	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
3-Methylpentane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
4-Ethyltoluene	**0.20**	b	ppmv	0.091	390	100715	07/17/24	07/17/24	KKR
Acetylene	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
Alpha pinene	ND	b	ppmv	0.085	390	100715	07/17/24	07/17/24	KKR
Benzene	**0.54**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Butane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
cis-2-Butene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
cis-2-Pentene	ND	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
Cyclohexane	ND	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
Cyclopentane	ND	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
Ethane	**350**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Ethene	**1.1**	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
Ethylbenzene	**0.39**	b	ppmv	0.092	390	100715	07/17/24	07/17/24	KKR
Isobutane	**0.26**	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Isobutylene	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
Isopentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
Isoprene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR
Isopropylbenzene	**0.37**	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
m-Ethyltoluene	**0.39**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
m-Xylene	**1.0**	b	ppmv	0.047	390	100715	07/17/24	07/17/24	KKR
Methane	**980**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Methylcyclohexane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
Methylcyclopentane	ND	b	ppmv	0.097	390	100715	07/17/24	07/17/24	KKR
n-Decane	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
n-Dodecane	ND	b	ppmv	1.8	390	100715	07/17/24	07/17/24	KKR

Analysis Results for 100758

100758-002 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
n-Heptane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
n-Hexane	ND	b	ppmv	0.098	390	100715	07/17/24	07/17/24	KKR
n-Nonane	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
n-Octane	ND	b	ppmv	0.095	390	100715	07/17/24	07/17/24	KKR
n-Pentane	ND	b	ppmv	0.10	390	100715	07/17/24	07/17/24	KKR
n-Undecane	ND	b	ppmv	0.19	390	100715	07/17/24	07/17/24	KKR
o-Xylene	**0.69**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
p-Xylene	**4.4**	b	ppmv	0.049	390	100715	07/17/24	07/17/24	KKR
Propane	**260**	b	ppmv	1.9	3.8	100700	07/10/24	07/10/24	EMD
Propylbenzene	**0.22**	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
Propylene	**47**	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
Styrene	**0.28**	b	ppmv	0.093	390	100715	07/17/24	07/17/24	KKR
Toluene	**2.8**	b	ppmv	0.096	390	100715	07/17/24	07/17/24	KKR
trans-2-Butene	ND	b	ppmv	0.094	390	100715	07/17/24	07/17/24	KKR
trans-2-Pentene	ND	b	ppmv	0.099	390	100715	07/17/24	07/17/24	KKR

Analysis Results for 100758

Sample ID: **C1 C2 C3 - CAT+AIR** **Lab ID:** **100758-003** **Collected:** **06/29/24 21:21**
Matrix: **Air**

100758-003 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
Method: EPA TO-14A									
1,2,3-Trimethylbenzene	**0.0012**	b	ppmv	0.00073	3.1	100715	07/16/24	07/16/24	KKR
1,2,4-Trimethylbenzene	**0.0037**	b	ppmv	0.00076	3.1	100715	07/16/24	07/16/24	KKR
1,3,5-Trimethylbenzene	ND	b	ppmv	0.00075	3.1	100715	07/16/24	07/16/24	KKR
1,3-Butadiene	**0.0027**	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
1,3-Diethylbenzene	ND	b	ppmv	0.00070	3.1	100715	07/16/24	07/16/24	KKR
1,4-Diethylbenzene	ND	b	ppmv	0.00075	3.1	100715	07/16/24	07/16/24	KKR
1-Butene	ND	b	ppmv	0.0081	31	100715	07/16/24	07/16/24	KKR
1-Hexene	ND	b	ppmv	0.00078	3.1	100715	07/16/24	07/16/24	KKR
1-Pentene	ND	b	ppmv	0.00082	3.1	100715	07/16/24	07/16/24	KKR
2,2,4-Trimethylpentane	**0.0010**	b	ppmv	0.00082	3.1	100715	07/16/24	07/16/24	KKR
2,2-Dimethylbutane	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
2,3,4-Trimethylpentane	**0.012**	b	ppmv	0.0080	31	100715	07/16/24	07/16/24	KKR
2,3-Dimethylbutane	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
2,3-Dimethylpentane	**0.00083**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
2,4-Dimethylpentane	ND	b	ppmv	0.00079	3.1	100715	07/16/24	07/16/24	KKR
2-Ethyltoluene	**0.0049**	b	ppmv	0.00076	3.1	100715	07/16/24	07/16/24	KKR
2-Methylheptane	**0.0093**	b	ppmv	0.0079	31	100715	07/16/24	07/16/24	KKR
2-Methylhexane	**0.0019**	b	ppmv	0.00081	3.1	100715	07/16/24	07/16/24	KKR
2-Methylpentane	**0.0030**	b	ppmv	0.00079	3.1	100715	07/16/24	07/16/24	KKR
3-Methylheptane	**0.0068**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
3-Methylhexane	**0.00099**	b	ppmv	0.00079	3.1	100715	07/16/24	07/16/24	KKR
3-Methylpentane	**0.00089**	b	ppmv	0.00079	3.1	100715	07/16/24	07/16/24	KKR
4-Ethyltoluene	**0.00098**	b	ppmv	0.00074	3.1	100715	07/16/24	07/16/24	KKR
Acetylene	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
Alpha pinene	**0.0065**	b	ppmv	0.00069	3.1	100715	07/16/24	07/16/24	KKR
Benzene	ND	b	ppmv	0.0082	31	100715	07/16/24	07/16/24	KKR
Butane	**0.0087**	b	ppmv	0.00082	3.1	100715	07/16/24	07/16/24	KKR
cis-2-Butene	**0.00089**	b	ppmv	0.00081	3.1	100715	07/16/24	07/16/24	KKR
cis-2-Pentene	ND	b	ppmv	0.00075	3.1	100715	07/16/24	07/16/24	KKR
Cyclohexane	**0.0015**	b	ppmv	0.00078	3.1	100715	07/16/24	07/16/24	KKR
Cyclopentane	ND	b	ppmv	0.00075	3.1	100715	07/16/24	07/16/24	KKR
Ethane	**8.3**	b	ppmv	1.6	3.1	100700	07/10/24	07/10/24	EMD
Ethene	**0.39**	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
Ethylbenzene	**0.0022**	b	ppmv	0.00075	3.1	100715	07/16/24	07/16/24	KKR
Isobutane	**0.0080**	b	ppmv	0.00082	3.1	100715	07/16/24	07/16/24	KKR
Isobutylene	ND	b	ppmv	0.0077	31	100715	07/16/24	07/16/24	KKR
Isopentane	**0.0048**	b	ppmv	0.00084	3.1	100715	07/16/24	07/16/24	KKR
Isoprene	**0.0018**	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
Isopropylbenzene	**0.0017**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
m-Ethyltoluene	**0.0016**	b	ppmv	0.00076	3.1	100715	07/16/24	07/16/24	KKR
m-Xylene	**0.0039**	b	ppmv	0.00039	3.1	100715	07/16/24	07/16/24	KKR
Methane	**44**	b	ppmv	1.6	3.1	100700	07/10/24	07/10/24	EMD
Methylcyclohexane	**0.0011**	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
Methylcyclopentane	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
n-Decane	**0.0014**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
n-Dodecane	ND	b	ppmv	0.015	3.1	100715	07/16/24	07/16/24	KKR

Results for any subcontracted analyses are not included in this section.

Analysis Results for 100758

100758-003 Analyte	Result	Qual	Units	RL	DF	Batch	Prepared	Analyzed	Chemist
n-Heptane	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
n-Hexane	ND	b	ppmv	0.00080	3.1	100715	07/16/24	07/16/24	KKR
n-Nonane	**0.0030**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
n-Octane	**0.0020**	b	ppmv	0.00078	3.1	100715	07/16/24	07/16/24	KKR
n-Pentane	**0.0028**	b	ppmv	0.00085	3.1	100715	07/16/24	07/16/24	KKR
n-Undecane	ND	b	ppmv	0.0015	3.1	100715	07/16/24	07/16/24	KKR
o-Xylene	**0.0018**	b	ppmv	0.00076	3.1	100715	07/16/24	07/16/24	KKR
p-Xylene	**0.0011**	b	ppmv	0.00040	3.1	100715	07/16/24	07/16/24	KKR
Propane	**3.6**	b	ppmv	0.0083	31	100715	07/16/24	07/16/24	KKR
Propylbenzene	**0.00084**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
Propylene	**0.64**	b	ppmv	0.0079	31	100715	07/16/24	07/16/24	KKR
Styrene	**0.0013**	b	ppmv	0.00076	3.1	100715	07/16/24	07/16/24	KKR
Toluene	**0.066**	b	ppmv	0.00078	3.1	100715	07/16/24	07/16/24	KKR
trans-2-Butene	**0.0011**	b	ppmv	0.00077	3.1	100715	07/16/24	07/16/24	KKR
trans-2-Pentene	**0.00090**	b	ppmv	0.00081	3.1	100715	07/16/24	07/16/24	KKR

Batch QC

Type:	**Lab Control Sample**	**Lab ID:**	**QC102257**	**Batch:**	**100700**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102257 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Ethane	19,840	19980	ppbv	99%		70-130
Propane	19,720	20020	ppbv	98%		70-130

Type:	**Lab Control Sample Duplicate**	**Lab ID:**	**QC102258**	**Batch:**	**100700**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102258 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
Ethane	18,970	19980	ppbv	95%		70-130	4	30
Propane	19,150	20020	ppbv	96%		70-130	3	30

Type:	**Blank**	**Lab ID:**	**QC102259**	**Batch:**	**100700**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102259 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Ethane	ND		ppbv	500	07/10/24	07/10/24
Propane	ND		ppbv	500	07/10/24	07/10/24

Batch QC

Type:	**Lab Control Sample**	**Lab ID:**	**QC102311**	**Batch:**	**100715**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102311 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
1,2,3-Trimethylbenzene	15.21	18.52	ppbv	82%		70-130
1,2,4-Trimethylbenzene	16.33	19.34	ppbv	84%		70-130
1,3,5-Trimethylbenzene	16.68	19.00	ppbv	88%		70-130
1,3-Butadiene	20.23	20.42	ppbv	99%		70-130
1,3-Diethylbenzene	14.77	17.82	ppbv	83%		70-130
1,4-Diethylbenzene	15.75	19.12	ppbv	82%	b	70-130
1-Butene	19.49	20.66	ppbv	94%		70-130
1-Hexene	19.26	19.90	ppbv	97%		70-130
1-Pentene	19.91	20.86	ppbv	95%		70-130
2,2,4-Trimethylpentane	19.65	20.78	ppbv	95%		70-130
2,2-Dimethylbutane	19.19	20.40	ppbv	94%		70-130
2,3,4-Trimethylpentane	19.43	20.32	ppbv	96%		70-130
2,3-Dimethylbutane	19.10	20.36	ppbv	94%		70-130
2,3-Dimethylpentane	18.45	19.60	ppbv	94%		70-130
2,4-Dimethylpentane	18.98	20.10	ppbv	94%		70-130
2-Ethyltoluene	16.93	19.24	ppbv	88%		70-130
2-Methylheptane	19.56	20.14	ppbv	97%		70-130
2-Methylhexane	19.79	20.66	ppbv	96%		70-130
2-Methylpentane	19.08	19.98	ppbv	96%		70-130
3-Methylheptane	19.07	19.66	ppbv	97%		70-130
3-Methylhexane	18.93	20.00	ppbv	95%		70-130
3-Methylpentane	18.88	20.10	ppbv	94%		70-130
4-Ethyltoluene	17.01	18.80	ppbv	90%		70-130
Acetylene	18.83	20.34	ppbv	93%		70-130
Alpha pinene	16.34	17.64	ppbv	93%		70-130
Benzene	19.85	20.76	ppbv	96%		70-130
Butane	19.34	20.76	ppbv	93%		70-130
cis-2-Butene	19.54	20.56	ppbv	95%		70-130
cis-2-Pentene	18.28	19.08	ppbv	96%		70-130
Cyclohexane	18.51	19.84	ppbv	93%		70-130
Cyclopentane	17.99	19.16	ppbv	94%		70-130
Ethane	18.82	20.64	ppbv	91%		70-130
Ethene	19.08	20.42	ppbv	93%		70-130
Ethylbenzene	18.12	19.16	ppbv	95%		70-130
Isobutane	19.60	20.92	ppbv	94%		70-130
Isobutylene	18.60	19.66	ppbv	95%		70-130
Isopentane	20.16	21.46	ppbv	94%		70-130
Isoprene	19.57	20.46	ppbv	96%		70-130
Isopropylbenzene	17.98	19.48	ppbv	92%		70-130
m-Ethyltoluene	16.61	19.36	ppbv	86%		70-130
m-Xylene	9.145	9.800	ppbv	93%		70-130
Methylcyclohexane	18.99	20.26	ppbv	94%		70-130
Methylcyclopentane	18.99	20.22	ppbv	94%		70-130
n-Decane	17.86	19.58	ppbv	91%		70-130
n-Dodecane	11.82	18.76	ppbv	63%	b,*	70-130
n-Heptane	19.95	20.40	ppbv	98%		70-130
n-Hexane	19.54	20.34	ppbv	96%		70-130

Batch QC

QC102311 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
n-Nonane	18.85	19.58	ppbv	96%		70-130
n-Octane	19.48	19.78	ppbv	98%		70-130
n-Pentane	20.48	21.60	ppbv	95%		70-130
n-Undecane	14.71	19.56	ppbv	75%	b	70-130
o-Xylene	18.00	19.28	ppbv	93%		70-130
p-Xylene	9.584	10.10	ppbv	95%		70-130
Propane	19.40	21.00	ppbv	92%		70-130
Propylbenzene	18.06	19.60	ppbv	92%		70-130
Propylene	18.75	20.02	ppbv	94%		70-130
Styrene	17.86	19.28	ppbv	93%		70-130
Toluene	19.11	19.86	ppbv	96%		70-130
trans-2-Butene	18.86	19.58	ppbv	96%		70-130
trans-2-Pentene	19.80	20.54	ppbv	96%		70-130

Batch QC

Type:	**Lab Control Sample Duplicate**	**Lab ID:**	**QC102312**	**Batch:**	**100715**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102312 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
1,2,3-Trimethylbenzene	15.15	18.52	ppbv	82%		70-130	0	30
1,2,4-Trimethylbenzene	16.27	19.34	ppbv	84%		70-130	0	30
1,3,5-Trimethylbenzene	16.66	19.00	ppbv	88%		70-130	0	30
1,3-Butadiene	19.97	20.42	ppbv	98%		70-130	1	30
1,3-Diethylbenzene	14.58	17.82	ppbv	82%		70-130	1	30
1,4-Diethylbenzene	15.53	19.12	ppbv	81%	b	70-130	1	30
1-Butene	19.51	20.66	ppbv	94%		70-130	0	30
1-Hexene	19.31	19.90	ppbv	97%		70-130	0	30
1-Pentene	19.93	20.86	ppbv	96%		70-130	0	30
2,2,4-Trimethylpentane	19.71	20.78	ppbv	95%		70-130	0	30
2,2-Dimethylbutane	19.27	20.40	ppbv	94%		70-130	0	30
2,3,4-Trimethylpentane	19.49	20.32	ppbv	96%		70-130	0	30
2,3-Dimethylbutane	19.16	20.36	ppbv	94%		70-130	0	30
2,3-Dimethylpentane	18.56	19.60	ppbv	95%		70-130	1	30
2,4-Dimethylpentane	19.04	20.10	ppbv	95%		70-130	0	30
2-Ethyltoluene	16.91	19.24	ppbv	88%		70-130	0	30
2-Methylheptane	19.67	20.14	ppbv	98%		70-130	1	30
2-Methylhexane	19.84	20.66	ppbv	96%		70-130	0	30
2-Methylpentane	19.16	19.98	ppbv	96%		70-130	0	30
3-Methylheptane	19.21	19.66	ppbv	98%		70-130	1	30
3-Methylhexane	19.13	20.00	ppbv	96%		70-130	1	30
3-Methylpentane	18.96	20.10	ppbv	94%		70-130	0	30
4-Ethyltoluene	16.98	18.80	ppbv	90%		70-130	0	30
Acetylene	19.06	20.34	ppbv	94%		70-130	1	30
Alpha pinene	16.36	17.64	ppbv	93%		70-130	0	30
Benzene	19.92	20.76	ppbv	96%		70-130	0	30
Butane	19.41	20.76	ppbv	94%		70-130	0	30
cis-2-Butene	19.56	20.56	ppbv	95%		70-130	0	30
cis-2-Pentene	18.27	19.08	ppbv	96%		70-130	0	30
Cyclohexane	18.57	19.84	ppbv	94%		70-130	0	30
Cyclopentane	18.04	19.16	ppbv	94%		70-130	0	30
Ethane	19.02	20.64	ppbv	92%		70-130	1	30
Ethene	19.19	20.42	ppbv	94%		70-130	1	30
Ethylbenzene	18.15	19.16	ppbv	95%		70-130	0	30
Isobutane	19.70	20.92	ppbv	94%		70-130	1	30
Isobutylene	18.64	19.66	ppbv	95%		70-130	0	30
Isopentane	20.22	21.46	ppbv	94%		70-130	0	30
Isoprene	19.58	20.46	ppbv	96%		70-130	0	30
Isopropylbenzene	17.99	19.48	ppbv	92%		70-130	0	30
m-Ethyltoluene	16.56	19.36	ppbv	86%		70-130	0	30
m-Xylene	9.095	9.800	ppbv	93%		70-130	1	30
Methylcyclohexane	19.06	20.26	ppbv	94%		70-130	0	30
Methylcyclopentane	19.06	20.22	ppbv	94%		70-130	0	30
n-Decane	17.65	19.58	ppbv	90%		70-130	1	30
n-Dodecane	10.97	18.76	ppbv	58%	b,*	70-130	8	30
n-Heptane	19.98	20.40	ppbv	98%		70-130	0	30

Batch QC

QC102312 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
n-Hexane	19.59	20.34	ppbv	96%		70-130	0	30
n-Nonane	18.80	19.58	ppbv	96%		70-130	0	30
n-Octane	19.49	19.78	ppbv	99%		70-130	0	30
n-Pentane	20.53	21.60	ppbv	95%		70-130	0	30
n-Undecane	15.02	19.56	ppbv	77%	b	70-130	2	30
o-Xylene	18.03	19.28	ppbv	94%		70-130	0	30
p-Xylene	9.659	10.10	ppbv	96%		70-130	1	30
Propane	19.52	21.00	ppbv	93%		70-130	1	30
Propylbenzene	18.03	19.60	ppbv	92%		70-130	0	30
Propylene	18.74	20.02	ppbv	94%		70-130	0	30
Styrene	17.78	19.28	ppbv	92%		70-130	0	30
Toluene	19.15	19.86	ppbv	96%		70-130	0	30
trans-2-Butene	18.83	19.58	ppbv	96%		70-130	0	30
trans-2-Pentene	19.76	20.54	ppbv	96%		70-130	0	30

Batch QC

Type:	**Blank**	**Lab ID:**	**QC102313**	**Batch:**	**100715**
Matrix:	**Air**	**Method:**	**EPA TO-14A**		

QC102313 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
1,2,3-Trimethylbenzene	ND		ppbv	0.23	07/16/24	07/16/24
1,2,4-Trimethylbenzene	ND		ppbv	0.24	07/16/24	07/16/24
1,3,5-Trimethylbenzene	ND		ppbv	0.24	07/16/24	07/16/24
1,3-Butadiene	ND		ppbv	0.26	07/16/24	07/16/24
1,3-Diethylbenzene	ND		ppbv	0.22	07/16/24	07/16/24
1,4-Diethylbenzene	ND		ppbv	0.24	07/16/24	07/16/24
1-Butene	ND		ppbv	0.26	07/16/24	07/16/24
1-Hexene	ND		ppbv	0.25	07/16/24	07/16/24
1-Pentene	ND		ppbv	0.26	07/16/24	07/16/24
2,2,4-Trimethylpentane	ND		ppbv	0.26	07/16/24	07/16/24
2,2-Dimethylbutane	ND		ppbv	0.26	07/16/24	07/16/24
2,3,4-Trimethylpentane	ND		ppbv	0.25	07/16/24	07/16/24
2,3-Dimethylbutane	ND		ppbv	0.25	07/16/24	07/16/24
2,3-Dimethylpentane	ND		ppbv	0.25	07/16/24	07/16/24
2,4-Dimethylpentane	ND		ppbv	0.25	07/16/24	07/16/24
2-Ethyltoluene	ND		ppbv	0.24	07/16/24	07/16/24
2-Methylheptane	ND		ppbv	0.25	07/16/24	07/16/24
2-Methylhexane	ND		ppbv	0.26	07/16/24	07/16/24
2-Methylpentane	ND		ppbv	0.25	07/16/24	07/16/24
3-Methylheptane	ND		ppbv	0.25	07/16/24	07/16/24
3-Methylhexane	ND		ppbv	0.25	07/16/24	07/16/24
3-Methylpentane	ND		ppbv	0.25	07/16/24	07/16/24
4-Ethyltoluene	ND		ppbv	0.24	07/16/24	07/16/24
Acetylene	ND		ppbv	0.25	07/16/24	07/16/24
Alpha pinene	ND		ppbv	0.22	07/16/24	07/16/24
Benzene	ND		ppbv	0.26	07/16/24	07/16/24
Butane	ND		ppbv	0.26	07/16/24	07/16/24
cis-2-Butene	ND		ppbv	0.26	07/16/24	07/16/24
cis-2-Pentene	ND		ppbv	0.24	07/16/24	07/16/24
Cyclohexane	ND		ppbv	0.25	07/16/24	07/16/24
Cyclopentane	ND		ppbv	0.24	07/16/24	07/16/24
Ethane	ND		ppbv	0.26	07/16/24	07/16/24
Ethene	ND		ppbv	0.26	07/16/24	07/16/24
Ethylbenzene	ND		ppbv	0.24	07/16/24	07/16/24
Isobutane	ND		ppbv	0.26	07/16/24	07/16/24
Isobutylene	ND		ppbv	0.25	07/16/24	07/16/24
Isopentane	ND		ppbv	0.27	07/16/24	07/16/24
Isoprene	ND		ppbv	0.26	07/16/24	07/16/24
Isopropylbenzene	ND		ppbv	0.24	07/16/24	07/16/24
m-Ethyltoluene	ND		ppbv	0.24	07/16/24	07/16/24
m-Xylene	ND		ppbv	0.12	07/16/24	07/16/24
Methylcyclohexane	ND		ppbv	0.25	07/16/24	07/16/24
Methylcyclopentane	ND		ppbv	0.25	07/16/24	07/16/24
n-Decane	ND		ppbv	0.24	07/16/24	07/16/24
n-Dodecane	ND	b	ppbv	4.7	07/16/24	07/16/24
n-Heptane	ND		ppbv	0.26	07/16/24	07/16/24
n-Hexane	ND		ppbv	0.25	07/16/24	07/16/24

Batch QC

QC102313 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
n-Nonane	ND		ppbv	0.24	07/16/24	07/16/24
n-Octane	ND		ppbv	0.25	07/16/24	07/16/24
n-Pentane	ND		ppbv	0.27	07/16/24	07/16/24
n-Undecane	ND		ppbv	0.49	07/16/24	07/16/24
o-Xylene	ND		ppbv	0.24	07/16/24	07/16/24
p-Xylene	ND		ppbv	0.13	07/16/24	07/16/24
Propane	ND		ppbv	0.26	07/16/24	07/16/24
Propylbenzene	ND		ppbv	0.25	07/16/24	07/16/24
Propylene	ND		ppbv	0.25	07/16/24	07/16/24
Styrene	ND		ppbv	0.24	07/16/24	07/16/24
Toluene	ND		ppbv	0.25	07/16/24	07/16/24
trans-2-Butene	ND		ppbv	0.24	07/16/24	07/16/24
trans-2-Pentene	ND		ppbv	0.26	07/16/24	07/16/24

Type: **Lab Control Sample** **Lab ID:** **QC102317** **Batch:** **100717**
Matrix: **Air** **Method:** **EPA TO-14A**

QC102317 Analyte	Result	Spiked	Units	Recovery	Qual	Limits
Ethane	18.87	20.64	ppbv	91%		70-130
Ethene	18.96	20.42	ppbv	93%		70-130
Propylene	18.78	20.02	ppbv	94%		70-130

Type: **Lab Control Sample Duplicate** **Lab ID:** **QC102318** **Batch:** **100717**
Matrix: **Air** **Method:** **EPA TO-14A**

QC102318 Analyte	Result	Spiked	Units	Recovery	Qual	Limits	RPD	RPD Lim
Ethane	18.54	20.64	ppbv	90%		70-130	2	30
Ethene	18.63	20.42	ppbv	91%		70-130	2	30
Propylene	18.28	20.02	ppbv	91%		70-130	3	30

Type: **Blank** **Lab ID:** **QC102319** **Batch:** **100717**
Matrix: **Air** **Method:** **EPA TO-14A**

QC102319 Analyte	Result	Qual	Units	RL	Prepared	Analyzed
Ethane	ND		ppbv	0.26	07/17/24	07/17/24
Ethene	ND		ppbv	0.26	07/17/24	07/17/24
Propylene	ND		ppbv	0.25	07/17/24	07/17/24

*	Value is outside QC limits
ND	Not Detected
b	See narrative

Texas Commission on
Environmental Quality

Certificate of Accreditation

Accreditation is hereby granted to

Enthalpy Analytical, LLC - Houston

2525 West Bellfort, Suite 175
Houston, TX 77054-5027

State Lab ID: T104704226
Effective Date: 07/01/2024
Expiration Date: 06/30/2025
Document ID: TX-C24-00247

Conditions of Accreditation

This laboratory has been found to conform with TCEQ rules and applicable standards for laboratory accreditation. The scope of accreditation is limited to the Fields of Accreditation (FoA) specifically listed on the subsequent page(s) of this certificate. Accreditation is for all version of a method approved per 40 CFR 136, 40 CFR 141, and/ or 40 CFR 143. Continued accreditation requires ongoing compliance with all applicable standards and requirements.

Note: For the attached FoA table, matrices may include DW (drinking water), NPW (non-potable water), S (solid and chemical materials), A (air), and/ or BT (biological tissue).

KKeel

Issued By: Kelly Keel, Executive Director Texas Commission on Environmental Quality
Date Issued: 07/01/2024

Laboratory Fields of Accreditation

Matrix	Method	Method Code	Analyte	Analyte Code	AB
NPW	Enterolert	60030208	Enterococci	2520	TX
NPW	EPA 1010	10116606	Ignitability	1780	TX
NPW	EPA 120.1	10006403	Conductivity	1610	TX
NPW	EPA 1311	10118806	Toxicity Characteristic Leaching Procedure (TCLP)	1466	TX
NPW	EPA 1312	10119003	Synthetic Precipitation Leaching Procedure (SPLP)	1460	TX
NPW	EPA 150.1	10008409	pH	1900	TX
NPW	EPA 160.1	10009208	Residue-filterable (TDS)	1955	TX
NPW	EPA 160.2	10009606	Residue-nonfilterable (TSS)	1960	TX
NPW	EPA 1664	10127807	n-Hexane Extractable Material (O&G)	1803	TX
NPW	EPA 200.8	10014605	Aluminum	1000	TX
NPW	EPA 200.8	10014605	Antimony	1005	TX
NPW	EPA 200.8	10014605	Arsenic	1010	TX
NPW	EPA 200.8	10014605	Barium	1015	TX
NPW	EPA 200.8	10014605	Beryllium	1020	TX
NPW	EPA 200.8	10014605	Boron	1025	TX
NPW	EPA 200.8	10014605	Cadmium	1030	TX
NPW	EPA 200.8	10014605	Calcium	1035	TX
NPW	EPA 200.8	10014605	Chromium	1040	TX
NPW	EPA 200.8	10014605	Cobalt	1050	TX
NPW	EPA 200.8	10014605	Copper	1055	TX
NPW	EPA 200.8	10014605	Iron	1070	TX
NPW	EPA 200.8	10014605	Lead	1075	TX
NPW	EPA 200.8	10014605	Magnesium	1085	TX
NPW	EPA 200.8	10014605	Manganese	1090	TX
NPW	EPA 200.8	10014605	Molybdenum	1100	TX
NPW	EPA 200.8	10014605	Nickel	1105	TX
NPW	EPA 200.8	10014605	Potassium	1125	TX
NPW	EPA 200.8	10014605	Selenium	1140	TX
NPW	EPA 200.8	10014605	Silver	1150	TX
NPW	EPA 200.8	10014605	Sodium	1155	TX
NPW	EPA 200.8	10014605	Strontium	1160	TX
NPW	EPA 200.8	10014605	Thallium	1165	TX
NPW	EPA 200.8	10014605	Tin	1175	TX
NPW	EPA 200.8	10014605	Titanium	1180	TX
NPW	EPA 200.8	10014605	Vanadium	1185	TX

NPW	EPA 200.8	10014605	Zinc	1190	TX
NPW	EPA 245.1	10036609	Mercury	1095	TX
NPW	EPA 300.0	10053200	Bromide	1540	TX
NPW	EPA 300.0	10053200	Chloride	1575	TX
NPW	EPA 300.0	10053200	Fluoride	1730	TX
NPW	EPA 300.0	10053200	Nitrate as N	1810	TX
NPW	EPA 300.0	10053200	Nitrate plus Nitrite as N	1820	TX
NPW	EPA 300.0	10053200	Nitrite as N	1840	TX
NPW	EPA 300.0	10053200	Orthophosphate as P	1870	TX
NPW	EPA 300.0	10053200	Sulfate	2000	TX
NPW	EPA 365.3	10070801	Orthophosphate as P	1870	TX
NPW	EPA 365.3	10070801	Total Phosphorus	1910	TX
NPW	EPA 376.2	10074609	Sulfide	2005	TX
NPW	EPA 410.4	10077404	Chemical Oxygen Demand (COD)	1565	TX
NPW	EPA 415.1	10078407	Total Organic Carbon (TOC)	2040	TX
NPW	EPA 420.1	10079400	Total Phenolics	1905	TX
NPW	EPA 6020	10156419	Aluminum	1000	TX
NPW	EPA 6020	10156419	Antimony	1005	TX
NPW	EPA 6020	10156419	Arsenic	1010	TX
NPW	EPA 6020	10156419	Barium	1015	TX
NPW	EPA 6020	10156419	Beryllium	1020	TX
NPW	EPA 6020	10156419	Boron	1025	TX
NPW	EPA 6020	10156419	Cadmium	1030	TX
NPW	EPA 6020	10156419	Calcium	1035	TX
NPW	EPA 6020	10156419	Chromium	1040	TX
NPW	EPA 6020	10156419	Cobalt	1050	TX
NPW	EPA 6020	10156419	Copper	1055	TX
NPW	EPA 6020	10156419	Iron	1070	TX
NPW	EPA 6020	10156419	Lead	1075	TX
NPW	EPA 6020	10156419	Magnesium	1085	TX
NPW	EPA 6020	10156419	Manganese	1090	TX
NPW	EPA 6020	10156419	Molybdenum	1100	TX
NPW	EPA 6020	10156419	Nickel	1105	TX
NPW	EPA 6020	10156419	Potassium	1125	TX
NPW	EPA 6020	10156419	Selenium	1140	TX
NPW	EPA 6020	10156419	Silver	1150	TX
NPW	EPA 6020	10156419	Sodium	1155	TX
NPW	EPA 6020	10156419	Strontium	1160	TX
NPW	EPA 6020	10156419	Thallium	1165	TX
NPW	EPA 6020	10156419	Tin	1175	TX
NPW	EPA 6020	10156419	Titanium	1180	TX

NPW	EPA 6020	10156419	Vanadium	1185	TX
NPW	EPA 6020	10156419	Zinc	1190	TX
NPW	EPA 608	10103603	4,4'-DDD	7355	TX
NPW	EPA 608	10103603	4,4'-DDE	7360	TX
NPW	EPA 608	10103603	4,4'-DDT	7365	TX
NPW	EPA 608	10103603	Aldrin	7025	TX
NPW	EPA 608	10103603	alpha-BHC (alpha-Hexachlorocyclohexane)	7110	TX
NPW	EPA 608	10103603	Aroclor-1016 (PCB-1016)	8880	TX
NPW	EPA 608	10103603	Aroclor-1221 (PCB-1221)	8885	TX
NPW	EPA 608	10103603	Aroclor-1232 (PCB-1232)	8890	TX
NPW	EPA 608	10103603	Aroclor-1242 (PCB-1242)	8895	TX
NPW	EPA 608	10103603	Aroclor-1248 (PCB-1248)	8900	TX
NPW	EPA 608	10103603	Aroclor-1254 (PCB-1254)	8905	TX
NPW	EPA 608	10103603	Aroclor-1260 (PCB-1260)	8910	TX
NPW	EPA 608	10103603	beta-BHC (beta-Hexachlorocyclohexane)	7115	TX
NPW	EPA 608	10103603	cis-Chlordane (alpha-Chlordane)	7240	TX
NPW	EPA 608	10103603	delta-BHC	7105	TX
NPW	EPA 608	10103603	Dieldrin	7470	TX
NPW	EPA 608	10103603	Endosulfan I	7510	TX
NPW	EPA 608	10103603	Endosulfan II	7515	TX
NPW	EPA 608	10103603	Endosulfan sulfate	7520	TX
NPW	EPA 608	10103603	Endrin	7540	TX
NPW	EPA 608	10103603	Endrin aldehyde	7530	TX
NPW	EPA 608	10103603	Endrin ketone	7535	TX
NPW	EPA 608	10103603	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	7120	TX
NPW	EPA 608	10103603	gamma-Chlordane	7245	TX
NPW	EPA 608	10103603	Heptachlor	7685	TX
NPW	EPA 608	10103603	Heptachlor epoxide	7690	TX
NPW	EPA 608	10103603	Isodrin	7725	TX
NPW	EPA 608	10103603	Methoxychlor	7810	TX
NPW	EPA 608	10103603	Toxaphene (Chlorinated Camphene)	8250	TX
NPW	EPA 624	10107207	1,1,1-Trichloroethane	5160	TX
NPW	EPA 624	10107207	1,1,2,2-Tetrachloroethane	5110	TX
NPW	EPA 624	10107207	1,1,2-Trichloroethane	5165	TX
NPW	EPA 624	10107207	1,1-Dichloroethane	4630	TX
NPW	EPA 624	10107207	1,1-Dichloroethylene	4640	TX
NPW	EPA 624	10107207	1,2-Dibromoethane (EDB, Ethylene dibromide)	4585	TX
NPW	EPA 624	10107207	1,2-Dichlorobenzene (o-	4610	TX

			Dichlorobenzene)		
NPW	EPA 624	10107207	1,2-Dichloroethane (Ethylene dichloride)	4635	TX
NPW	EPA 624	10107207	1,2-Dichloropropane	4655	TX
NPW	EPA 624	10107207	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
NPW	EPA 624	10107207	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
NPW	EPA 624	10107207	2-Butanone (Methyl ethyl ketone, MEK)	4410	TX
NPW	EPA 624	10107207	2-Chloroethyl vinyl ether	4500	TX
NPW	EPA 624	10107207	Acetone	4315	TX
NPW	EPA 624	10107207	Acrolein (Propenal)	4325	TX
NPW	EPA 624	10107207	Acrylonitrile	4340	TX
NPW	EPA 624	10107207	Benzene	4375	TX
NPW	EPA 624	10107207	Bromodichloromethane	4395	TX
NPW	EPA 624	10107207	Bromoform	4400	TX
NPW	EPA 624	10107207	Carbon tetrachloride	4455	TX
NPW	EPA 624	10107207	Chlorobenzene	4475	TX
NPW	EPA 624	10107207	Chlorodibromomethane	4575	TX
NPW	EPA 624	10107207	Chloroethane (Ethyl chloride)	4485	TX
NPW	EPA 624	10107207	Chloroform	4505	TX
NPW	EPA 624	10107207	cis-1,2-Dichloroethylene	4645	TX
NPW	EPA 624	10107207	cis-1,3-Dichloropropene	4680	TX
NPW	EPA 624	10107207	Ethylbenzene	4765	TX
NPW	EPA 624	10107207	m+p-xylene	5240	TX
NPW	EPA 624	10107207	Methyl bromide (Bromomethane)	4950	TX
NPW	EPA 624	10107207	Methyl chloride (Chloromethane)	4960	TX
NPW	EPA 624	10107207	Methyl tert-butyl ether (MTBE)	5000	TX
NPW	EPA 624	10107207	Methylene chloride (Dichloromethane)	4975	TX
NPW	EPA 624	10107207	Naphthalene	5005	TX
NPW	EPA 624	10107207	o-Xylene	5250	TX
NPW	EPA 624	10107207	Tetrachloroethylene (Perchloroethylene)	5115	TX
NPW	EPA 624	10107207	Toluene	5140	TX
NPW	EPA 624	10107207	Total Trihalomethanes (TTHMs)	5205	TX
NPW	EPA 624	10107207	Total Xylene	5260	TX
NPW	EPA 624	10107207	trans-1,2-Dichloroethylene	4700	TX
NPW	EPA 624	10107207	trans-1,3-Dichloropropylene	4685	TX
NPW	EPA 624	10107207	Trichloroethene (Trichloroethylene)	5170	TX
NPW	EPA 624	10107207	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175	TX

NPW	EPA 624	10107207	Vinyl chloride (Chloroethene)	5235	TX
NPW	EPA 624.1	10298121	1,1,1-Trichloroethane	5160	TX
NPW	EPA 624.1	10298121	1,1,2,2-Tetrachloroethane	5110	TX
NPW	EPA 624.1	10298121	1,1,2-Trichloroethane	5165	TX
NPW	EPA 624.1	10298121	1,1-Dichloroethane	4630	TX
NPW	EPA 624.1	10298121	1,1-Dichloroethylene	4640	TX
NPW	EPA 624.1	10298121	1,2-Dibromoethane (EDB, Ethylene dibromide)	4585	TX
NPW	EPA 624.1	10298121	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX
NPW	EPA 624.1	10298121	1,2-Dichloroethane (Ethylene dichloride)	4635	TX
NPW	EPA 624.1	10298121	1,2-Dichloropropane	4655	TX
NPW	EPA 624.1	10298121	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
NPW	EPA 624.1	10298121	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
NPW	EPA 624.1	10298121	2-Butanone (Methyl ethyl ketone, MEK)	4410	TX
NPW	EPA 624.1	10298121	2-Chloroethyl vinyl ether	4500	TX
NPW	EPA 624.1	10298121	Acetone	4315	TX
NPW	EPA 624.1	10298121	Acrolein (Propenal)	4325	TX
NPW	EPA 624.1	10298121	Acrylonitrile	4340	TX
NPW	EPA 624.1	10298121	Benzene	4375	TX
NPW	EPA 624.1	10298121	Bromodichloromethane	4395	TX
NPW	EPA 624.1	10298121	Bromoform	4400	TX
NPW	EPA 624.1	10298121	Carbon tetrachloride	4455	TX
NPW	EPA 624.1	10298121	Chlorobenzene	4475	TX
NPW	EPA 624.1	10298121	Chlorodibromomethane	4575	TX
NPW	EPA 624.1	10298121	Chloroethane (Ethyl chloride)	4485	TX
NPW	EPA 624.1	10298121	Chloroform	4505	TX
NPW	EPA 624.1	10298121	cis-1,2-Dichloroethylene	4645	TX
NPW	EPA 624.1	10298121	cis-1,3-Dichloropropene	4680	TX
NPW	EPA 624.1	10298121	Ethylbenzene	4765	TX
NPW	EPA 624.1	10298121	m+p-xylene	5240	TX
NPW	EPA 624.1	10298121	Methyl bromide (Bromomethane)	4950	TX
NPW	EPA 624.1	10298121	Methyl chloride (Chloromethane)	4960	TX
NPW	EPA 624.1	10298121	Methyl tert-butyl ether (MTBE)	5000	TX
NPW	EPA 624.1	10298121	Methylene chloride (Dichloromethane)	4975	TX
NPW	EPA 624.1	10298121	Naphthalene	5005	TX
NPW	EPA 624.1	10298121	o-Xylene	5250	TX
NPW	EPA 624.1	10298121	Tetrachloroethylene	5115	TX

			(Perchloroethylene)		
NPW	EPA 624.1	10298121	Toluene	5140	TX
NPW	EPA 624.1	10298121	Total Trihalomethanes (TTHMs)	5205	TX
NPW	EPA 624.1	10298121	Total Xylene	5260	TX
NPW	EPA 624.1	10298121	trans-1,2-Dichloroethylene	4700	TX
NPW	EPA 624.1	10298121	trans-1,3-Dichloropropylene	4685	TX
NPW	EPA 624.1	10298121	Trichloroethene (Trichloroethylene)	5170	TX
NPW	EPA 624.1	10298121	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175	TX
NPW	EPA 624.1	10298121	Vinyl chloride (Chloroethene)	5235	TX
NPW	EPA 625	10107401	1,2,4,5-Tetrachlorobenzene	6715	TX
NPW	EPA 625	10107401	1,2,4-Trichlorobenzene	5155	TX
NPW	EPA 625	10107401	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX
NPW	EPA 625	10107401	1,2-Diphenylhydrazine	6220	TX
NPW	EPA 625	10107401	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
NPW	EPA 625	10107401	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
NPW	EPA 625	10107401	2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	4659	TX
NPW	EPA 625	10107401	2,3,4,6-Tetrachlorophenol	6735	TX
NPW	EPA 625	10107401	2,4,5-Trichlorophenol	6835	TX
NPW	EPA 625	10107401	2,4,6-Trichlorophenol	6840	TX
NPW	EPA 625	10107401	2,4-Dichlorophenol	6000	TX
NPW	EPA 625	10107401	2,4-Dimethylphenol	6130	TX
NPW	EPA 625	10107401	2,4-Dinitrophenol	6175	TX
NPW	EPA 625	10107401	2,4-Dinitrotoluene (2,4-DNT)	6185	TX
NPW	EPA 625	10107401	2,6-Dinitrotoluene (2,6-DNT)	6190	TX
NPW	EPA 625	10107401	2-Chloronaphthalene	5795	TX
NPW	EPA 625	10107401	2-Chlorophenol	5800	TX
NPW	EPA 625	10107401	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	6360	TX
NPW	EPA 625	10107401	2-Methylphenol (o-Cresol)	6400	TX
NPW	EPA 625	10107401	2-Nitrophenol	6490	TX
NPW	EPA 625	10107401	3,3'-Dichlorobenzidine	5945	TX
NPW	EPA 625	10107401	4-Bromophenyl phenyl ether (BDE-3)	5660	TX
NPW	EPA 625	10107401	4-Chloro-3-methylphenol	5700	TX
NPW	EPA 625	10107401	4-Chlorophenyl phenylether	5825	TX
NPW	EPA 625	10107401	4-Methylphenol (p-Cresol)	6410	TX
NPW	EPA 625	10107401	4-Nitrophenol	6500	TX
NPW	EPA 625	10107401	Acenaphthene	5500	TX

NPW	EPA 625	10107401	Acenaphthylene	5505	TX
NPW	EPA 625	10107401	Anthracene	5555	TX
NPW	EPA 625	10107401	Benzidine	5595	TX
NPW	EPA 625	10107401	Benzo(a)anthracene	5575	TX
NPW	EPA 625	10107401	Benzo(a)pyrene	5580	TX
NPW	EPA 625	10107401	Benzo(g,h,i)perylene	5590	TX
NPW	EPA 625	10107401	Benzo(k)fluoranthene	5600	TX
NPW	EPA 625	10107401	Benzo[b]fluoranthene	5585	TX
NPW	EPA 625	10107401	bis(2-Chloroethoxy)methane	5760	TX
NPW	EPA 625	10107401	bis(2-Chloroethyl) ether	5765	TX
NPW	EPA 625	10107401	Butyl benzyl phthalate	5670	TX
NPW	EPA 625	10107401	Chrysene	5855	TX
NPW	EPA 625	10107401	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	6065	TX
NPW	EPA 625	10107401	Di-n-butyl phthalate	5925	TX
NPW	EPA 625	10107401	Di-n-octyl phthalate	6200	TX
NPW	EPA 625	10107401	Dibenz(a,h) anthracene	5895	TX
NPW	EPA 625	10107401	Diethyl phthalate	6070	TX
NPW	EPA 625	10107401	Dimethyl phthalate	6135	TX
NPW	EPA 625	10107401	Fluoranthene	6265	TX
NPW	EPA 625	10107401	Fluorene	6270	TX
NPW	EPA 625	10107401	Hexachlorobenzene	6275	TX
NPW	EPA 625	10107401	Hexachlorobutadiene	4835	TX
NPW	EPA 625	10107401	Hexachlorocyclopentadiene	6285	TX
NPW	EPA 625	10107401	Hexachloroethane	4840	TX
NPW	EPA 625	10107401	Indeno(1,2,3-cd) pyrene	6315	TX
NPW	EPA 625	10107401	Isophorone	6320	TX
NPW	EPA 625	10107401	n-Nitroso-di-n-butylamine	5025	TX
NPW	EPA 625	10107401	n-Nitrosodi-n-propylamine	6545	TX
NPW	EPA 625	10107401	n-Nitrosodiethylamine	6525	TX
NPW	EPA 625	10107401	n-Nitrosodimethylamine	6530	TX
NPW	EPA 625	10107401	n-Nitrosodiphenylamine	6535	TX
NPW	EPA 625	10107401	Naphthalene	5005	TX
NPW	EPA 625	10107401	Nitrobenzene	5015	TX
NPW	EPA 625	10107401	Pentachlorobenzene	6590	TX
NPW	EPA 625	10107401	Pentachlorophenol	6605	TX
NPW	EPA 625	10107401	Phenanthrene	6615	TX
NPW	EPA 625	10107401	Phenol	6625	TX
NPW	EPA 625	10107401	Pyrene	6665	TX
NPW	EPA 625	10107401	Pyridine	5095	TX
NPW	EPA 7196	10162206	Chromium (VI)	1045	TX

NPW	EPA 7470	10165807	Mercury	1095	TX
NPW	EPA 8015	10173203	Ethanol	4750	TX
NPW	EPA 8015	10173203	Ethylene glycol	4785	TX
NPW	EPA 8015	10173203	Methanol	4930	TX
NPW	EPA 8081	10178402	4,4'-DDD	7355	TX
NPW	EPA 8081	10178402	4,4'-DDE	7360	TX
NPW	EPA 8081	10178402	4,4'-DDT	7365	TX
NPW	EPA 8081	10178402	Aldrin	7025	TX
NPW	EPA 8081	10178402	alpha-BHC (alpha-Hexachlorocyclohexane)	7110	TX
NPW	EPA 8081	10178402	beta-BHC (beta-Hexachlorocyclohexane)	7115	TX
NPW	EPA 8081	10178402	Chlorthalonil (Daconil)	7310	TX
NPW	EPA 8081	10178402	cis-Chlordane (alpha-Chlordane)	7240	TX
NPW	EPA 8081	10178402	Dacthal (DCPA)	8550	TX
NPW	EPA 8081	10178402	delta-BHC	7105	TX
NPW	EPA 8081	10178402	Dieldrin	7470	TX
NPW	EPA 8081	10178402	Endosulfan I	7510	TX
NPW	EPA 8081	10178402	Endosulfan II	7515	TX
NPW	EPA 8081	10178402	Endosulfan sulfate	7520	TX
NPW	EPA 8081	10178402	Endrin	7540	TX
NPW	EPA 8081	10178402	Endrin aldehyde	7530	TX
NPW	EPA 8081	10178402	Endrin ketone	7535	TX
NPW	EPA 8081	10178402	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	7120	TX
NPW	EPA 8081	10178402	gamma-Chlordane	7245	TX
NPW	EPA 8081	10178402	Heptachlor	7685	TX
NPW	EPA 8081	10178402	Heptachlor epoxide	7690	TX
NPW	EPA 8081	10178402	Hexachlorobenzene	6275	TX
NPW	EPA 8081	10178402	Methoxychlor	7810	TX
NPW	EPA 8081	10178402	Mirex	7870	TX
NPW	EPA 8081	10178402	Toxaphene (Chlorinated Camphene)	8250	TX
NPW	EPA 8082	10179007	Aroclor-1016 (PCB-1016)	8880	TX
NPW	EPA 8082	10179007	Aroclor-1221 (PCB-1221)	8885	TX
NPW	EPA 8082	10179007	Aroclor-1232 (PCB-1232)	8890	TX
NPW	EPA 8082	10179007	Aroclor-1242 (PCB-1242)	8895	TX
NPW	EPA 8082	10179007	Aroclor-1248 (PCB-1248)	8900	TX
NPW	EPA 8082	10179007	Aroclor-1254 (PCB-1254)	8905	TX
NPW	EPA 8082	10179007	Aroclor-1260 (PCB-1260)	8910	TX
NPW	EPA 8082	10179007	Total PCBs	8870	TX
NPW	EPA 8260	10184802	1,1,1,2-Tetrachloroethane	5105	TX
NPW	EPA 8260	10184802	1,1,1-Trichloroethane	5160	TX

NPW	EPA 8260	10184802	1,1,2,2-Tetrachloroethane	5110	TX
NPW	EPA 8260	10184802	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	5185	TX
NPW	EPA 8260	10184802	1,1,2-Trichloroethane	5165	TX
NPW	EPA 8260	10184802	1,1-Dichloroethane	4630	TX
NPW	EPA 8260	10184802	1,1-Dichloroethylene	4640	TX
NPW	EPA 8260	10184802	1,1-Dichloropropene	4670	TX
NPW	EPA 8260	10184802	1,2,3-Trichlorobenzene	5150	TX
NPW	EPA 8260	10184802	1,2,3-Trichloropropane	5180	TX
NPW	EPA 8260	10184802	1,2,4-Trichlorobenzene	5155	TX
NPW	EPA 8260	10184802	1,2,4-Trimethylbenzene	5210	TX
NPW	EPA 8260	10184802	1,2-Dibromo-3-chloropropane (DBCP)	4570	TX
NPW	EPA 8260	10184802	1,2-Dibromoethane (EDB, Ethylene dibromide)	4585	TX
NPW	EPA 8260	10184802	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX
NPW	EPA 8260	10184802	1,2-Dichloroethane (Ethylene dichloride)	4635	TX
NPW	EPA 8260	10184802	1,2-Dichloropropane	4655	TX
NPW	EPA 8260	10184802	1,3,5-Trimethylbenzene	5215	TX
NPW	EPA 8260	10184802	1,3-Dichloro-2-propanol	4690	TX
NPW	EPA 8260	10184802	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
NPW	EPA 8260	10184802	1,3-Dichloropropane	4660	TX
NPW	EPA 8260	10184802	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
NPW	EPA 8260	10184802	1,4-Dioxane (1,4- Diethyleneoxide)	4735	TX
NPW	EPA 8260	10184802	2,2-Dichloropropane	4665	TX
NPW	EPA 8260	10184802	2-Butanone (Methyl ethyl ketone, MEK)	4410	TX
NPW	EPA 8260	10184802	2-Chloroethyl vinyl ether	4500	TX
NPW	EPA 8260	10184802	2-Chlorotoluene	4535	TX
NPW	EPA 8260	10184802	2-Hexanone	4860	TX
NPW	EPA 8260	10184802	2-Propanol	5065	TX
NPW	EPA 8260	10184802	4-Chlorotoluene	4540	TX
NPW	EPA 8260	10184802	4-Isopropyltoluene (p-Cymene)	4910	TX
NPW	EPA 8260	10184802	4-Methyl-2-pentanone (MIBK)	4995	TX
NPW	EPA 8260	10184802	Acetone	4315	TX
NPW	EPA 8260	10184802	Acetonitrile	4320	TX
NPW	EPA 8260	10184802	Acrolein (Propenal)	4325	TX
NPW	EPA 8260	10184802	Acrylonitrile	4340	TX
NPW	EPA 8260	10184802	Allyl alcohol	4350	TX

NPW	EPA 8260	10184802	Allyl chloride (3-Chloropropene)	4355	TX
NPW	EPA 8260	10184802	Benzene	4375	TX
NPW	EPA 8260	10184802	Benzyl chloride	5635	TX
NPW	EPA 8260	10184802	Bromobenzene	4385	TX
NPW	EPA 8260	10184802	Bromochloromethane	4390	TX
NPW	EPA 8260	10184802	Bromodichloromethane	4395	TX
NPW	EPA 8260	10184802	Bromoform	4400	TX
NPW	EPA 8260	10184802	Carbon disulfide	4450	TX
NPW	EPA 8260	10184802	Carbon tetrachloride	4455	TX
NPW	EPA 8260	10184802	Chlorobenzene	4475	TX
NPW	EPA 8260	10184802	Chlorodibromomethane	4575	TX
NPW	EPA 8260	10184802	Chloroethane (Ethyl chloride)	4485	TX
NPW	EPA 8260	10184802	Chloroform	4505	TX
NPW	EPA 8260	10184802	Chloroprene (2-Chloro-1,3-butadiene)	4525	TX
NPW	EPA 8260	10184802	cis-1,2-Dichloroethylene	4645	TX
NPW	EPA 8260	10184802	cis-1,3-Dichloropropene	4680	TX
NPW	EPA 8260	10184802	cis-1,4-Dichloro-2-butene	4600	TX
NPW	EPA 8260	10184802	Crotonaldehyde	4545	TX
NPW	EPA 8260	10184802	Dibromofluoromethane	4590	TX
NPW	EPA 8260	10184802	Dibromomethane (Methylene bromide)	4595	TX
NPW	EPA 8260	10184802	Dichlorodifluoromethane (Freon-12)	4625	TX
NPW	EPA 8260	10184802	Diethyl ether	4725	TX
NPW	EPA 8260	10184802	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	4745	TX
NPW	EPA 8260	10184802	Ethyl acetate	4755	TX
NPW	EPA 8260	10184802	Ethyl methacrylate	4810	TX
NPW	EPA 8260	10184802	Ethylbenzene	4765	TX
NPW	EPA 8260	10184802	Ethylene oxide	4795	TX
NPW	EPA 8260	10184802	Hexachlorobutadiene	4835	TX
NPW	EPA 8260	10184802	Hexachloroethane	4840	TX
NPW	EPA 8260	10184802	Iodomethane (Methyl iodide)	4870	TX
NPW	EPA 8260	10184802	Isobutyl alcohol (2-Methyl-1-propanol)	4875	TX
NPW	EPA 8260	10184802	Isopropylbenzene	4900	TX
NPW	EPA 8260	10184802	m+p-xylene	5240	TX
NPW	EPA 8260	10184802	Methacrylonitrile	4925	TX
NPW	EPA 8260	10184802	Methyl bromide (Bromomethane)	4950	TX
NPW	EPA 8260	10184802	Methyl chloride (Chloromethane)	4960	TX
NPW	EPA 8260	10184802	Methyl methacrylate	4990	TX
NPW	EPA 8260	10184802	Methyl tert-butyl ether (MTBE)	5000	TX

NPW	EPA 8260	10184802	Methylene chloride (Dichloromethane)	4975	TX
NPW	EPA 8260	10184802	n-Butyl alcohol (1-Butanol, n-Butanol)	4425	TX
NPW	EPA 8260	10184802	n-Butylbenzene	4435	TX
NPW	EPA 8260	10184802	n-Propylbenzene	5090	TX
NPW	EPA 8260	10184802	Naphthalene	5005	TX
NPW	EPA 8260	10184802	o-Xylene	5250	TX
NPW	EPA 8260	10184802	Paraldehyde	5030	TX
NPW	EPA 8260	10184802	Pentachloroethane	5035	TX
NPW	EPA 8260	10184802	Pentafluorobenzene	5040	TX
NPW	EPA 8260	10184802	Propionitrile (Ethyl cyanide)	5080	TX
NPW	EPA 8260	10184802	sec-Butylbenzene	4440	TX
NPW	EPA 8260	10184802	Styrene	5100	TX
NPW	EPA 8260	10184802	tert-Butyl alcohol (2-Methyl-2-Propanol)	4420	TX
NPW	EPA 8260	10184802	tert-Butylbenzene	4445	TX
NPW	EPA 8260	10184802	Tetrachloroethylene (Perchloroethylene)	5115	TX
NPW	EPA 8260	10184802	Toluene	5140	TX
NPW	EPA 8260	10184802	Total Trihalomethanes (TTHMs)	5205	TX
NPW	EPA 8260	10184802	Total Xylene	5260	TX
NPW	EPA 8260	10184802	trans-1,2-Dichloroethylene	4700	TX
NPW	EPA 8260	10184802	trans-1,3-Dichloropropylene	4685	TX
NPW	EPA 8260	10184802	trans-1,4-Dichloro-2-butene	4605	TX
NPW	EPA 8260	10184802	Trichloroethene (Trichloroethylene)	5170	TX
NPW	EPA 8260	10184802	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175	TX
NPW	EPA 8260	10184802	Vinyl acetate	5225	TX
NPW	EPA 8260	10184802	Vinyl chloride (Chloroethene)	5235	TX
NPW	EPA 8270	10186002	1,2,4,5-Tetrachlorobenzene	6715	TX
NPW	EPA 8270	10186002	1,2,4-Trichlorobenzene	5155	TX
NPW	EPA 8270	10186002	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX
NPW	EPA 8270	10186002	1,2-Diphenylhydrazine	6220	TX
NPW	EPA 8270	10186002	1,3,5-Trinitrobenzene (1,3,5-TNB)	6885	TX
NPW	EPA 8270	10186002	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
NPW	EPA 8270	10186002	1,3-Dinitrobenzene (1,3-DNB)	6160	TX
NPW	EPA 8270	10186002	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
NPW	EPA 8270	10186002	1,4-Dinitrobenzene (1,4-DNB)	6165	TX
NPW	EPA 8270	10186002	1,4-Naphthoquinone	6420	TX

NPW	EPA 8270	10186002	1,4-Phenylenediamine	6630	TX
NPW	EPA 8270	10186002	1-Chloronaphthalene	5790	TX
NPW	EPA 8270	10186002	1-Naphthylamine	6425	TX
NPW	EPA 8270	10186002	2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	4659	TX
NPW	EPA 8270	10186002	2,3,4,6-Tetrachlorophenol	6735	TX
NPW	EPA 8270	10186002	2,4,5-Trichlorophenol	6835	TX
NPW	EPA 8270	10186002	2,4,6-Trichlorophenol	6840	TX
NPW	EPA 8270	10186002	2,4-Diaminotoluene	5880	TX
NPW	EPA 8270	10186002	2,4-Dichlorophenol	6000	TX
NPW	EPA 8270	10186002	2,4-Dimethylphenol	6130	TX
NPW	EPA 8270	10186002	2,4-Dinitrophenol	6175	TX
NPW	EPA 8270	10186002	2,4-Dinitrotoluene (2,4-DNT)	6185	TX
NPW	EPA 8270	10186002	2,6-Dichlorophenol	6005	TX
NPW	EPA 8270	10186002	2,6-Dinitrotoluene (2,6-DNT)	6190	TX
NPW	EPA 8270	10186002	2-Acetylaminofluorene	5515	TX
NPW	EPA 8270	10186002	2-Chloronaphthalene	5795	TX
NPW	EPA 8270	10186002	2-Chlorophenol	5800	TX
NPW	EPA 8270	10186002	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	6360	TX
NPW	EPA 8270	10186002	2-Methylaniline (o-Toluidine)	5145	TX
NPW	EPA 8270	10186002	2-Methylnaphthalene	6385	TX
NPW	EPA 8270	10186002	2-Methylphenol (o-Cresol)	6400	TX
NPW	EPA 8270	10186002	2-Naphthylamine	6430	TX
NPW	EPA 8270	10186002	2-Nitroaniline	6460	TX
NPW	EPA 8270	10186002	2-Nitrophenol	6490	TX
NPW	EPA 8270	10186002	2-Picoline (2-Methylpyridine)	5050	TX
NPW	EPA 8270	10186002	3,3'-Dichlorobenzidine	5945	TX
NPW	EPA 8270	10186002	3,3'-Dimethoxybenzidine	6100	TX
NPW	EPA 8270	10186002	3,3'-Dimethylbenzidine	6120	TX
NPW	EPA 8270	10186002	3-Methylcholanthrene	6355	TX
NPW	EPA 8270	10186002	3-Methylphenol (m-Cresol)	6405	TX
NPW	EPA 8270	10186002	3-Nitroaniline	6465	TX
NPW	EPA 8270	10186002	4,4'-Methylenebis(2-chloroaniline)	6365	TX
NPW	EPA 8270	10186002	4-Aminobiphenyl	5540	TX
NPW	EPA 8270	10186002	4-Bromophenyl phenyl ether (BDE-3)	5660	TX
NPW	EPA 8270	10186002	4-Chloro-3-methylphenol	5700	TX
NPW	EPA 8270	10186002	4-Chloroaniline	5745	TX
NPW	EPA 8270	10186002	4-Chlorophenyl phenylether	5825	TX
NPW	EPA 8270	10186002	4-Dimethyl aminoazobenzene	6105	TX
NPW	EPA 8270	10186002	4-Methylphenol (p-Cresol)	6410	TX

NPW	EPA 8270	10186002	4-Nitroaniline	6470	TX
NPW	EPA 8270	10186002	4-Nitrophenol	6500	TX
NPW	EPA 8270	10186002	5-Nitro-o-toluidine	6570	TX
NPW	EPA 8270	10186002	7,12-Dimethylbenz(a)anthracene	6115	TX
NPW	EPA 8270	10186002	a-a-Dimethylphenethylamine	6125	TX
NPW	EPA 8270	10186002	Acenaphthene	5500	TX
NPW	EPA 8270	10186002	Acenaphthylene	5505	TX
NPW	EPA 8270	10186002	Acetophenone	5510	TX
NPW	EPA 8270	10186002	Aniline	5545	TX
NPW	EPA 8270	10186002	Anthracene	5555	TX
NPW	EPA 8270	10186002	Aramite	5560	TX
NPW	EPA 8270	10186002	Benzidine	5595	TX
NPW	EPA 8270	10186002	Benzo(a)anthracene	5575	TX
NPW	EPA 8270	10186002	Benzo(a)pyrene	5580	TX
NPW	EPA 8270	10186002	Benzo(g,h,i)perylene	5590	TX
NPW	EPA 8270	10186002	Benzo(k)fluoranthene	5600	TX
NPW	EPA 8270	10186002	Benzoic acid	5610	TX
NPW	EPA 8270	10186002	Benzo[b]fluoranthene	5585	TX
NPW	EPA 8270	10186002	Benzyl alcohol	5630	TX
NPW	EPA 8270	10186002	Biphenyl	5640	TX
NPW	EPA 8270	10186002	bis(2-Chloroethoxy)methane	5760	TX
NPW	EPA 8270	10186002	bis(2-Chloroethyl) ether	5765	TX
NPW	EPA 8270	10186002	Butyl benzyl phthalate	5670	TX
NPW	EPA 8270	10186002	Carbazole	5680	TX
NPW	EPA 8270	10186002	Chlorobenzilate	7260	TX
NPW	EPA 8270	10186002	Chrysene	5855	TX
NPW	EPA 8270	10186002	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	6065	TX
NPW	EPA 8270	10186002	Di-n-butyl phthalate	5925	TX
NPW	EPA 8270	10186002	Di-n-octyl phthalate	6200	TX
NPW	EPA 8270	10186002	Diallate	7405	TX
NPW	EPA 8270	10186002	Dibenz(a, j) acridine	5900	TX
NPW	EPA 8270	10186002	Dibenz(a,h) anthracene	5895	TX
NPW	EPA 8270	10186002	Dibenzofuran	5905	TX
NPW	EPA 8270	10186002	Diethyl phthalate	6070	TX
NPW	EPA 8270	10186002	Dimethoate	7475	TX
NPW	EPA 8270	10186002	Dimethyl phthalate	6135	TX
NPW	EPA 8270	10186002	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	8620	TX
NPW	EPA 8270	10186002	Diphenylamine	6205	TX
NPW	EPA 8270	10186002	Disulfoton	8625	TX

NPW	EPA 8270	10186002	Ethyl methanesulfonate	6260	TX
NPW	EPA 8270	10186002	Famphur	7580	TX
NPW	EPA 8270	10186002	Fluoranthene	6265	TX
NPW	EPA 8270	10186002	Fluorene	6270	TX
NPW	EPA 8270	10186002	Hexachlorobenzene	6275	TX
NPW	EPA 8270	10186002	Hexachlorobutadiene	4835	TX
NPW	EPA 8270	10186002	Hexachlorocyclopentadiene	6285	TX
NPW	EPA 8270	10186002	Hexachloroethane	4840	TX
NPW	EPA 8270	10186002	Hexachlorophene	6290	TX
NPW	EPA 8270	10186002	Hexachloropropene	6295	TX
NPW	EPA 8270	10186002	Hydroquinone	6310	TX
NPW	EPA 8270	10186002	Indeno(1,2,3-cd) pyrene	6315	TX
NPW	EPA 8270	10186002	Isodrin	7725	TX
NPW	EPA 8270	10186002	Isophorone	6320	TX
NPW	EPA 8270	10186002	Isosafrole	6325	TX
NPW	EPA 8270	10186002	Kepone	7740	TX
NPW	EPA 8270	10186002	Malathion	7770	TX
NPW	EPA 8270	10186002	Methapyrilene	6345	TX
NPW	EPA 8270	10186002	Methyl methanesulfonate	6375	TX
NPW	EPA 8270	10186002	Methyl parathion (Parathion, methyl)	7825	TX
NPW	EPA 8270	10186002	n-Nitroso-di-n-butylamine	5025	TX
NPW	EPA 8270	10186002	n-Nitrosodi-n-propylamine	6545	TX
NPW	EPA 8270	10186002	n-Nitrosodiethylamine	6525	TX
NPW	EPA 8270	10186002	n-Nitrosodimethylamine	6530	TX
NPW	EPA 8270	10186002	n-Nitrosodiphenylamine	6535	TX
NPW	EPA 8270	10186002	n-Nitrosomethylethylamine	6550	TX
NPW	EPA 8270	10186002	n-Nitrosomorpholine	6555	TX
NPW	EPA 8270	10186002	n-Nitrosopiperidine	6560	TX
NPW	EPA 8270	10186002	n-Nitrosopyrrolidine	6565	TX
NPW	EPA 8270	10186002	Naphthalene	5005	TX
NPW	EPA 8270	10186002	Nicotine	6450	TX
NPW	EPA 8270	10186002	Nitrobenzene	5015	TX
NPW	EPA 8270	10186002	o,o,o-Triethyl phosphorothioate	8290	TX
NPW	EPA 8270	10186002	Parathion, ethyl	7955	TX
NPW	EPA 8270	10186002	Pentachlorobenzene	6590	TX
NPW	EPA 8270	10186002	Pentachloronitrobenzene	6600	TX
NPW	EPA 8270	10186002	Pentachlorophenol	6605	TX
NPW	EPA 8270	10186002	Phenacetin	6610	TX
NPW	EPA 8270	10186002	Phenanthrene	6615	TX
NPW	EPA 8270	10186002	Phenol	6625	TX

NPW	EPA 8270	10186002	Phorate	7985	TX
NPW	EPA 8270	10186002	Pronamide (Kerb)	6650	TX
NPW	EPA 8270	10186002	Pyrene	6665	TX
NPW	EPA 8270	10186002	Pyridine	5095	TX
NPW	EPA 8270	10186002	Safrole	6685	TX
NPW	EPA 8270	10186002	Strychnine	6695	TX
NPW	EPA 8270	10186002	Sulfotep (Tetraethyl dithiopyrophospahte)	8155	TX
NPW	EPA 8270	10186002	Thionazin (Zinophos)	8235	TX
NPW	EPA 8315	10188008	Acetaldehyde	4300	TX
NPW	EPA 8315	10188008	Butyraldehyde (Butanal)	4430	TX
NPW	EPA 8315	10188008	Crotonaldehyde	4545	TX
NPW	EPA 8315	10188008	Cyclohexanone	4560	TX
NPW	EPA 8315	10188008	Decanal	4565	TX
NPW	EPA 8315	10188008	Formaldehyde	4815	TX
NPW	EPA 8315	10188008	Heptanal	4820	TX
NPW	EPA 8315	10188008	Hexanaldehyde (Hexanal)	3825	TX
NPW	EPA 8315	10188008	m-Tolualdehyde (1,3-Tolualdehyde)	5125	TX
NPW	EPA 8315	10188008	n-Octaldehyde (Octanal)	9525	TX
NPW	EPA 8315	10188008	Nonanal	6575	TX
NPW	EPA 8315	10188008	Propionaldehyde (Propanal)	3965	TX
NPW	EPA 8315	10188008	Valeraldehyde (Pentanal, Pentanaldehyde)	4040	TX
NPW	EPA 9014	10193803	Amenable Cyanide	1510	TX
NPW	EPA 9014	10193803	Total Cyanide	1645	TX
NPW	EPA 9040	10196802	pH	1900	TX
NPW	EPA 9050	10198604	Conductivity	1610	TX
NPW	EPA 9056	10199209	Bromide	1540	TX
NPW	EPA 9056	10199209	Chloride	1575	TX
NPW	EPA 9056	10199209	Fluoride	1730	TX
NPW	EPA 9056	10199209	Nitrate as N	1810	TX
NPW	EPA 9056	10199209	Nitrate plus Nitrite as N	1820	TX
NPW	EPA 9056	10199209	Nitrite as N	1840	TX
NPW	EPA 9056	10199209	Orthophosphate as P	1870	TX
NPW	EPA 9056	10199209	Sulfate	2000	TX
NPW	EPA 9060	10200201	Total Organic Carbon (TOC)	2040	TX
NPW	EPA 9065	10200405	Total Phenolics	1905	TX
NPW	SM 2320 B	20045005	Alkalinity as CaCO3	1505	TX
NPW	SM 2340 B	20046008	Total hardness as CaCO3	1755	TX
NPW	SM 2540 B	20004608	Residue-total (TS)	1950	TX
NPW	SM 2540 C	20049803	Residue-filterable (TDS)	1955	TX

NPW	SM 2540 D	20004802	Residue-nonfilterable (TSS)	1960	TX
NPW	SM 3500-Cr B	20065809	Chromium (VI)	1045	TX
NPW	SM 4500-Cl G	20020604	Total Residual Chlorine	1940	TX
NPW	SM 4500-CN⁻ C	20020808	Total Cyanide	1645	TX
NPW	SM 4500-CN⁻ E	20021209	Total Cyanide	1645	TX
NPW	SM 4500-CN⁻ G	20021607	Amenable Cyanide	1510	TX
NPW	SM 4500-H+ B	20104603	pH	1900	TX
NPW	SM 4500-NH3 B	20022804	Ammonia as N	1515	TX
NPW	SM 4500-NH3 D	20108809	Ammonia as N	1515	TX
NPW	SM 4500-S2⁻ D	20125400	Sulfide	2005	TX
NPW	SM 4500-SiO2 C	20128205	Silica as SiO2	1990	TX
NPW	SM 5210 B	20027401	Biochemical Oxygen Demand (BOD)	1530	TX
NPW	SM 5210 B	20027401	Carbonaceous BOD (CBOD)	1555	TX
NPW	SM 5310 B	20137206	Total Organic Carbon (TOC)	2040	TX
NPW	SM 9223 B (Colilert-18 Quanti-Tray)	20212800	Escherichia coli (E. coli)	2525	TX
NPW	TNRCC 1005	90019208	Total Petroleum Hydrocarbons (TPH)	2050	TX
S	EPA 1010	10116606	Ignitability	1780	TX
S	EPA 1030	10117201	Ignitability	1780	TX
S	EPA 1311	10118806	Toxicity Characteristic Leaching Procedure (TCLP)	1466	TX
S	EPA 1312	10119003	Synthetic Precipitation Leaching Procedure (SPLP)	1460	TX
S	EPA 300.0	10053200	Bromide	1540	TX
S	EPA 300.0	10053200	Chloride	1575	TX
S	EPA 300.0	10053200	Fluoride	1730	TX
S	EPA 300.0	10053200	Nitrate as N	1810	TX
S	EPA 300.0	10053200	Nitrate plus Nitrite as N	1820	TX
S	EPA 300.0	10053200	Nitrite as N	1840	TX
S	EPA 300.0	10053200	Orthophosphate as P	1870	TX
S	EPA 350.2	10064003	Ammonia as N	1515	TX
S	EPA 350.3	10064401	Ammonia as N	1515	TX
S	EPA 6020	10156419	Aluminum	1000	TX
S	EPA 6020	10156419	Antimony	1005	TX
S	EPA 6020	10156419	Arsenic	1010	TX
S	EPA 6020	10156419	Barium	1015	TX
S	EPA 6020	10156419	Beryllium	1020	TX
S	EPA 6020	10156419	Boron	1025	TX
S	EPA 6020	10156419	Cadmium	1030	TX
S	EPA 6020	10156419	Calcium	1035	TX
S	EPA 6020	10156419	Chromium	1040	TX

S	EPA 6020	10156419	Cobalt	1050	TX
S	EPA 6020	10156419	Copper	1055	TX
S	EPA 6020	10156419	Iron	1070	TX
S	EPA 6020	10156419	Lead	1075	TX
S	EPA 6020	10156419	Magnesium	1085	TX
S	EPA 6020	10156419	Manganese	1090	TX
S	EPA 6020	10156419	Molybdenum	1100	TX
S	EPA 6020	10156419	Nickel	1105	TX
S	EPA 6020	10156419	Potassium	1125	TX
S	EPA 6020	10156419	Selenium	1140	TX
S	EPA 6020	10156419	Silver	1150	TX
S	EPA 6020	10156419	Sodium	1155	TX
S	EPA 6020	10156419	Strontium	1160	TX
S	EPA 6020	10156419	Thallium	1165	TX
S	EPA 6020	10156419	Tin	1175	TX
S	EPA 6020	10156419	Titanium	1180	TX
S	EPA 6020	10156419	Vanadium	1185	TX
S	EPA 6020	10156419	Zinc	1190	TX
S	EPA 7471	10166457	Mercury	1095	TX
S	EPA 8015	10173203	Ethanol	4750	TX
S	EPA 8015	10173203	Ethylene glycol	4785	TX
S	EPA 8015	10173203	Methanol	4930	TX
S	EPA 8081	10178402	4,4'-DDE	7360	TX
S	EPA 8081	10178402	4,4'-DDT	7365	TX
S	EPA 8081	10178402	Aldrin	7025	TX
S	EPA 8081	10178402	alpha-BHC (alpha-Hexachlorocyclohexane)	7110	TX
S	EPA 8081	10178402	beta-BHC (beta-Hexachlorocyclohexane)	7115	TX
S	EPA 8081	10178402	Chlorthalonil (Daconil)	7310	TX
S	EPA 8081	10178402	cis-Chlordane (alpha-Chlordane)	7240	TX
S	EPA 8081	10178402	Dacthal (DCPA)	8550	TX
S	EPA 8081	10178402	delta-BHC	7105	TX
S	EPA 8081	10178402	Dieldrin	7470	TX
S	EPA 8081	10178402	Endosulfan I	7510	TX
S	EPA 8081	10178402	Endosulfan II	7515	TX
S	EPA 8081	10178402	Endosulfan sulfate	7520	TX
S	EPA 8081	10178402	Endrin	7540	TX
S	EPA 8081	10178402	Endrin aldehyde	7530	TX
S	EPA 8081	10178402	Endrin ketone	7535	TX
S	EPA 8081	10178402	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	7120	TX

S	EPA 8081	10178402	gamma-Chlordane	7245	TX
S	EPA 8081	10178402	Heptachlor	7685	TX
S	EPA 8081	10178402	Heptachlor epoxide	7690	TX
S	EPA 8081	10178402	Hexachlorobenzene	6275	TX
S	EPA 8081	10178402	Methoxychlor	7810	TX
S	EPA 8081	10178402	Mirex	7870	TX
S	EPA 8081	10178402	Toxaphene (Chlorinated Camphene)	8250	TX
S	EPA 8082	10179007	Aroclor-1016 (PCB-1016)	8880	TX
S	EPA 8082	10179007	Aroclor-1221 (PCB-1221)	8885	TX
S	EPA 8082	10179007	Aroclor-1232 (PCB-1232)	8890	TX
S	EPA 8082	10179007	Aroclor-1242 (PCB-1242)	8895	TX
S	EPA 8082	10179007	Aroclor-1248 (PCB-1248)	8900	TX
S	EPA 8082	10179007	Aroclor-1254 (PCB-1254)	8905	TX
S	EPA 8082	10179007	Aroclor-1260 (PCB-1260)	8910	TX
S	EPA 8082	10179007	Total PCBs	8870	TX
S	EPA 8260	10184802	1,1,1,2-Tetrachloroethane	5105	TX
S	EPA 8260	10184802	1,1,1-Trichloroethane	5160	TX
S	EPA 8260	10184802	1,1,2,2-Tetrachloroethane	5110	TX
S	EPA 8260	10184802	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	5185	TX
S	EPA 8260	10184802	1,1,2-Trichloroethane	5165	TX
S	EPA 8260	10184802	1,1-Dichloroethane	4630	TX
S	EPA 8260	10184802	1,1-Dichloroethylene	4640	TX
S	EPA 8260	10184802	1,1-Dichloropropene	4670	TX
S	EPA 8260	10184802	1,2,3-Trichlorobenzene	5150	TX
S	EPA 8260	10184802	1,2,3-Trichloropropane	5180	TX
S	EPA 8260	10184802	1,2,4-Trichlorobenzene	5155	TX
S	EPA 8260	10184802	1,2,4-Trimethylbenzene	5210	TX
S	EPA 8260	10184802	1,2-Dibromo-3-chloropropane (DBCP)	4570	TX
S	EPA 8260	10184802	1,2-Dibromoethane (EDB, Ethylene dibromide)	4585	TX
S	EPA 8260	10184802	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX
S	EPA 8260	10184802	1,2-Dichloroethane (Ethylene dichloride)	4635	TX
S	EPA 8260	10184802	1,2-Dichloropropane	4655	TX
S	EPA 8260	10184802	1,3,5-Trimethylbenzene	5215	TX
S	EPA 8260	10184802	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
S	EPA 8260	10184802	1,3-Dichloropropane	4660	TX
S	EPA 8260	10184802	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX

S	EPA 8260	10184802	2,2-Dichloropropane	4665	TX
S	EPA 8260	10184802	2-Butanone (Methyl ethyl ketone, MEK)	4410	TX
S	EPA 8260	10184802	2-Chloroethyl vinyl ether	4500	TX
S	EPA 8260	10184802	2-Chlorotoluene	4535	TX
S	EPA 8260	10184802	2-Hexanone	4860	TX
S	EPA 8260	10184802	4-Chlorotoluene	4540	TX
S	EPA 8260	10184802	4-Isopropyltoluene (p-Cymene)	4910	TX
S	EPA 8260	10184802	4-Methyl-2-pentanone (MIBK)	4995	TX
S	EPA 8260	10184802	Acetone	4315	TX
S	EPA 8260	10184802	Acetonitrile	4320	TX
S	EPA 8260	10184802	Acrolein (Propenal)	4325	TX
S	EPA 8260	10184802	Acrylonitrile	4340	TX
S	EPA 8260	10184802	Allyl alcohol	4350	TX
S	EPA 8260	10184802	Allyl chloride (3-Chloropropene)	4355	TX
S	EPA 8260	10184802	Benzene	4375	TX
S	EPA 8260	10184802	Benzyl chloride	5635	TX
S	EPA 8260	10184802	Bromobenzene	4385	TX
S	EPA 8260	10184802	Bromochloromethane	4390	TX
S	EPA 8260	10184802	Bromodichloromethane	4395	TX
S	EPA 8260	10184802	Bromoform	4400	TX
S	EPA 8260	10184802	Carbon disulfide	4450	TX
S	EPA 8260	10184802	Carbon tetrachloride	4455	TX
S	EPA 8260	10184802	Chlorobenzene	4475	TX
S	EPA 8260	10184802	Chlorodibromomethane	4575	TX
S	EPA 8260	10184802	Chloroethane (Ethyl chloride)	4485	TX
S	EPA 8260	10184802	Chloroform	4505	TX
S	EPA 8260	10184802	Chloroprene (2-Chloro-1,3-butadiene)	4525	TX
S	EPA 8260	10184802	cis-1,2-Dichloroethylene	4645	TX
S	EPA 8260	10184802	cis-1,3-Dichloropropene	4680	TX
S	EPA 8260	10184802	Crotonaldehyde	4545	TX
S	EPA 8260	10184802	Dibromofluoromethane	4590	TX
S	EPA 8260	10184802	Dibromomethane (Methylene bromide)	4595	TX
S	EPA 8260	10184802	Dichlorodifluoromethane (Freon-12)	4625	TX
S	EPA 8260	10184802	Ethyl acetate	4755	TX
S	EPA 8260	10184802	Ethyl methacrylate	4810	TX
S	EPA 8260	10184802	Ethylbenzene	4765	TX
S	EPA 8260	10184802	Ethylene oxide	4795	TX
S	EPA 8260	10184802	Hexachlorobutadiene	4835	TX
S	EPA 8260	10184802	Iodomethane (Methyl iodide)	4870	TX

S	EPA 8260	10184802	Isobutyl alcohol (2-Methyl-1-propanol)	4875	TX
S	EPA 8260	10184802	Isopropyl alcohol (2-Propanol, Isopropanol)	4895	TX
S	EPA 8260	10184802	Isopropylbenzene	4900	TX
S	EPA 8260	10184802	m+p-xylene	5240	TX
S	EPA 8260	10184802	Methacrylonitrile	4925	TX
S	EPA 8260	10184802	Methyl bromide (Bromomethane)	4950	TX
S	EPA 8260	10184802	Methyl chloride (Chloromethane)	4960	TX
S	EPA 8260	10184802	Methyl methacrylate	4990	TX
S	EPA 8260	10184802	Methyl tert-butyl ether (MTBE)	5000	TX
S	EPA 8260	10184802	Methylene chloride (Dichloromethane)	4975	TX
S	EPA 8260	10184802	n-Butyl alcohol (1-Butanol, n-Butanol)	4425	TX
S	EPA 8260	10184802	n-Butylbenzene	4435	TX
S	EPA 8260	10184802	n-Propylbenzene	5090	TX
S	EPA 8260	10184802	Naphthalene	5005	TX
S	EPA 8260	10184802	o-Xylene	5250	TX
S	EPA 8260	10184802	Pentachloroethane	5035	TX
S	EPA 8260	10184802	Pentafluorobenzene	5040	TX
S	EPA 8260	10184802	Propionitrile (Ethyl cyanide)	5080	TX
S	EPA 8260	10184802	sec-Butylbenzene	4440	TX
S	EPA 8260	10184802	Styrene	5100	TX
S	EPA 8260	10184802	tert-Butyl alcohol (2-Methyl-2-Propanol)	4420	TX
S	EPA 8260	10184802	tert-Butylbenzene	4445	TX
S	EPA 8260	10184802	Tetrachloroethylene (Perchloroethylene)	5115	TX
S	EPA 8260	10184802	Toluene	5140	TX
S	EPA 8260	10184802	Total Xylene	5260	TX
S	EPA 8260	10184802	trans-1,2-Dichloroethylene	4700	TX
S	EPA 8260	10184802	trans-1,3-Dichloropropylene	4685	TX
S	EPA 8260	10184802	trans-1,4-Dichloro-2-butene	4605	TX
S	EPA 8260	10184802	Trichloroethene (Trichloroethylene)	5170	TX
S	EPA 8260	10184802	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175	TX
S	EPA 8260	10184802	Vinyl acetate	5225	TX
S	EPA 8260	10184802	Vinyl chloride (Chloroethene)	5235	TX
S	EPA 8270	10186002	1,2,4,5-Tetrachlorobenzene	6715	TX
S	EPA 8270	10186002	1,2,4-Trichlorobenzene	5155	TX
S	EPA 8270	10186002	1,2-Dichlorobenzene (o-Dichlorobenzene)	4610	TX

S	EPA 8270	10186002	1,2-Diphenylhydrazine	6220	TX
S	EPA 8270	10186002	1,3-Dichlorobenzene (m-Dichlorobenzene)	4615	TX
S	EPA 8270	10186002	1,3-Dinitrobenzene (1,3-DNB)	6160	TX
S	EPA 8270	10186002	1,4-Dichlorobenzene (p-Dichlorobenzene)	4620	TX
S	EPA 8270	10186002	1,4-Dinitrobenzene (1,4-DNB)	6165	TX
S	EPA 8270	10186002	1,4-Naphthoquinone	6420	TX
S	EPA 8270	10186002	1,4-Phenylenediamine	6630	TX
S	EPA 8270	10186002	1-Chloronaphthalene	5790	TX
S	EPA 8270	10186002	1-Naphthylamine	6425	TX
S	EPA 8270	10186002	2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	4659	TX
S	EPA 8270	10186002	2,3,4,6-Tetrachlorophenol	6735	TX
S	EPA 8270	10186002	2,4,5-Trichlorophenol	6835	TX
S	EPA 8270	10186002	2,4,6-Trichlorophenol	6840	TX
S	EPA 8270	10186002	2,4-Dichlorophenol	6000	TX
S	EPA 8270	10186002	2,4-Dimethylphenol	6130	TX
S	EPA 8270	10186002	2,4-Dinitrophenol	6175	TX
S	EPA 8270	10186002	2,4-Dinitrotoluene (2,4-DNT)	6185	TX
S	EPA 8270	10186002	2,6-Dichlorophenol	6005	TX
S	EPA 8270	10186002	2,6-Dinitrotoluene (2,6-DNT)	6190	TX
S	EPA 8270	10186002	2-Acetylaminofluorene	5515	TX
S	EPA 8270	10186002	2-Chloronaphthalene	5795	TX
S	EPA 8270	10186002	2-Chlorophenol	5800	TX
S	EPA 8270	10186002	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	6360	TX
S	EPA 8270	10186002	2-Methylaniline (o-Toluidine)	5145	TX
S	EPA 8270	10186002	2-Methylnaphthalene	6385	TX
S	EPA 8270	10186002	2-Methylphenol (o-Cresol)	6400	TX
S	EPA 8270	10186002	2-Naphthylamine	6430	TX
S	EPA 8270	10186002	2-Nitroaniline	6460	TX
S	EPA 8270	10186002	2-Nitrophenol	6490	TX
S	EPA 8270	10186002	2-Picoline (2-Methylpyridine)	5050	TX
S	EPA 8270	10186002	3,3'-Dichlorobenzidine	5945	TX
S	EPA 8270	10186002	3,3'-Dimethylbenzidine	6120	TX
S	EPA 8270	10186002	3-Methylcholanthrene	6355	TX
S	EPA 8270	10186002	3-Nitroaniline	6465	TX
S	EPA 8270	10186002	4,4'-Methylenebis(n, n-dimethyl)aniline	6370	TX
S	EPA 8270	10186002	4-Aminobiphenyl	5540	TX
S	EPA 8270	10186002	4-Bromophenyl phenyl ether (BDE-3)	5660	TX

S	EPA 8270	10186002	4-Chloro-3-methylphenol	5700	TX
S	EPA 8270	10186002	4-Chloroaniline	5745	TX
S	EPA 8270	10186002	4-Chlorophenyl phenylether	5825	TX
S	EPA 8270	10186002	4-Dimethyl aminoazobenzene	6105	TX
S	EPA 8270	10186002	4-Methylphenol (p-Cresol)	6410	TX
S	EPA 8270	10186002	4-Nitroaniline	6470	TX
S	EPA 8270	10186002	4-Nitrophenol	6500	TX
S	EPA 8270	10186002	5-Nitro-o-toluidine	6570	TX
S	EPA 8270	10186002	7,12-Dimethylbenz(a)anthracene	6115	TX
S	EPA 8270	10186002	a-a-Dimethylphenethylamine	6125	TX
S	EPA 8270	10186002	Acenaphthene	5500	TX
S	EPA 8270	10186002	Acenaphthylene	5505	TX
S	EPA 8270	10186002	Acetophenone	5510	TX
S	EPA 8270	10186002	Aniline	5545	TX
S	EPA 8270	10186002	Anthracene	5555	TX
S	EPA 8270	10186002	Aramite	5560	TX
S	EPA 8270	10186002	Benzidine	5595	TX
S	EPA 8270	10186002	Benzo(a)anthracene	5575	TX
S	EPA 8270	10186002	Benzo(a)pyrene	5580	TX
S	EPA 8270	10186002	Benzo(g,h,i)perylene	5590	TX
S	EPA 8270	10186002	Benzo(k)fluoranthene	5600	TX
S	EPA 8270	10186002	Benzoic acid	5610	TX
S	EPA 8270	10186002	Benzo[b]fluoranthene	5585	TX
S	EPA 8270	10186002	Benzyl alcohol	5630	TX
S	EPA 8270	10186002	bis(2-Chloroethoxy)methane	5760	TX
S	EPA 8270	10186002	bis(2-Chloroethyl) ether	5765	TX
S	EPA 8270	10186002	Butyl benzyl phthalate	5670	TX
S	EPA 8270	10186002	Carbazole	5680	TX
S	EPA 8270	10186002	Chlorobenzilate	7260	TX
S	EPA 8270	10186002	Chrysene	5855	TX
S	EPA 8270	10186002	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	6065	TX
S	EPA 8270	10186002	Di-n-butyl phthalate	5925	TX
S	EPA 8270	10186002	Di-n-octyl phthalate	6200	TX
S	EPA 8270	10186002	Diallate	7405	TX
S	EPA 8270	10186002	Dibenz(a, j) acridine	5900	TX
S	EPA 8270	10186002	Dibenz(a,h) anthracene	5895	TX
S	EPA 8270	10186002	Dibenzofuran	5905	TX
S	EPA 8270	10186002	Diethyl phthalate	6070	TX
S	EPA 8270	10186002	Dimethoate	7475	TX
S	EPA 8270	10186002	Dimethyl phthalate	6135	TX

S	EPA 8270	10186002	Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	8620	TX
S	EPA 8270	10186002	Diphenylamine	6205	TX
S	EPA 8270	10186002	Disulfoton	8625	TX
S	EPA 8270	10186002	Ethyl methanesulfonate	6260	TX
S	EPA 8270	10186002	Famphur	7580	TX
S	EPA 8270	10186002	Fluoranthene	6265	TX
S	EPA 8270	10186002	Fluorene	6270	TX
S	EPA 8270	10186002	Hexachlorobenzene	6275	TX
S	EPA 8270	10186002	Hexachlorobutadiene	4835	TX
S	EPA 8270	10186002	Hexachlorocyclopentadiene	6285	TX
S	EPA 8270	10186002	Hexachloroethane	4840	TX
S	EPA 8270	10186002	Hexachloropropene	6295	TX
S	EPA 8270	10186002	Hydroquinone	6310	TX
S	EPA 8270	10186002	Indeno(1,2,3-cd) pyrene	6315	TX
S	EPA 8270	10186002	Isodrin	7725	TX
S	EPA 8270	10186002	Isophorone	6320	TX
S	EPA 8270	10186002	Isosafrole	6325	TX
S	EPA 8270	10186002	Kepone	7740	TX
S	EPA 8270	10186002	Methapyrilene	6345	TX
S	EPA 8270	10186002	Methyl methanesulfonate	6375	TX
S	EPA 8270	10186002	Methyl parathion (Parathion, methyl)	7825	TX
S	EPA 8270	10186002	n-Nitroso-di-n-butylamine	5025	TX
S	EPA 8270	10186002	n-Nitrosodi-n-propylamine	6545	TX
S	EPA 8270	10186002	n-Nitrosodiethylamine	6525	TX
S	EPA 8270	10186002	n-Nitrosodimethylamine	6530	TX
S	EPA 8270	10186002	n-Nitrosodiphenylamine	6535	TX
S	EPA 8270	10186002	n-Nitrosomethylethylamine	6550	TX
S	EPA 8270	10186002	n-Nitrosomorpholine	6555	TX
S	EPA 8270	10186002	n-Nitrosopiperidine	6560	TX
S	EPA 8270	10186002	n-Nitrosopyrrolidine	6565	TX
S	EPA 8270	10186002	Naphthalene	5005	TX
S	EPA 8270	10186002	Nitrobenzene	5015	TX
S	EPA 8270	10186002	o,o,o-Triethyl phosphorothioate	8290	TX
S	EPA 8270	10186002	Parathion, ethyl	7955	TX
S	EPA 8270	10186002	Pentachlorobenzene	6590	TX
S	EPA 8270	10186002	Pentachloronitrobenzene	6600	TX
S	EPA 8270	10186002	Pentachlorophenol	6605	TX
S	EPA 8270	10186002	Phenacetin	6610	TX
S	EPA 8270	10186002	Phenanthrene	6615	TX

S	EPA 8270	10186002	Phenol	6625	TX
S	EPA 8270	10186002	Phorate	7985	TX
S	EPA 8270	10186002	Pronamide (Kerb)	6650	TX
S	EPA 8270	10186002	Pyrene	6665	TX
S	EPA 8270	10186002	Pyridine	5095	TX
S	EPA 8270	10186002	Safrole	6685	TX
S	EPA 8270	10186002	Sulfotep (Tetraethyl dithiopyrophospahte)	8155	TX
S	EPA 8270	10186002	Thionazin (Zinophos)	8235	TX
S	EPA 8315	10188008	Acetaldehyde	4300	TX
S	EPA 8315	10188008	Formaldehyde	4815	TX
S	EPA 9014	10193803	Amenable Cyanide	1510	TX
S	EPA 9014	10193803	Total Cyanide	1645	TX
S	EPA 9040	10196802	Corrosivity	1615	TX
S	EPA 9040	10196802	pH	1900	TX
S	EPA 9045	10198455	pH	1900	TX
S	EPA 9056	10199209	Bromide	1540	TX
S	EPA 9056	10199209	Chloride	1575	TX
S	EPA 9056	10199209	Fluoride	1730	TX
S	EPA 9056	10199209	Nitrate as N	1810	TX
S	EPA 9056	10199209	Nitrate plus Nitrite as N	1820	TX
S	EPA 9056	10199209	Nitrite as N	1840	TX
S	EPA 9056	10199209	Orthophosphate as P	1870	TX
S	EPA 9056	10199209	Sulfate	2000	TX
S	EPA 9060	10200201	Total Organic Carbon (TOC)	2040	TX
S	EPA 9065	10200405	Total Phenolics	1905	TX
S	EPA 9095	10204009	Paint Filter Test	1434	TX
S	SM 2540 G	20005203	Residue-total (TS)	1950	TX
S	TNRCC 1005	90019208	Total Petroleum Hydrocarbons (TPH)	2050	TX
S	Walkley-Black	60012002	Carbon, organic (Walkley-Black) *	10340	TX

DRAWING INDEX

SHEET NO.	DRAWING TITLE
1.1	DRAWING INDEX & REVISION STATUS
2.1	BLOCK DIAGRAM – UTILITY CONNECTIONS
4.1	DIMENSIONAL DIAGRAM – ANALYZER
6.1	ARRANGEMENT DIAGRAM – ELECTRONICS CONTROLLER (EC)
7.1	WIRING DIAGRAM – ANALYZER SYSTEM CONTROLLER (SYSCON)/POWER ENTRY CONTROL MODULE (PECM)
8.0	COLUMN DESCRIPTIONS AND FUNCTIONS
8.1	PLUMBING DIAGRAM – OVEN (LEFT DPM)
8.3	PLUMBING DIAGRAM – OVEN (RIGHT DPM)
8.4	PLUMBING DIAGRAM – SVCM, PRESSURE & FLOW CONTROL
9.1	STREAM COMPOSITION DATA
9.5	CUSTOM MAXBASIC PROGRAMS
10.1	SPARE PARTS LIST

REVISION STATUS

REV LEVEL	DATE	SHEET NO.	REASON
0	14 OCT 20	ALL	FIRST ISSUE
1	23 NOV 20	ALL	ISSUED FOR CONSTRUCTION
2	3 MAY 21	1.1 2.1 8.0 8.1 8.3 9.1 10.1	AS BUILT

⚠ **WARNING**

AN OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, OR STATEMENT, WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY OR DEATH. REFER TO MAXUM EDITION II GAS CHROMATOGRAPHY ONLINE LIBRARY 2000597-001.

SII PROJECT NO. 3008639334
TAG 1-AIT-9575
EXTRA TAG
USER SMITH ANALYTICAL LLC
PURCHASER SMITH ANALYTICAL LLC
P.O. NO. 2161
LOCATION ALVIN, TX
DESIGN CHAU DATE 10/14/20
DRAWN OSPINA 10/14/20
CHECKED CHAU 10/14/20
APPROVED CHAU 10/14/20

Siemens Industry, Inc.

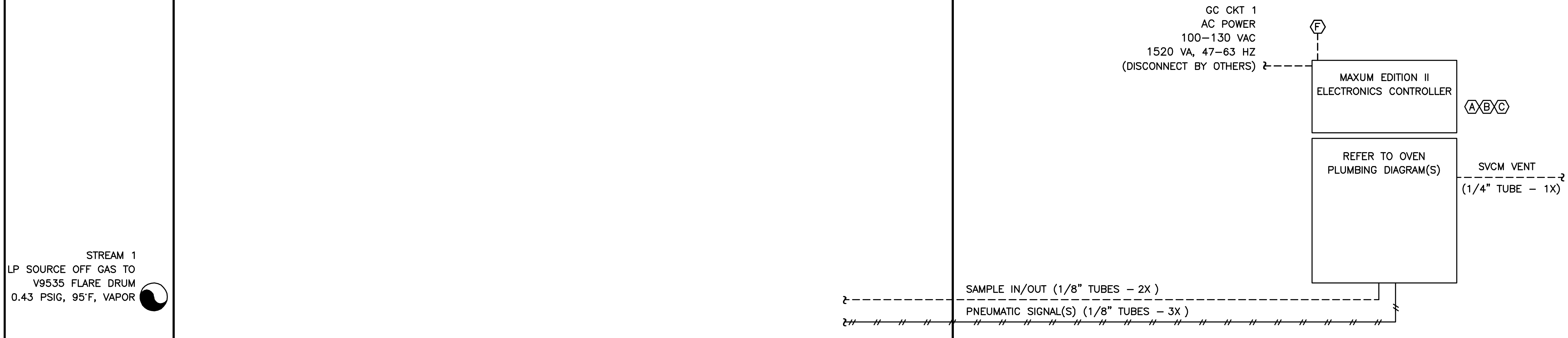
TITLE DRAWING INDEX & REVISION STATUS

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	1.1	2	1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. △ REFER TO EQUIPMENT LABELING FOR SPECIFIC REGULATOR AND CONNECTION LOCATIONS.
2. CARRIER, FUEL AND MAKE UP GAS AS REQUIRED SHALL BE SUPPLIED BY OTHERS.
3. CALIBRATION BLEND(S) WITH CGA FITTINGS AND/OR REGULATORS AS REQUIRED BY OTHERS.
   - 3.1 CONSTANT HEAD PRESSURE MUST BE MAINTAINED USING A SEPARATE NON-INTERFERING GAS ON LIQUID CALIBRATION BLENDS.
   - 3.2 VAPOR CALIBRATION BLEND(S) MUST BE KEPT ABOVE THE DEWPOINT TEMPERATURE.
4. CABLE SPECIFICATION: (SEE SHEET 7.1 FOR SPECIFIC REQUIREMENTS)
   - 4.1 ANALYZER POWER: TWO 12AWG WITH GROUND PER POWER CIRCUIT
   - 4.2 DATA HIGHWAY: DUAL 22AWG TWISTED PAIR W/SHIELD, LOW CAPACITANCE, 150 OHM MIN (1681000-003) COLOR CODE: CHA (+) = WHITE, CHA (-) = BLACK, CHB (+) = RED, CHB (-) = GREEN
   - 4.3 ETHERNET: EIT/TIA 568A, CAT 6 UTP (1681003-006)
   - 4.4 FIBER OPTIC CABLE: MULTI MODE 62.5/125 MICRON, 2 FIBERS IN 0.175 OD PVC JACKET (1270002-002)
5. MAXIMUM INLET PRESSURE/FLOW OF FLAMMABLE GASES, IF REQUIRED, TO EPC MODULES SHALL NOT EXCEED 700 KPA [102 PSIG]/440 CM3/MIN.
6. WARNING: AN OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, OR STATEMENT, WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY OR DEATH. REFER TO MAXUM EDITION II GAS CHROMATOGRAPHY ONLINE LIBRARY 2000597-001.
7. LINE LEGEND: —//— PNEUMATIC SIGNAL, – – – FIELD CONNECTION, —— FACTORY CONNECTION

SAMPLE TAP (BY OTHERS)	SAMPLE SYSTEM (BY OTHERS)	DESIGNED FOR AREA CLASSIFICATION: CLASS I, DIV. 2, GROUPS B,C,D – T3 (200°C) BUILT TO MEET: NRTL, CSA REQUIREMENTS



CONNECTION LEGEND ANALYZER △

SYMBOL	SERVICE DESCRIPTION	CONNECTION
A	AIR, CLEAN & DRY, 4.2 KG/CM2 [60 PSIG] MIN, 17KG/CM2 [240 PSIG] MAX, AT 140 L/MIN [5 SCF/MIN], NONFLAMMABLE	1/4" F-NPT
B	VALVE GAS, 6.7 KG/CM2 [95 PSIG] MIN, 17KG/CM2 [240 PSIG] MAX, AT 20 L/DAY [20 SCF/MONTH], NONFLAMMABLE	1/4" BULKHEAD
C	CARRIER AND/OR FID/FPD FUEL, HYDROGEN, 6KG/CM2 [85 PSIG] MIN, 7KG/CM2 [100 PSIG] MAX, AT 225 L/DAY [240 SCF/MONTH] 99.999% PURE (SEE NOTE 5)	(2X) 1/4" BULKHEAD
F	COMMUNICATION PORT AND/OR DISCRETE I/O SIGNALS	CONDUIT AS REQUIRED

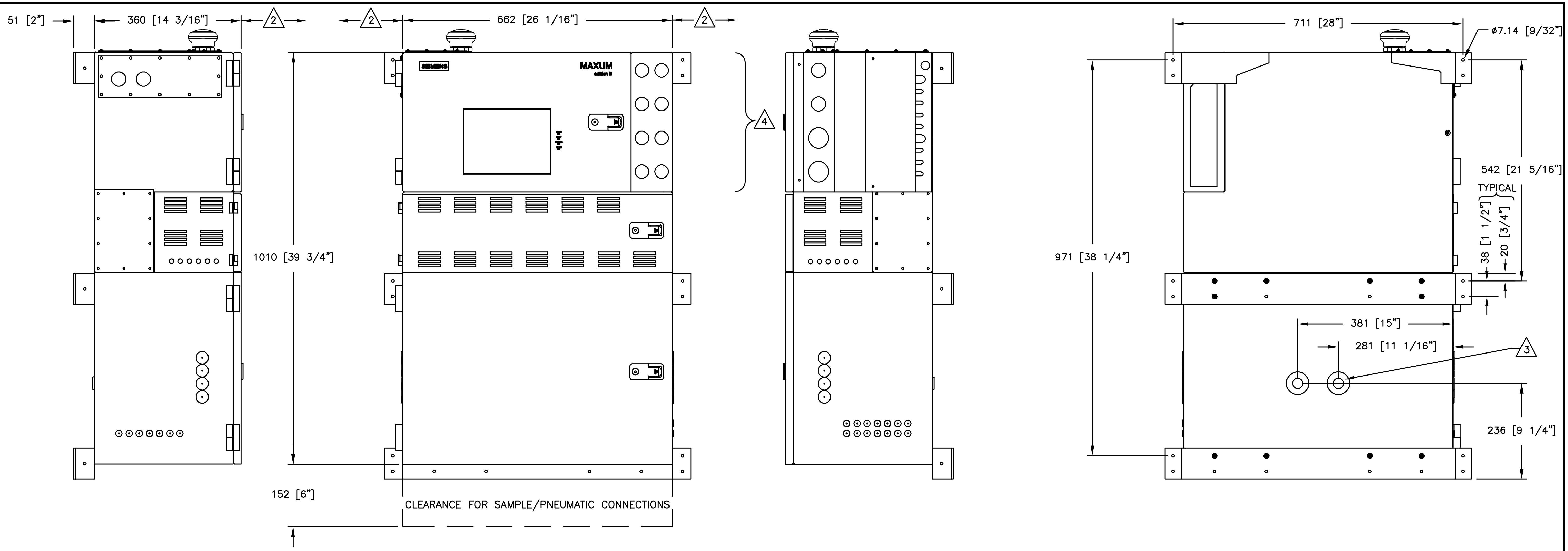
SII PROJECT NO. 3008639334
TAG 1-AIT-9575
EXTRA TAG
USER SMITH ANALYTICAL LLC
PURCHASER SMITH ANALYTICAL LLC
P.O. NO. 2161
LOCATION ALVIN, TX

		DATE
DESIGN	CHAU	10/14/20
DRAWN	OSPINA	10/14/20
CHECKED	CHAU	10/14/20
APPROVED	CHAU	10/14/20

Siemens Industry, Inc.

TITLE
BLOCK DIAGRAM
UTILITY CONNECTIONS

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	2.1	2	1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE SHOWN AS MILLIMETERS [INCHES].

△2 RECOMMENDED CLEARANCE:
LEFT SIDE – 460 [18"]
RIGHT SIDE – 460 [18"]
FRONT SIDE – 654 [25 3/4"]
CENTER TO CENTER – 1120 [44"]

△3 LEFT EXHAUST FOR SINGLE OVEN APPLICATIONS (1" NIPPLE)
LEFT AND RIGHT EXHAUST FOR SPLIT OVEN APPLICATIONS (1" NIPPLE)

△4 REGULATOR AND UTILITY CONNECTIONS.
SEE SHEET 2.1.

SII PROJECT NO. 3008639334
TAG 1–AIT–9575
EXTRA TAG
USER SMITH ANALYTICAL LLC
PURCHASER SMITH ANALYTICAL LLC
P.O. NO. 2161
LOCATION ALVIN, TX

DESIGN	CHAU	10/14/20
DRAWN	OSPINA	10/14/20
CHECKED	CHAU	10/14/20
APPROVED	CHAU	10/14/20

Siemens Industry, Inc.

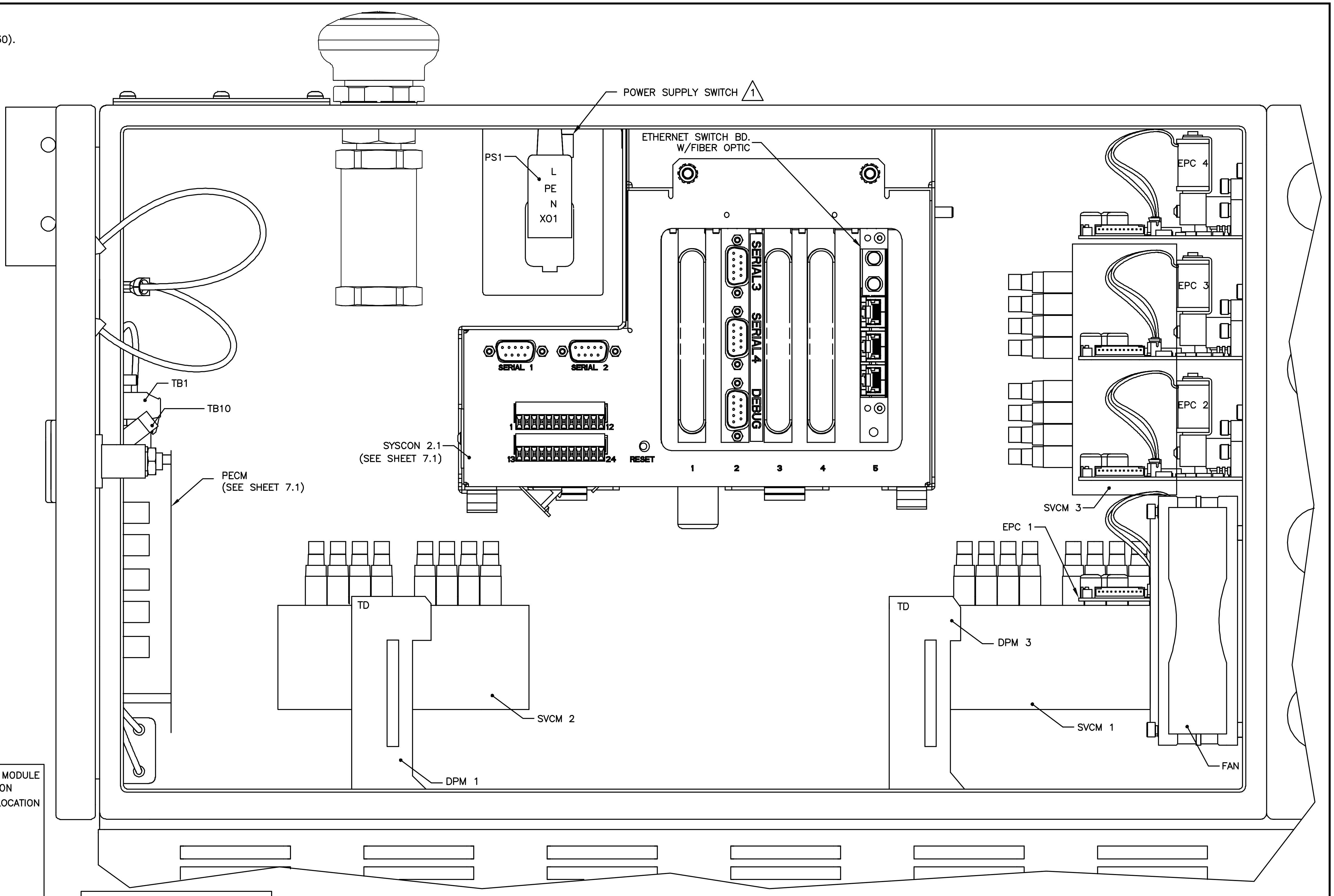
TITLE
DIMENSIONAL DIAGRAM
ANALYZER

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	4.1	0	1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

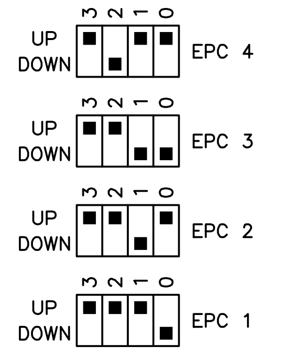
1. SET TO PRIMARY AC POWER INPUT VOLTAGE (115/230). SEE SHEET 2.1 FOR CORRECT OPERATING VOLTAGE.
2. NOMENCLATURE:

ACRONYM	DEFINITION
APU	AUTOMATIC PURGE UNIT
CAC	COMMUNICATION AND CONTROL
CAN	CONTROL AREA NETWORK
CIM	CONTROLLER INTERFACE MODULE
DPM	DETECTOR PERSONALITY MODULE
EC	ELECTRONIC CONTROLLER
EPC	ELECTRONIC PRESSURE CONTROL
FD	FILAMENT DETECTOR
FID	FLAME IONIZATION DETECTOR
FPD	FLAME PHOTOMETRIC DETECTOR
LWH	LOW WATTAGE HEATER
MWH	MEDIUM WATTAGE HEATER
MMI	MAN-MACHINE INTERFACE
PCBA	PRINTED CIRCUIT BOARD ASSEMBLY
PECM	POWER ENTRY CONTROL MODULE
PMT	PHOTO MULTIPLIER TUBE
PS	POWER SUPPLY
SIB	SYSCON INTERFACE BOARD
SNE	SENSOR NEAR ELECTRONICS
SNECON	SNE CONTROLLER
SVCM	SOLENOID VALVE CONTROL MODULE
SYSCON	SYSTEM CONTROLLER
TC	TEMPERATURE CONTROLLER
TD	THERMISTOR DETECTOR



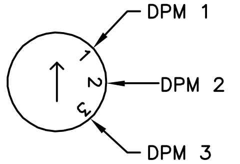
ELECTRONICS CONTROLLER
(DOOR ROTATED OPEN FOR CLARITY)

EPC BOARD SETTINGS PER LOCATION.



DETECTOR PERSONALITY MODULE (DPM) IDENTIFICATION

SET SWITCH PER DPM LOCATION



HEATER NAME	TC POSITION	HEATER CHANNEL	CONTROLLER	RESISTOR VALUE
ROVEN	PECM	2	OVEN HTR 2	16.9KOHM
UNASSIGNED	PECM	1	OVEN HTR 1	12.4KOHM
–	RIGHT DPM	2	–	–
–	RIGHT DPM	1	–	–
–	CENTER DPM	2	–	–
–	CENTER DPM	1	–	–
–	LEFT DPM	2	–	–
–	LEFT DPM	1	–	–

DATA ENTRY

LAN 1 SETTINGS
LID:
IP ADDRESS:
ROUTER:
SUBNETMASK:

LAN 2 SETTINGS
IP ADDRESS:
ROUTER:
SUBNETMASK:

SOFTWARE VERSION: 5.3
SOFTWARE REVISION: 16

SII PROJECT NO.	TAG	EXTRA TAG		
3008639334	1-AIT-9575			
USER		DESIGN	DATE	
SMITH ANALYTICAL LLC		CHAU	10/14/20	
PURCHASER		DRAWN		
SMITH ANALYTICAL LLC		OSPINA	10/14/20	
P.O. NO.		CHECKED		
2161		CHAU	10/14/20	
LOCATION		APPROVED		
ALVIN, TX		CHAU	10/14/20	

Siemens Industry, Inc.

TITLE
ARRANGEMENT DIAGRAM
ELECTRONICS CONTROLLER (EC)

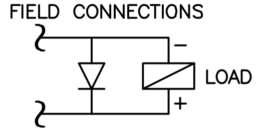
SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	6.1	0	1 OF 1

NOTE: UNLESS OTHERWISE SPECIFIED

⚠1 I/O OPTIONS

1.1 DIGITAL INPUTS: OPTOCOUPLER WITH INTERNAL 24 VDC POWER SUPPLY, SWITCHABLE WITH FLOATING CONTACTS.

1.2 DIGITAL OUTPUTS: FLOATING DOUBLE-THROW CONTACTS, MAXIMUM RESISTIVE CONTACT LOAD RATING IS 1 A AT 30 VDC. WHEN USING AN INDUCTIVE LOAD, INSTALL AN ARC SUPRESSING DIODE AS CLOSE AS POSSIBLE TO THE LOAD. A RECTIFING DIODE SUCH AS IN4005, SII PART NUMBER D34005, IS SUITABLE FOR THIS PURPOSE. A TYPICAL INSTALLATION IS SHOWN BELOW.



1.3 ANALOG INPUTS: -20 TO +20 MA INTO 50 OHMS OR -10 TO +10 VR =1 M OHM, MUTUALLY ISOLATED TO 10 V.

1.4 ANALOG OUTPUTS: 4-20 MA INTO 750 OHMS MAXIMUM, COMMON NEGATIVE POLE, GALVANICALLY SEPARATED FROM GROUND, FREELY CONNECTABLE TO GROUND.

NOTES CONTINUED

⚠2 POWER OPTIONS

2.1 ENSURE POWER SWITCH IS IN CORRECT POSITION (SEE SHEET 6.1).

2.2 ENSURE GROUND WIRE IS CONNECTED TO GROUND LUG BEFORE CONNECTING TO TB1, TB2, OR TB10.

2.3 TO ISOLATE THE ELECTRONICS POWER FROM THE HEATER POWER, REMOVE THE JUMPERS BETWEEN TB1 AND TB10 AND CONNECT A SEPARATE CIRCUIT TO TB10.

3. FUSE VALUES AND LOCATIONS:

FUSE LOCATION	OPERATING VOLTAGE	
	115 VAC	230 VAC
OVEN HTR 1 PECM	16A	10A
OVEN HTR 2 PECM	16A	10A
FILT AC PECM	3.15A	3.15A
LWH 1-5 PECM	10A	10A
MWH/LWH6 PECM	6.3A	6.3A
POWER SUPPLY	4A	4A

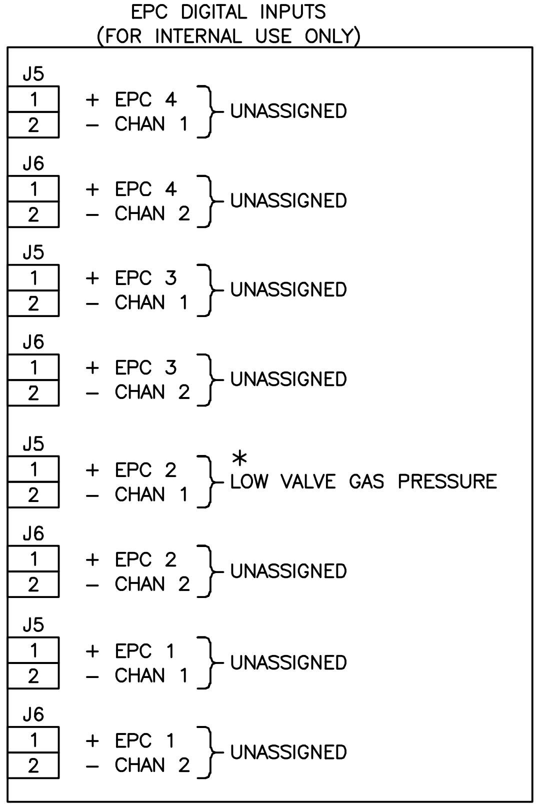
NOTES CONTINUED

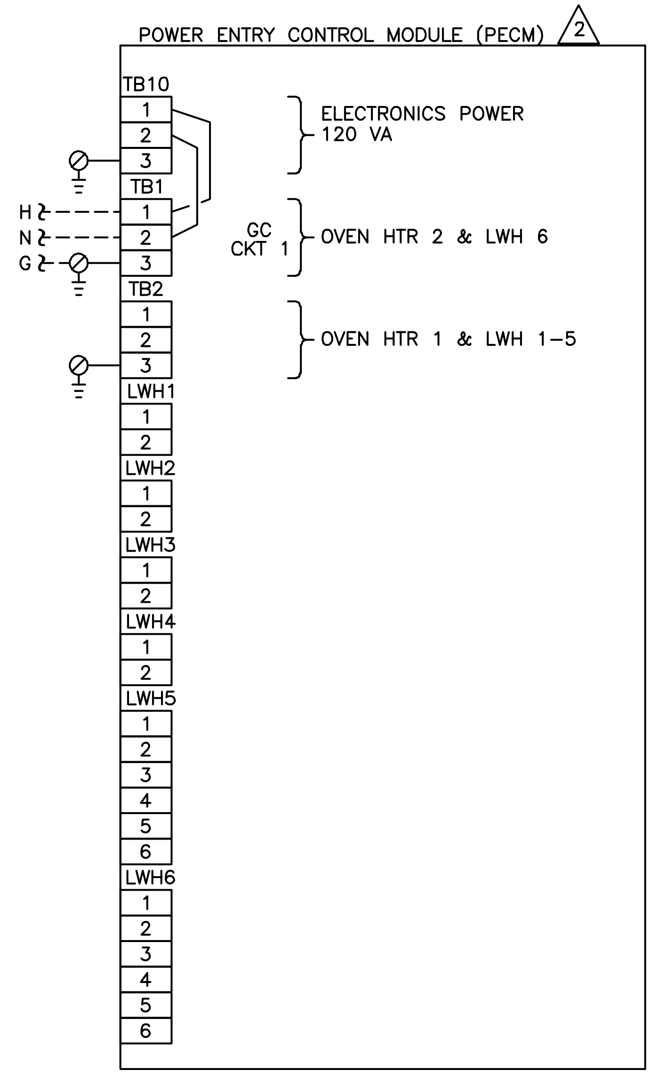
⚠4 RS-485 SERIAL CONNECTOR, DB-9 MALE.

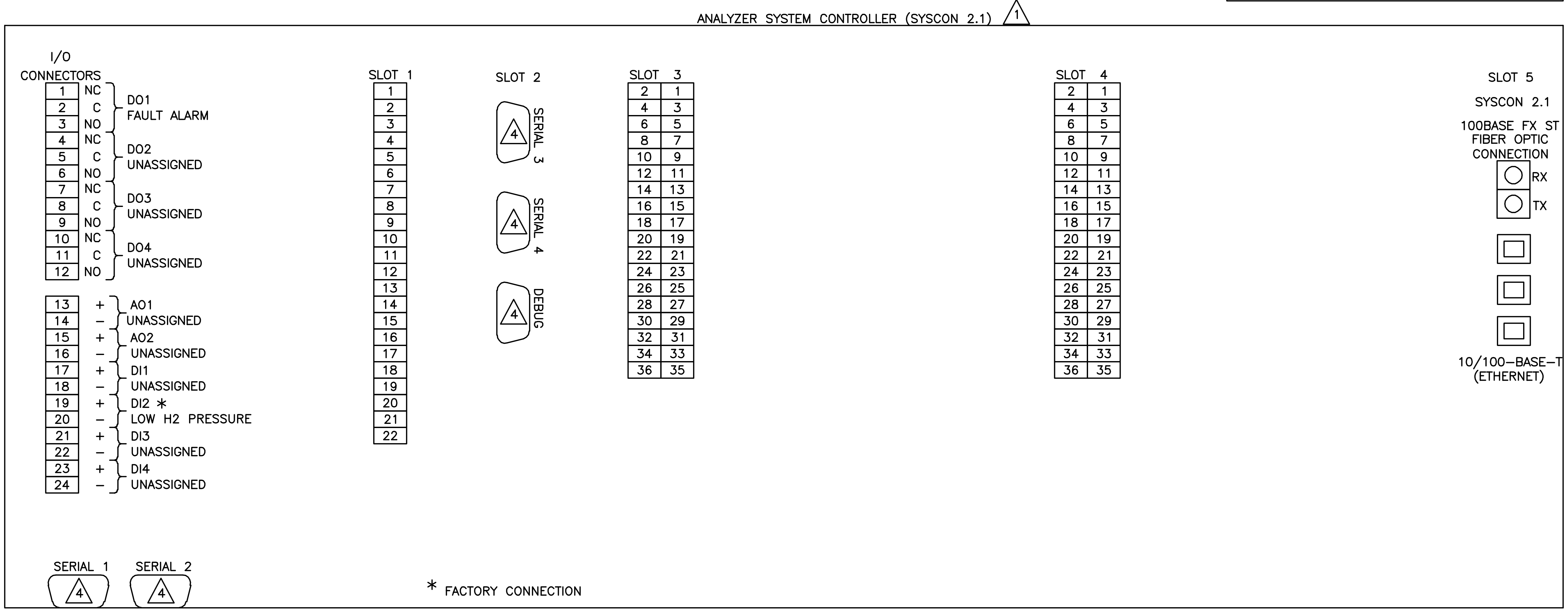
PIN 2	5 V PWR
PIN 3	RS485 A (+)
PIN 5	COMMON
PIN 8	RS485 B (-)

RS-232 SERIAL CONNECTOR, DB-9 MALE.

PIN 1	DCD
PIN 2	RxD
PIN 3	TxD
PIN 4	DTR
PIN 5	GND
PIN 6	DSR
PIN 7	RTS
PIN 8	CTS
PIN 9	RI







SII PROJECT NO.	TAG	EXTRA TAG		Siemens Industry, Inc.
3008639334	1-AIT-9575			
USER		DESIGN	DATE	TITLE
SMITH ANALYTICAL LLC		CHAU	10/14/20	WIRING DIAGRAM - ANALYZER SYSTEM CONTROLLER (SYSCON 2.1) & POWER ENTRY CONTROL MODULE (PECM)
PURCHASER		DRAWN		
SMITH ANALYTICAL LLC		OSPINA	10/14/20	
P.O. NO.		CHECKED		
2161		CHAU	10/14/20	
LOCATION		APPROVED		
ALVIN, TX		CHAU	10/14/20	

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	7.1	0	1 OF 1

COLUMN DESCRIPTIONS AND FUNCTIONS:

COL #	LENGTH	TUBING TYPE	COLUMN DESCRIPTION	FUNCTION OF COLUMN	MLFB
R1-1	0.5M	1/16IN SULFINERT	HAYESEP N 100/120	HOLDS HEAVIER THEN PROPAN AND WATER FOR BF	7KQ2908-1BB10-0AA0-z +A19
R1-2	0.5M	1/16IN SULFINERT	HAYESEP N 100/120	SEPARATES WATER AND PROPAN FROM ETHANE AND LIGHTER	7KQ2908-1BB10-0AA0-z +A19
R1-3	2M	1/16IN SULFINERT	HAYESEP N 100/120	SEPARATES OXYGEN/NITROGEN FROM METHANE, CARBONDIOXIDE AND ETHANE	7KQ2908-1GB10-0AA0-z +A19
R1-4	2M	1/16IN 316 SS	5A MOLE SIEVE 80/100	SEPARATES OXYGEN AND NITROGEN	7KQ2908-1GA10-0AA0-z +A24

NOTE

This unit uses Mole Sieve column(s). Mole Sieve columns are susceptible to moisture, carbon dioxide and hydrocarbons heavier than methane.

Indications of contamination are gradual loss of peak retention and separation. It is recommended that the carrier manifold for this unit utilize a suitable carrier gas purifier.

Sources of contamination:

* Wet carrier

* Improper setting of backflush timing (set too late)

* Carrier leak

Contaminated columns can easily be reconditioned by baking them out under the conditions located on the back of the column tag.

(**Reconditioning should be carried out in a suitable laboratory oven**)

SII PROJECT NO. 3008639334
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LOCATION ALVIN, TX
DESIGN CHAU DATE 4/8/2021
DRAWN OSPINA 4/8/2021
CHECKED CHAU 4/8/2021
APPROVED CHAU 4/8/2021

Siemens Industry, Inc.

TITLE
COLUMN DESCRIPTIONS
AND FUNCTIONS

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	8.0	2	1 of 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. DEACTUATED FLOW PATHS ARE SHOWN BY SOLID LINES.

2. TO PREVENT COLUMN DAMAGE ALWAYS MAINTAIN CARRIER FLOW DURING ANALYZER STARTUP AND OPERATION.

△3 SPECIFIED FLOWS AND PRESSURES MAY NEED TO BE FIELD ADJUSTED.
FLOW = CM3/M
PRESSURE = PSIG

4. SEE SHEET 8.4 FOR UTILITY GAS PRESSURE/FLOW CONTROL AND SOLENOID PNEUMATIC SIGNAL ASSIGNMENTS.

5. ABBREVIATION CODES:

5.1 RESTRICTORS – RC–20–40
20 = PRESS AT STANDARD TEST (NITROGEN AT 23°C)
40 = FLOW RATE (CM3/M)

5.2 VALVES – SR1–1
S = SAMPLE/COLUMN (S,C)
R = LEFT, CENTER OR RIGHT (L,C,R)
1 = NUMBER SEQUENCE
1 = VALVE NUMBER WITHIN TRAIN

5.3 DETECTORS – RR1_X
R = LEFT, CENTER OR RIGHT (L,C,R)
R = LEFT/RIGHT (L,R) (TD ONLY)
1 = NUMBER SEQUENCE (TD OR 4 CELL FD ONLY)
X = TD, FD, FID, FPD, HID, ECD & ELCD

5.4 CARRIER LABELS – (R1–1)
R = LEFT, CENTER OR RIGHT (L,C,R)
1 = ANALYTICAL TRAIN NUMBER
1 = CARRIER NUMBER WITHIN TRAIN

NOTES: CONTINUED

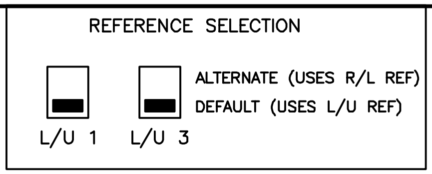
5.5 EPC TO VALVE CONNECTIONS – (X–Y–Z)
X = CARRIER TYPE (HE, H2, N2, AR)
Y = EPC MODULE NUMBER (1, 2, 3 OR 4)
Z = EPC CHANNEL NUMBER (1 OR 2)

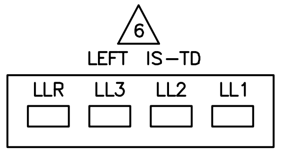
5.6 COLUMN LABELS – (R1–1)
R = LEFT, CENTER OR RIGHT (L,C,R)
1 = ANALYTICAL TRAIN NUMBER
1 = COLUMN NUMBER WITHIN TRAIN

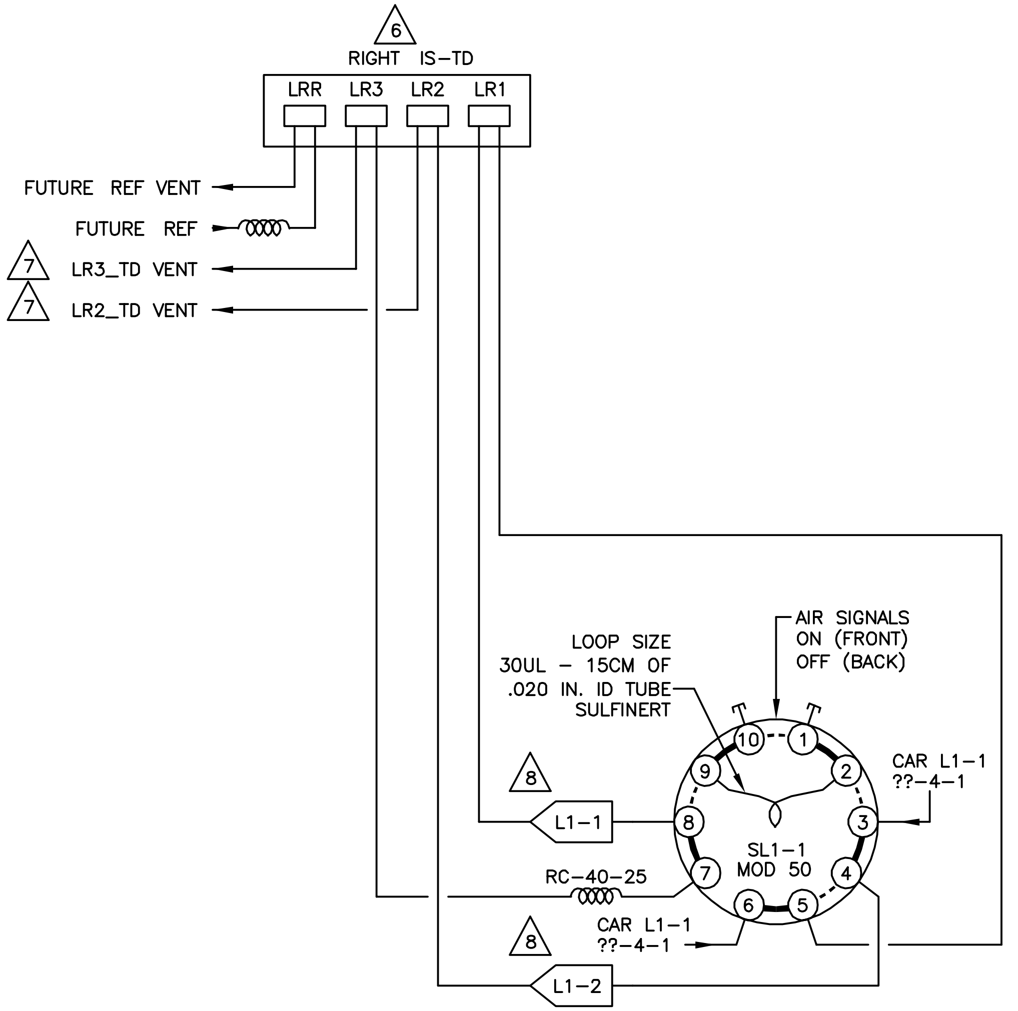
△6 REFER TO DETECTOR LABELS FOR ACTUAL PORT LOCATIONS.

△7 THE FOLLOWING VENTS ARE TO BE CONVERTED FROM 1/16" TUBING TO 1/8" TUBING AT THE OVEN WALL USING A 1/16" X 1/8" REDUCING UNION. THE 1/8" VENTS ARE TO HAVE A DOWNWARD SLOPE.

△8 COLUMN SUPPLIED AND INSTALLED BY OTHERS.







FLOW SETUP PROCEDURE △3

VENT	ORDER	VALVE OPERATION	ADJUSTMENT	FLOW
FUTURE	NA	NONE	FIXED RESTRICTOR (1–20)	N/A

FLOW SETUP PROCEDURE CONTINUED

VENT	ORDER	VALVE OPERATION	ADJUSTMENT	FLOW

SII PROJECT NO. 3008639334	TAG 1–AIT–9575	EXTRA TAG	
USER SMITH ANALYTICAL LLC		DESIGN CHAU	DATE 10/14/20
PURCHASER SMITH ANALYTICAL LLC		DRAWN OSPINA	10/14/20
P.O. NO. 2161		CHECKED CHAU	10/14/20
LOCATION ALVIN, TX		APPROVED CHAU	10/14/20

Siemens Industry, Inc.

M11000EL

TITLE
PLUMBING DIAGRAM, OVEN (LEFT DPM)
BACKFLUSH TO VENT

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	8.1	2	1 OF 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. DEACTUATED FLOW PATHS ARE SHOWN BY SOLID LINES.

2. TO PREVENT COLUMN DAMAGE ALWAYS MAINTAIN CARRIER FLOW DURING ANALYZER STARTUP AND OPERATION.

3. SPECIFIED FLOWS AND PRESSURES MAY NEED TO BE FIELD ADJUSTED.
FLOW = CM3/M
PRESSURE = PSIG

4. SEE SHEET 8.4 FOR UTILITY GAS PRESSURE/FLOW CONTROL AND SOLENOID PNEUMATIC SIGNAL ASSIGNMENTS.

5. ABBREVIATION CODES:
   - 5.1 RESTRICTORS – RC–20–40
     - 20 = PRESS AT STANDARD TEST (NITROGEN AT 23°C)
     - 40 = FLOW RATE (CM3/M)
   - 5.2 VALVES – SR1–1
     - S = SAMPLE/COLUMN (S,C)
     - R = LEFT, CENTER OR RIGHT (L,C,R)
     - 1 = NUMBER SEQUENCE
     - 1 = VALVE NUMBER WITHIN TRAIN
   - 5.3 DETECTORS – RR1_X
     - R = LEFT, CENTER OR RIGHT (L,C,R)
     - R = LEFT/RIGHT (L,R) (TD ONLY)
     - 1 = NUMBER SEQUENCE (TD OR 4 CELL FD ONLY)
     - X = TD, FD, FID, FPD, HID, ECD & ELCD
   - 5.4 CARRIER LABELS – (R1–1)
     - R = LEFT, CENTER OR RIGHT (L,C,R)
     - 1 = ANALYTICAL TRAIN NUMBER
     - 1 = CARRIER NUMBER WITHIN TRAIN

NOTES: CONTINUED

   - 5.5 EPC TO VALVE CONNECTIONS – (X–Y–Z)
     - X = CARRIER TYPE (HE, H2, N2, AR)
     - Y = EPC MODULE NUMBER (1, 2, 3 OR 4)
     - Z = EPC CHANNEL NUMBER (1 OR 2)
   - 5.6 COLUMN LABELS – (R1–1)
     - R = LEFT, CENTER OR RIGHT (L,C,R)
     - 1 = ANALYTICAL TRAIN NUMBER
     - 1 = COLUMN NUMBER WITHIN TRAIN

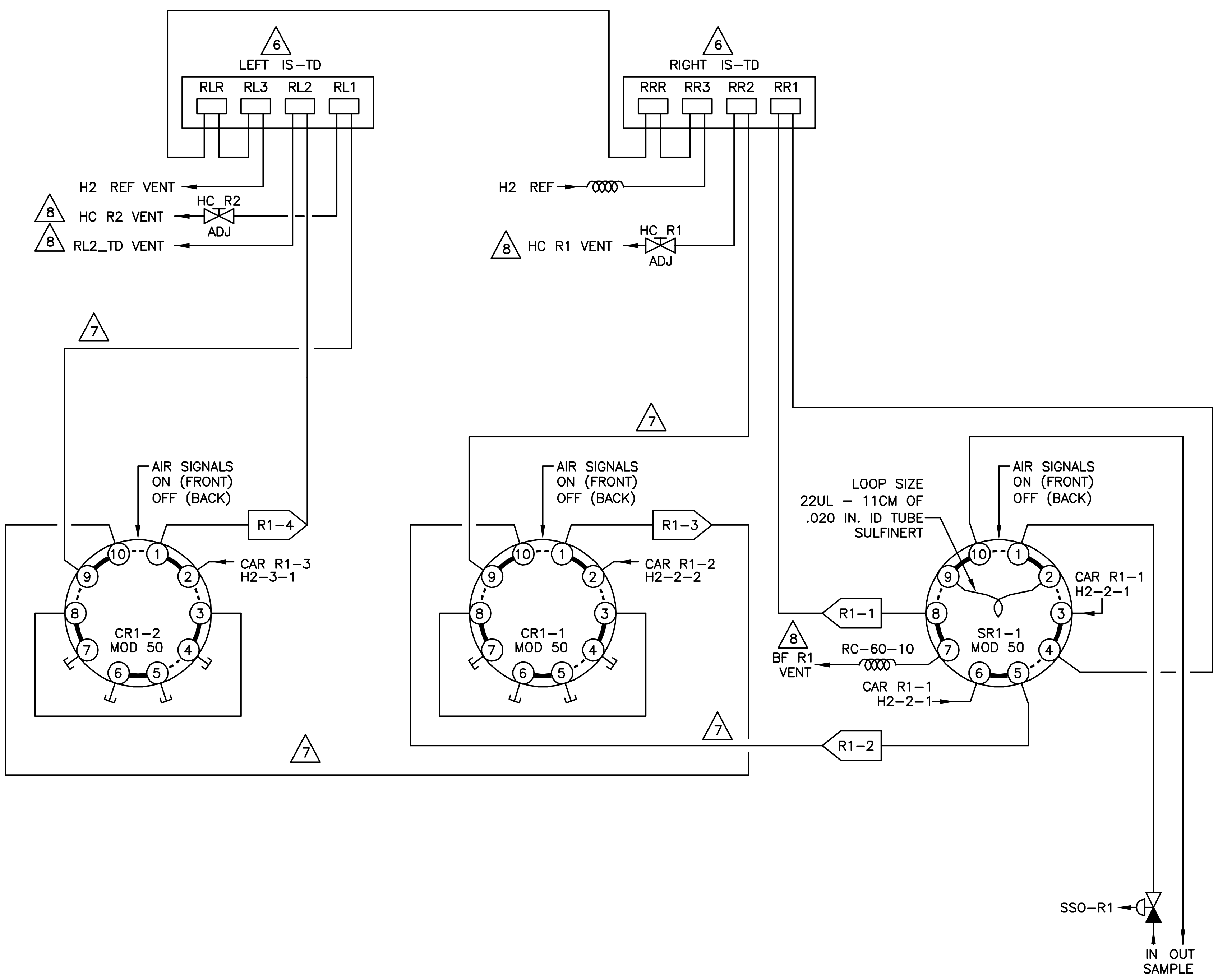
6. REFER TO DETECTOR LABELS FOR ACTUAL PORT LOCATIONS.

7. MAKE TUBING RUN WITH MINIMUM TUBE LENGTH AND BENDS.

8. THE FOLLOWING VENTS ARE TO BE CONVERTED FROM 1/16" TUBING TO 1/8" TUBING AT THE OVEN WALL USING A 1/16" X 1/8" REDUCING UNION. THE 1/8" VENTS ARE TO HAVE A DOWNWARD SLOPE.

REFERENCE SELECTION

L/U 1	L/U 3	
☐	☐	ALTERNATE (USES R/L REF)
■	■	DEFAULT (USES L/U REF)



OVEN TEMPERATURE
105°C/221°F

FLOW SETUP PROCEDURE 3				
VENT	ORDER	VALVE OPERATION	ADJUSTMENT	FLOW
H2 REF	NA	NONE	FIXED RESTRICTOR (1–20)	6.6
BF R1	7	$\overline{\text{SR1–1}}$ CR1–1	FIXED (TYPICAL 1–2X FWD FLOW)	9.1
RL2_TD	1	SR1–1 CR1–1 CR1–2	CAR R1–1 (P1 PRESS = 40.6)	9
	2	$\overline{\text{SR1–1}}$ CR1–1 CR1–2	CAR R1–1 (P2 PRESS = 38.6)	9
	3	$\overline{\text{SR1–1}}$ $\overline{\text{CR1–1}}$ CR1–2	CAR R1–2 (P1 PRESS = 36.4)	9
HC R1	4	$\overline{\text{SR1–1}}$ $\overline{\text{CR1–1}}$ CR1–2	HC R1 ADJ	9

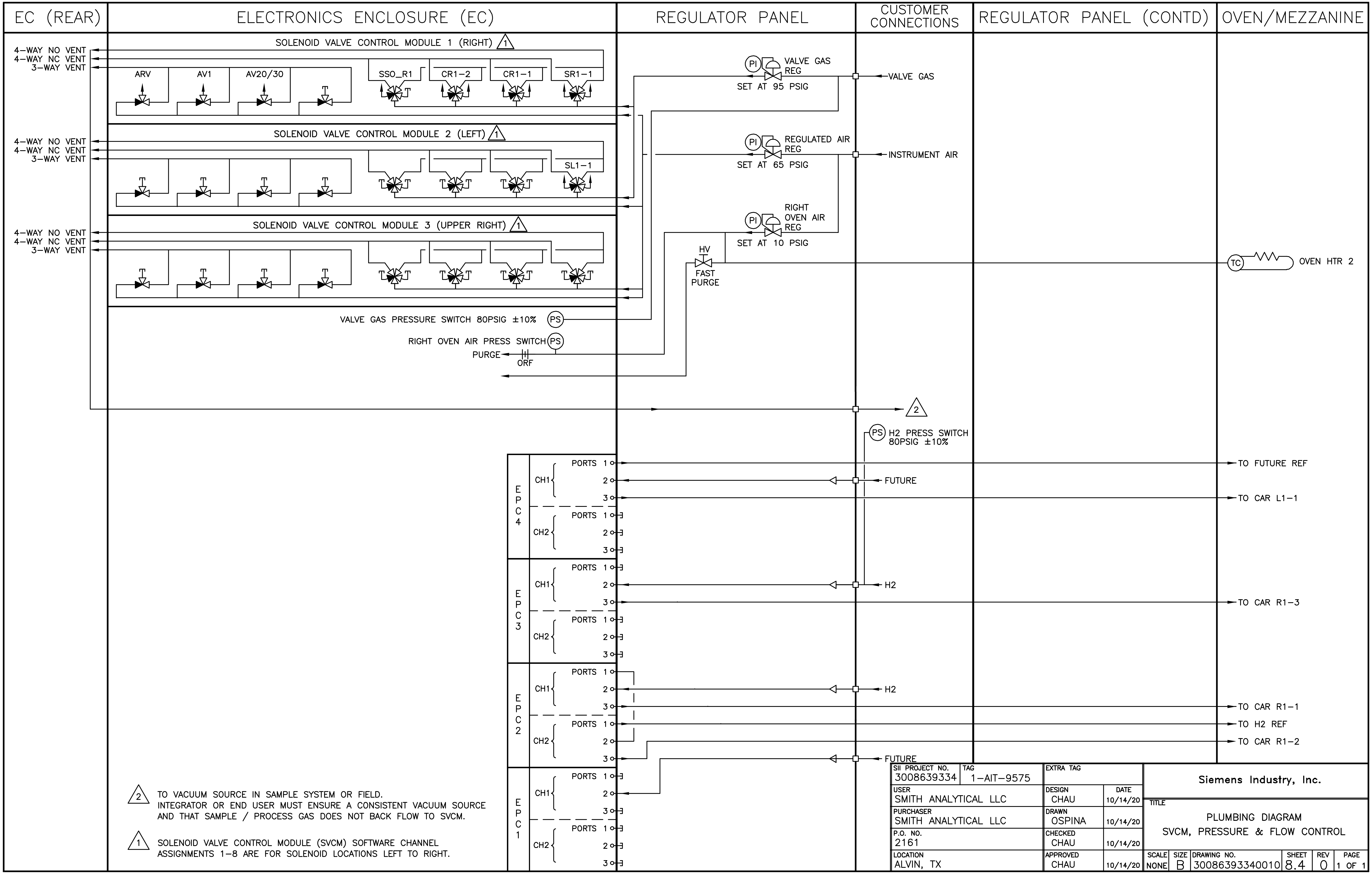
FLOW SETUP PROCEDURE CONTINUED				
VENT	ORDER	VALVE OPERATION	ADJUSTMENT	FLOW
RL2_TD	5	$\overline{\text{SR1–1 CR1–1 CR1–2}}$	CAR R1–3 (P1 PRESS = 19.3)	9
HC R2	6	$\overline{\text{SR1–1 CR1–1 CR1–2}}$	HC R2 ADJ	9

SII PROJECT NO. 3008639334	TAG 1–AIT–9575	EXTRA TAG	
USER SMITH ANALYTICAL LLC		DESIGN CHAU	DATE 10/14/20
PURCHASER SMITH ANALYTICAL LLC		DRAWN OSPINA	10/14/20
P.O. NO. 2161		CHECKED CHAU	10/14/20
LOCATION ALVIN, TX		APPROVED CHAU	10/14/20

Siemens Industry, Inc.
M41007ER

TITLE
PLUMBING DIAGRAM, OVEN (RIGHT DPM)
DUAL DUAL SENSE HEARTCUT,
BACKFLUSH TO VENT W/COM REF

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	8.3	2	1 OF 1



△2 TO VACUUM SOURCE IN SAMPLE SYSTEM OR FIELD. INTEGRATOR OR END USER MUST ENSURE A CONSISTENT VACUUM SOURCE AND THAT SAMPLE / PROCESS GAS DOES NOT BACK FLOW TO SVCM.

△1 SOLENOID VALVE CONTROL MODULE (SVCM) SOFTWARE CHANNEL ASSIGNMENTS 1-8 ARE FOR SOLENOID LOCATIONS LEFT TO RIGHT.

SII PROJECT NO.	TAG	EXTRA TAG	
3008639334	1-AIT-9575		
USER		DESIGN	DATE
SMITH ANALYTICAL LLC		CHAU	10/14/20
PURCHASER		DRAWN	
SMITH ANALYTICAL LLC		OSPINA	10/14/20
P.O. NO.		CHECKED	
2161		CHAU	10/14/20
LOCATION		APPROVED	
ALVIN, TX		CHAU	10/14/20

Siemens Industry, Inc.

TITLE
PLUMBING DIAGRAM
SVCM, PRESSURE & FLOW CONTROL

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	8.4	0	1 OF 1

1. CYCLE TIME:

APPLICATION NUMBER	METHOD NUMBER	CYCLE CLOCK (SECONDS)
1	1	300

2. STREAM COMPOSITION(S), REPEATABILITY IS EXPRESSED AS PERCENT OF FULL SCALE:

STREAM 1 : LP SOUCE OFF GAS TO V9535 FLARE DRUM

COMPONENT	CONCENTRATION NORMAL	RANGE	UNITS	REPEAT-ABILITY	DET.	CAL STREAM	METHOD NO.	RESULT ID
OXYGEN (NOTE 1)	10	0 - 10	VOL%	0.5	RL2_TD	30	1	1
NITROGEN	50	0 - 100	VOL%	0.5	RL2_TD	30	1	2
METHANE	10	0 - 50	VOL%	0.5	RL2_TD	30	1	3
CARBONDIOXIDE	1	0 - 10	VOL%	0.5	RL1_TD	30	1	4
ETHANE	5.7	0 - 10	VOL%	0.5	RL1_TD	30	1	5
WATER (NOTE 2)	5	0 - 20	VOL%	2	RR2_TD		1	7
PROPANE	1	0 - 10	VOL%	0.5	RR2_TD	30	1	6
ACRYLONITRILE	15		PPMV					
BUTYLACRYLATE	15		PPMV					
STYRENE	15		PPMV					
ETHYLBENZENE	15		PPMV					

NOTE 1: ARGON WILL BE USED AS A SURROGATE FOR OXYGEN

NOTE 2: WATER CALIBRATION IS DONE USING THE RESPONSE FACTOR FOR PROPANE.

PROPANE STD MULTIPLIER SHOULD BE 64.5 IN THE PEAK TABLE.

WATER STD MULTIPLIER SHOULD BE 33 AND THE STD ID# SHOULD BE 6 (PROPANE) IN THE PEAK TABLE.

SII PROJECT NO.: 3008639334
TAG: 1-AIT-9575
EXTRA TAG:
USER: SMITH ANALYTICAL LLC
PURCHASER: SMITH ANALYTICAL LLC
P.O. NO.: 2161
LOCATION: ALVIN, TX

		DATE
DESIGN	CHAU	10/12/2020
DRAWN	OSPINA	10/12/2020
CHECKED	CHAU	10/12/2020
APPROVED	CHAU	10/12/2020

Siemens Industry, Inc.

TITLE: STREAM COMPOSITION DATA

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	B	30086393340010	9.1	2	1 of 1

CUSTOM MAXBASIC PROGRAMS

			FUNCTION				
APP	ID	PROGRAM NAME	PGM	DB	SCHEDULE	STREAM	PROGRAM DESCRIPTION
1	907	SHUTDOWN_ANALYZER	-	6	DI/LIMIT/ALARMHANDLER	-	SETS THE APPLICATIONS TO "HOLD", DISABLES THE PRESSURE AND TEMP. CONTROLLERS

SII PROJECT NO. 3008639334	TAG 1-AIT-9575	EXTRA TAG		**Siemens Industry, Inc.**
USER SMITH ANALYTICAL LLC		DESIGN CHAU	DATE 11/24/2020	TITLE CUSTOM MAXBASIC PROGRAMS
PURCHASER SMITH ANALYTICAL LLC		DRAWN OSPINA	11/24/2020	
P.O. NO. 2161		CHECKED CHAU	11/24/2020	
LOCATION ALVIN, TX		APPROVED CHAU	11/24/2020	SCALE NONE · SIZE B · DRAWING NO. 30086393340010 · SHEET 9.5 · REV 0 · PAGE 1 of 1

PART NO.	ITEM DESCRIPTION
2021343-001	Filter, Power Supply Line Assembly
2020151-001	Fuse Kit
1605001-007	Pressure Switch, 5 psig, oven air
2017660-001	Valve, Model 50, 10 port
2020164-001	Model 50 Repair Kit
2020281-001	Valve Assembly Fixture (tool to center diaphragm)
A5E02412308001	Model 50 Repair Kit & Tools
1671004-103	Valve, Veriflow air actuated, diaphragm (Sample Shut Off)
1291509-003	Fitting, Nut, 1/16"T, SST, Valco, (ZN1) LDV
A5E02178914	FILTER ELEMENT, 0.5 MICRON 1/8" SWAGELOK
1282001-017	FILTER,INLINE,0.5 MICRON,1/8 TUBING,SST
1605000-002	Pressure switch, Inert Gas - 80 psig setpoint
A6X30065842	Pressure switch, Hydrogen - ATEX and CSA approved
R28010	Pressure Regulator, 250 lb. Max.Inlet/0-125 PSI, Outlet, ¼" NPT Inlet & Outlet 2 1/8" NPT Outlet Ports, ...
A5E44952741001	CABLE, ISTCD, MAA
A5E36852549001	ASSEMBLY, INSERT, ISTCD
2020176-001	TCD-2 Thermistor Bead Kit
2021240-001	Reference Flow or Valve Purge Flow Restrictor
A5E42685089001	THERMISTOR DPM V4, W/ BRACKET
2020376-701	KIT, RELAY, SOLID STATE, MAXUM II
2021284-001	Air Bath Heater II Assembly
A5E02129060001	PROBE, DUAL RTD, AIRFLOW, 100 OHM,W/BEND
A5E02144046001	Probe, RTD 100ohm, 1/8T, 14" leads, 3 wire
A5E02599492004	Communication and Control Board, (CAC3) - With >= 5.2 Software
A5E31994086002	SYSCON INTERFACE BOARD, V3 (SIB3)
A5E02555919001	Ethernet Switch Board with Fiber (ESBF)
A5E02529816	SYSCON 2 (CAC3) to ESB or ESBF Cable, CAT5 Ethernet
2017562-001	SYSCON+ or SYSCON 2 Power Cable - Internal to SYSCON Assembly
2017906-001	SYSCON Internal Serial Port Cable - Serial 1 or Serial 2
2017906-002	SYSCON Internal Serial Port Cable - Serial 3, Serial 4, or SYSCON Debug
A5E31993951001	PCBA, TOUCH SCREEN INTERFACE BOARD (TIB)
A5E32869588001	CABLE, SIB-TO-TIB
A5E35858157001	KIT, DISPLAY CABLES, TIB, MAXUM II
2021757-002	CABLE, I2C, PECM-CIM
A5E03990228001	KIT, SPARE, TOUCH SCREEN ASSEMBLY
A5E02645922001	PECM CTRL BOARD, V3 (PECM3 CTRL)
2021789-001	PCBA, PECM SSR Board
2020146-001	PECM to SSR Cable and Connector Kit
2020183-701	Cable Harness Kit
1481000-008	Power Supply Module for GC, with Cables

Customer Service

Phone: 800-448-8224

Phone: 918-662-7030

SII PROJECT NO. 3008639334
TAG 1-AIT-9575
EXTRA TAG
USER SMITH ANALYTICAL LLC
PURCHASER SMITH ANALYTICAL LLC
P.O. NO. 2161
LOCATION ALVIN, TX

		DATE
DESIGN	CHAU	5/3/2021
DRAWN	OSPINA	5/3/2021
CHECKED	CHAU	5/3/2021
APPROVED	CHAU	5/3/2021

Siemens Industry, Inc.

TITLE

SPARE PARTS LIST

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
NONE	A	30086393340010	10.1	2	1 of 2

PART NO.	ITEM DESCRIPTION
2020165-001	EPC Module Complete with Manifold and Seals
2020158-001	Internal Ethernet Cable Kit
A5E41895195001	Purge Control Assembly Module, Airbath
1262000-035	Fan, 24vdc, 0.26amp, modified
2021637-001	Regulator & Gauge, Module 0-30
2021638-001	Regulator & Gauge, Module 0-160
2020155-001	Fitting Kit
2020102-701	Gasket and Seal Kit
2020157-001	Hardware Kit
2020166-001	Solenoid Valve Control Module with o-rings (no electronics)
2022021-001	Solenoid Kit
2020174-001	Solenoid tube manifold kit
1291510-005	Fitting, Ferrule, 1/16"T, SST, Valco, (ZF1) LDV
2021212-701	Airbath oven door gasket
A5E44730908002	ASSEMBLY, DETECTOR, ISTCD W/ MOUNT
A5E03790944016	RESTRICTOR, CRIMP TUBE, RC-60-10
2021717-009	16.9 K T-Limit Board
2021715-005	T-Limit Resistor Board for unused heater circuits, 12.4K Ohms
2022001-001	SIEMENS NEEDLE VALVE KIT, LOW TEMP (PTFE FERRULE SYSTEM)

Customer Service

Phone: 800-448-8224

Phone: 918-662-7030

SII PROJECT NO. 3008639334
TAG 1-AIT-9575
EXTRA TAG
USER SMITH ANALYTICAL LLC
PURCHASER SMITH ANALYTICAL LLC
P.O. NO. 2161
LOCATION ALVIN, TX

		DATE
DESIGN	CHAU	5/3/2021
DRAWN	OSPINA	5/3/2021
CHECKED	CHAU	5/3/2021
APPROVED	CHAU	5/3/2021

Siemens Industry, Inc.

TITLE
SPARE PARTS LIST

SCALE	SIZE	DRAWING NO.	SHEET	REV	PAGE
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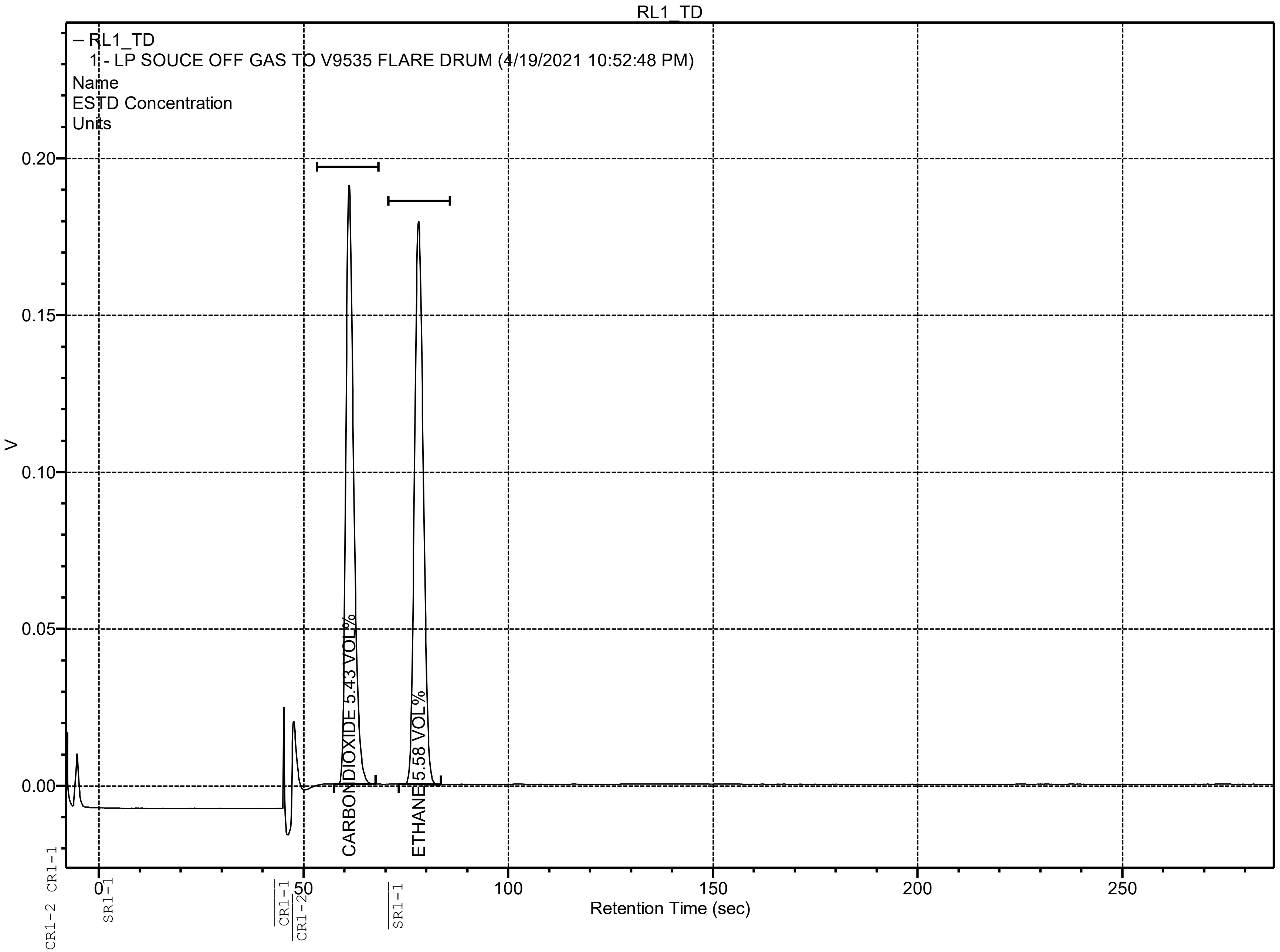

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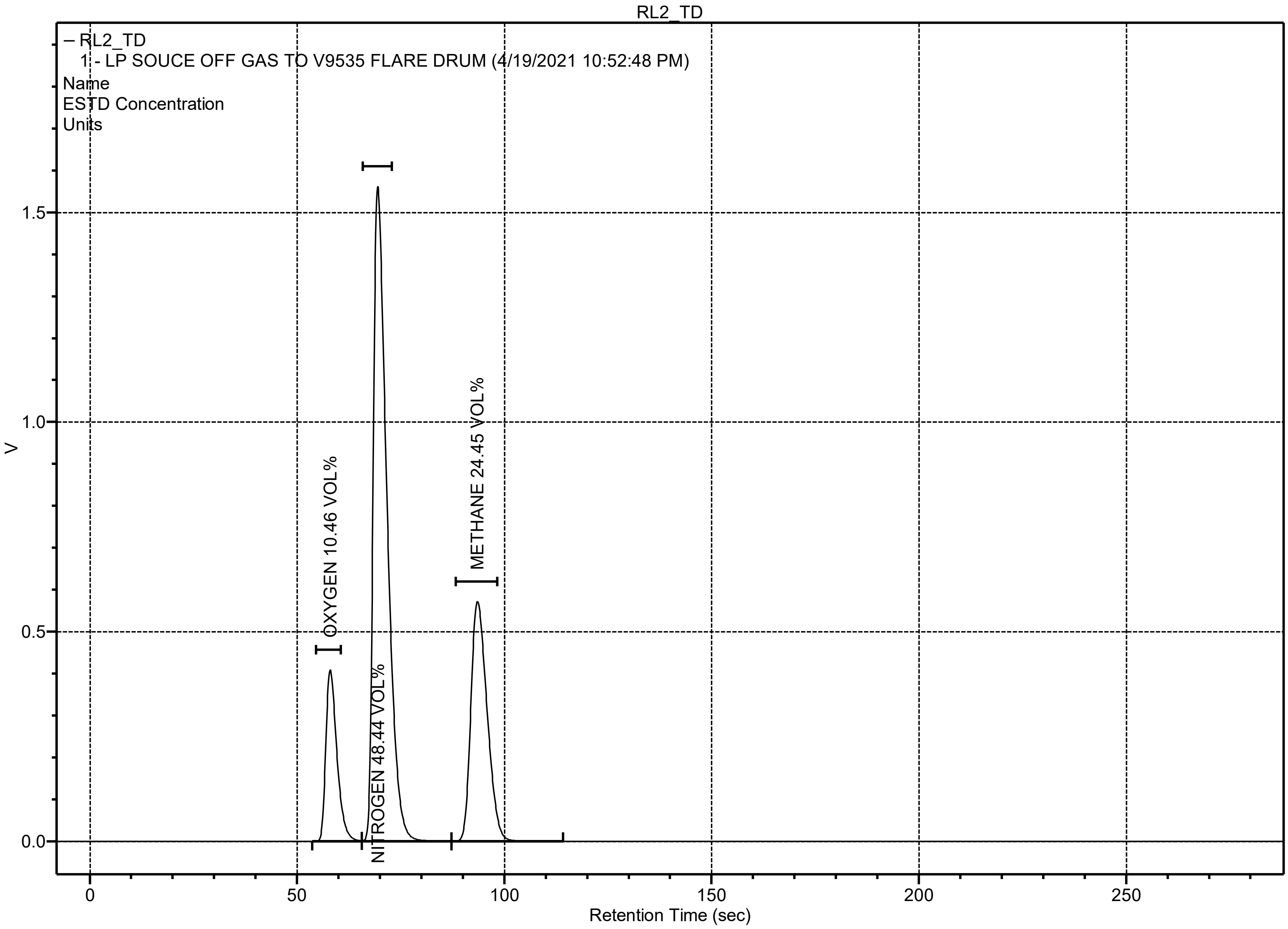

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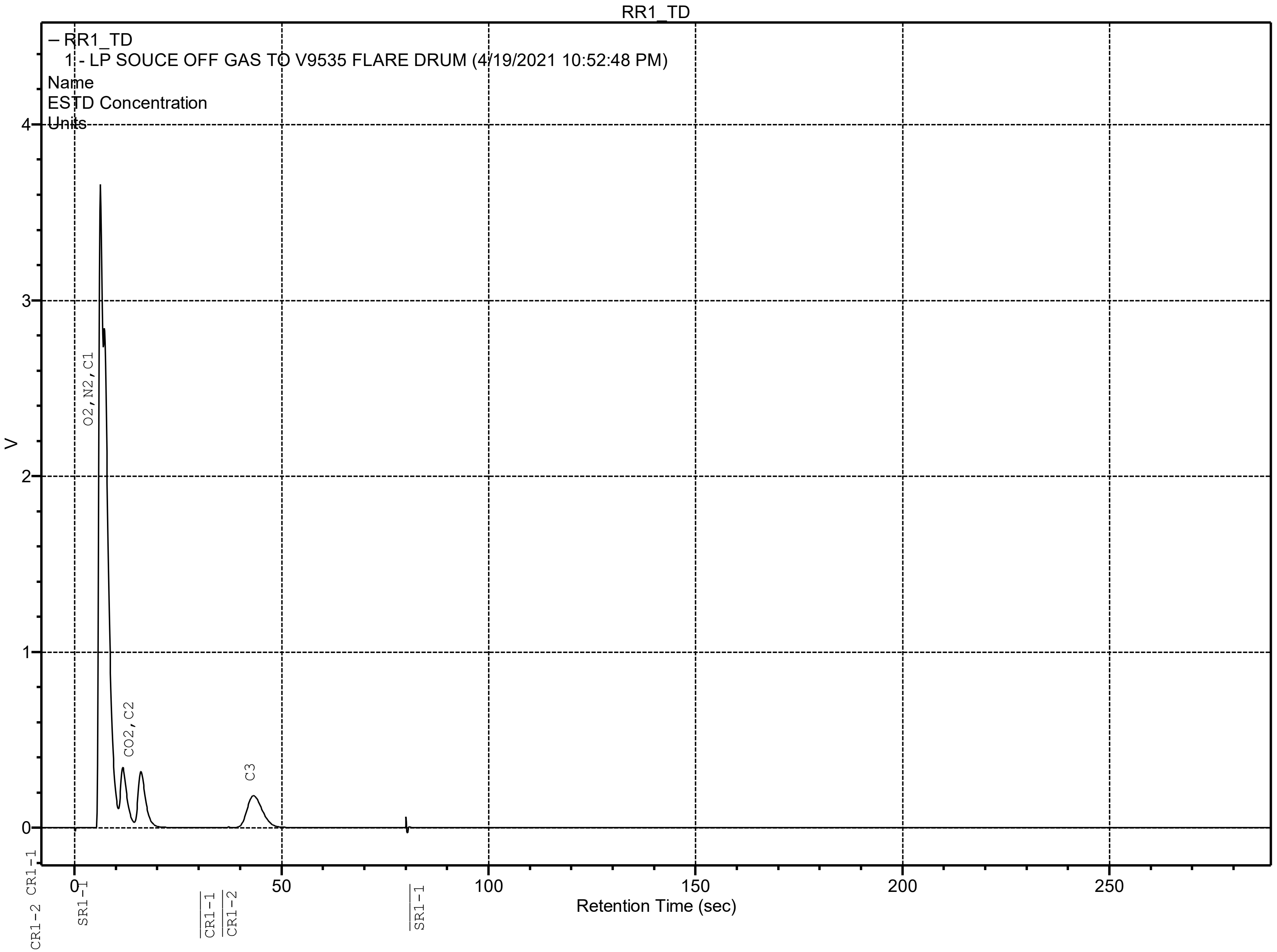

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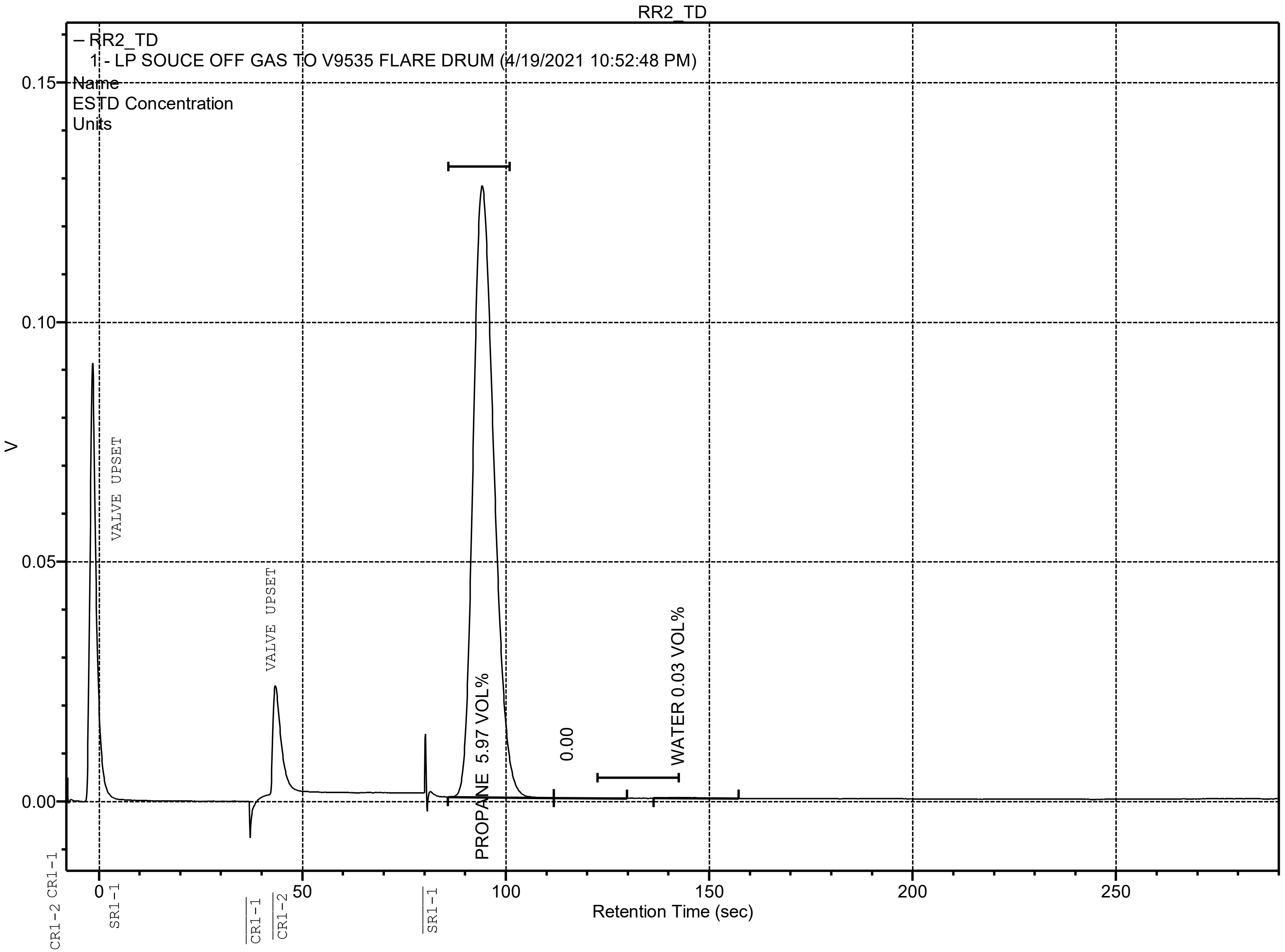

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SMITH ANALYTICAL LLC
30086393340010-1-1
1-AIT-9575

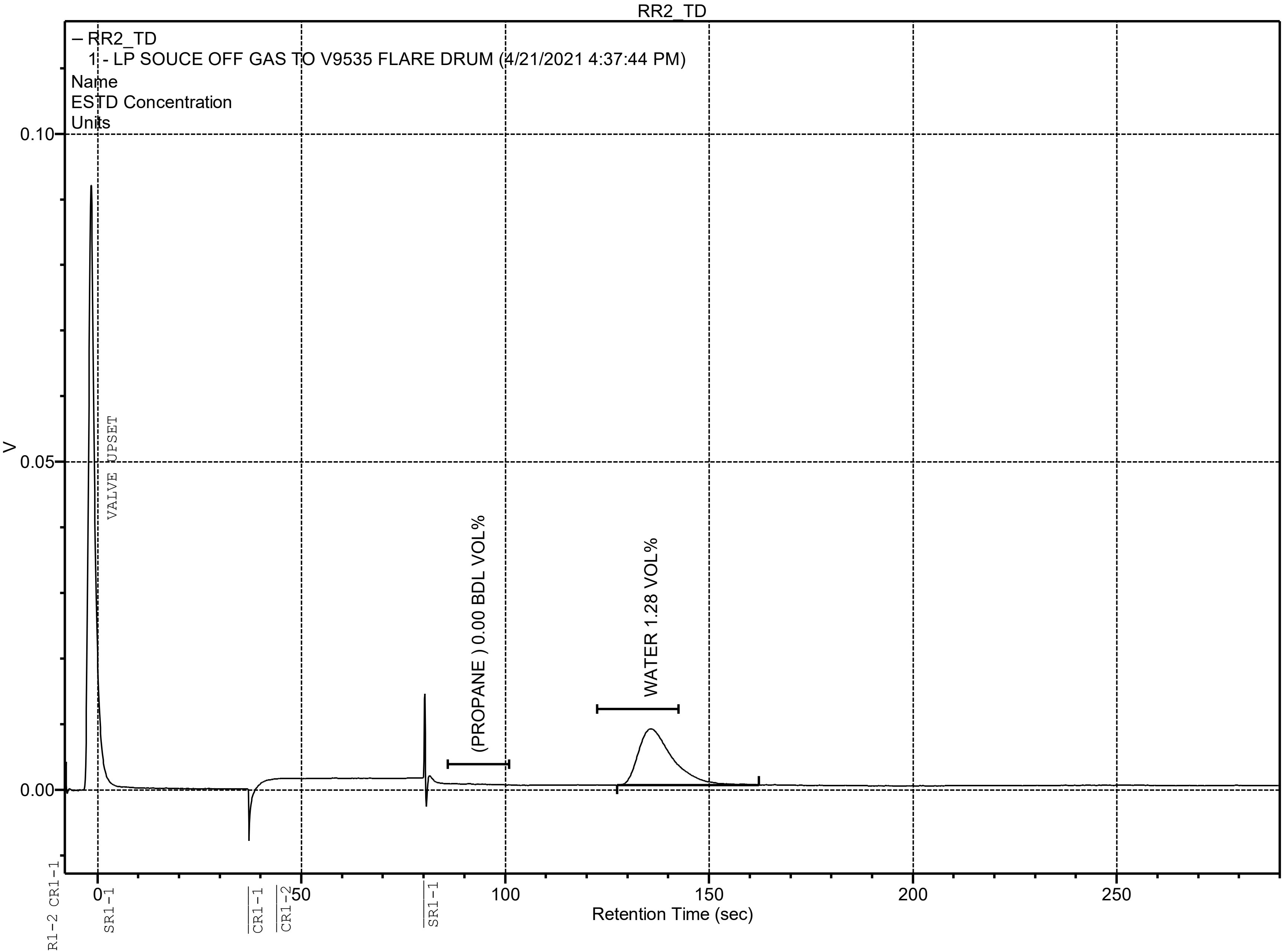
Stream	1
Cycle Time (sec)	300
Required Time (hrs)	8
Required # Cycles	96

	Start	End	
Date	19-Apr-21	20-Apr-21	
Time	22:52	6:48	8 hrs
Cycle	1	96	96 cycles

Result Number	Result Name	Pass	Actual Repeat.	Target Repeat.	Range	Units	Std Dev	Relative Std Dev	Min Value	Max Value	Mean
1	OXYGEN	OK	0.105	0.5	10	VOL%	0.0042	0.0397	10.447	10.468	10.457
2	NITROGEN	OK	0.0326	0.5	100	VOL%	0.0155	0.0319	48.394	48.459	48.431
3	METHANE	OK	0.0573	0.5	50	VOL%	0.0121	0.0495	24.419	24.476	24.444
4	CARBONDIOXIDE	OK	0.0525	0.5	10	VOL%	0.0021	0.0381	5.42	5.431	5.425
5	ETHANE	OK	0.091	0.5	10	VOL%	0.004	0.0715	5.563	5.581	5.572
6	PROPANE	OK	0.1115	0.5	10	VOL%	0.0045	0.076	5.963	5.985	5.972

Repeatability = [(max - min) * 100] / (2 * range)

RSD = (std_dev * 100) / mean



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SMITH ANALYTICAL LLC
30086393340010-1-1
1-AIT-9575

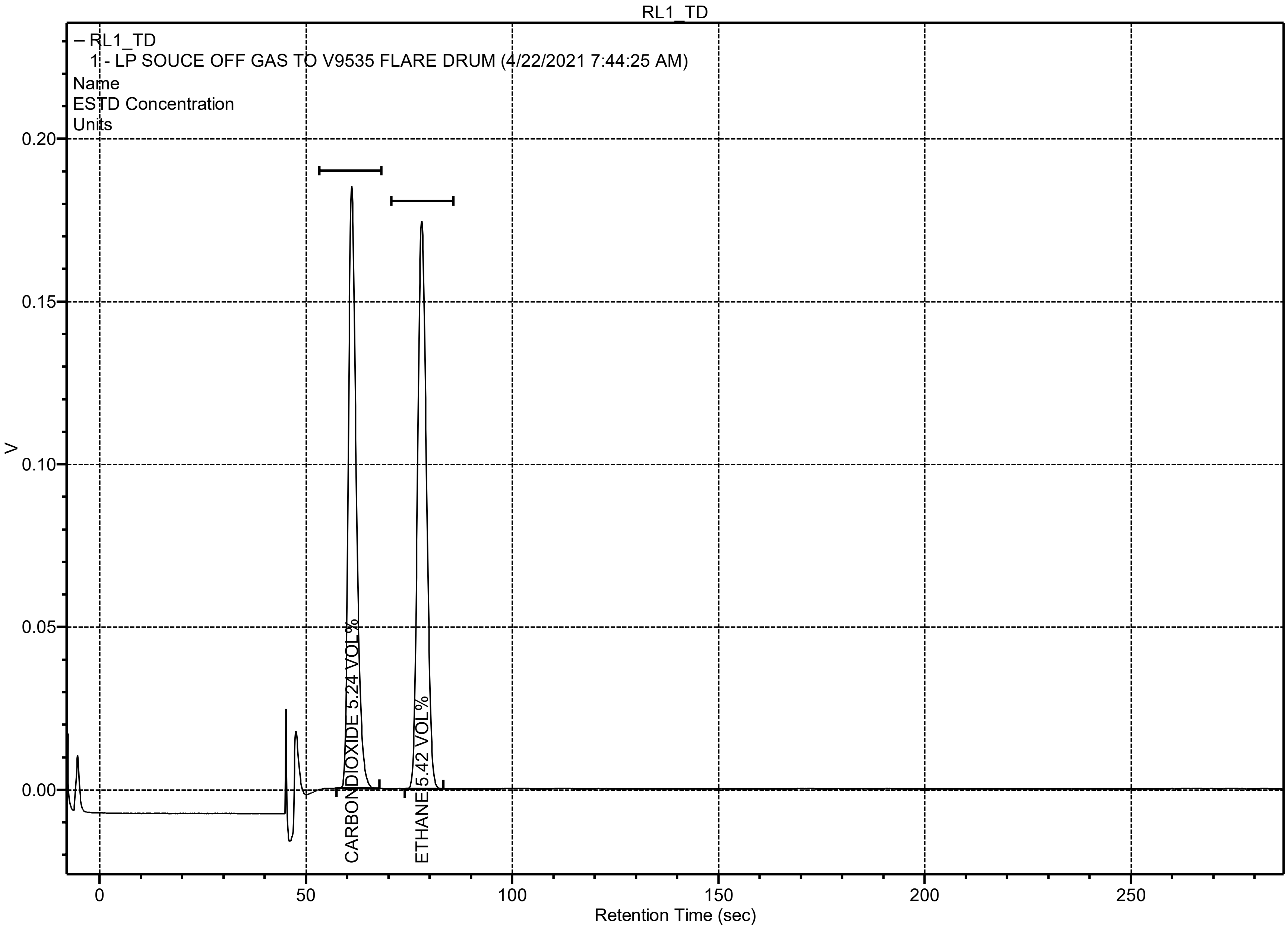
Stream	1
Cycle Time (sec)	300
Required Time (hrs)	8
Required # Cycles	96

	Start	End	
Date	21-Apr-21	22-Apr-21	
Time	16:37	0:33	8 hrs
Cycle	1	96	96 cycles

Result Number	Result Name	Pass	Actual Repeat.	Target Repeat.	Range	Units	Std Dev	Relative Std Dev	Min Value	Max Value	Mean
7	WATER	OK	0.513	2	20	VOL%	0.0404	3.4408	1.109	1.314	1.174

Repeatability = [(max - min) * 100] / (2 * range)

RSD = (std_dev * 100) / mean



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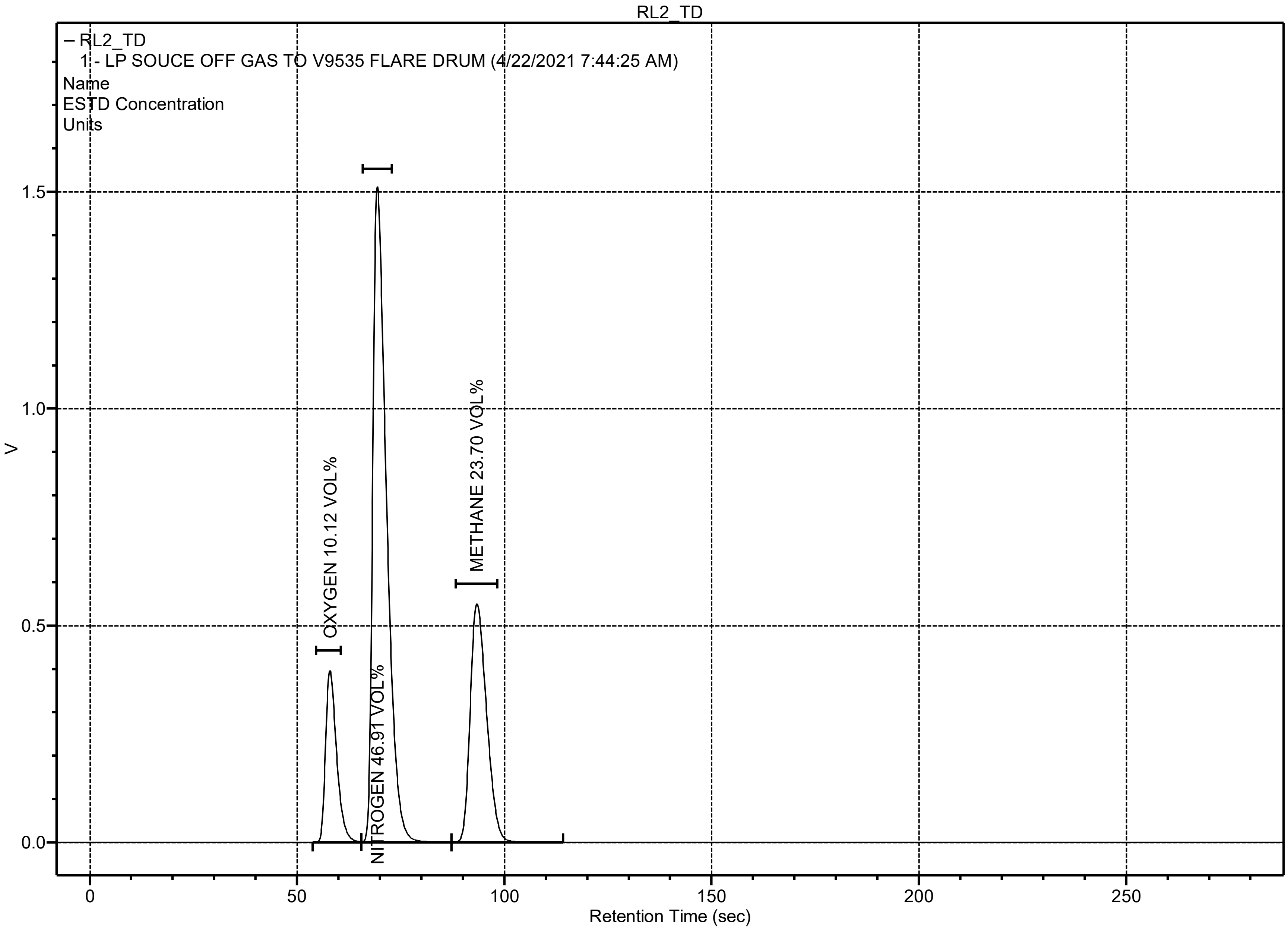

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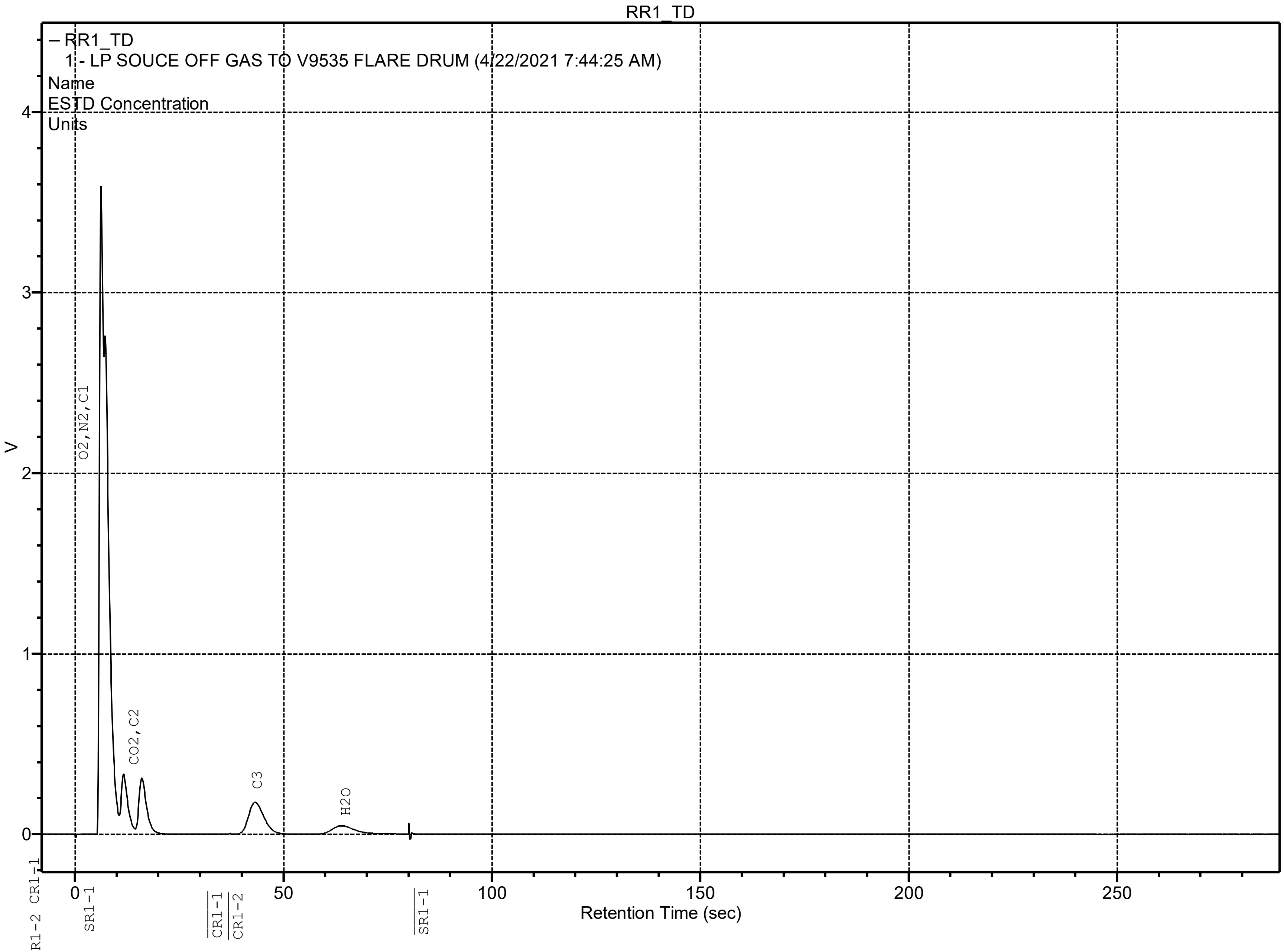

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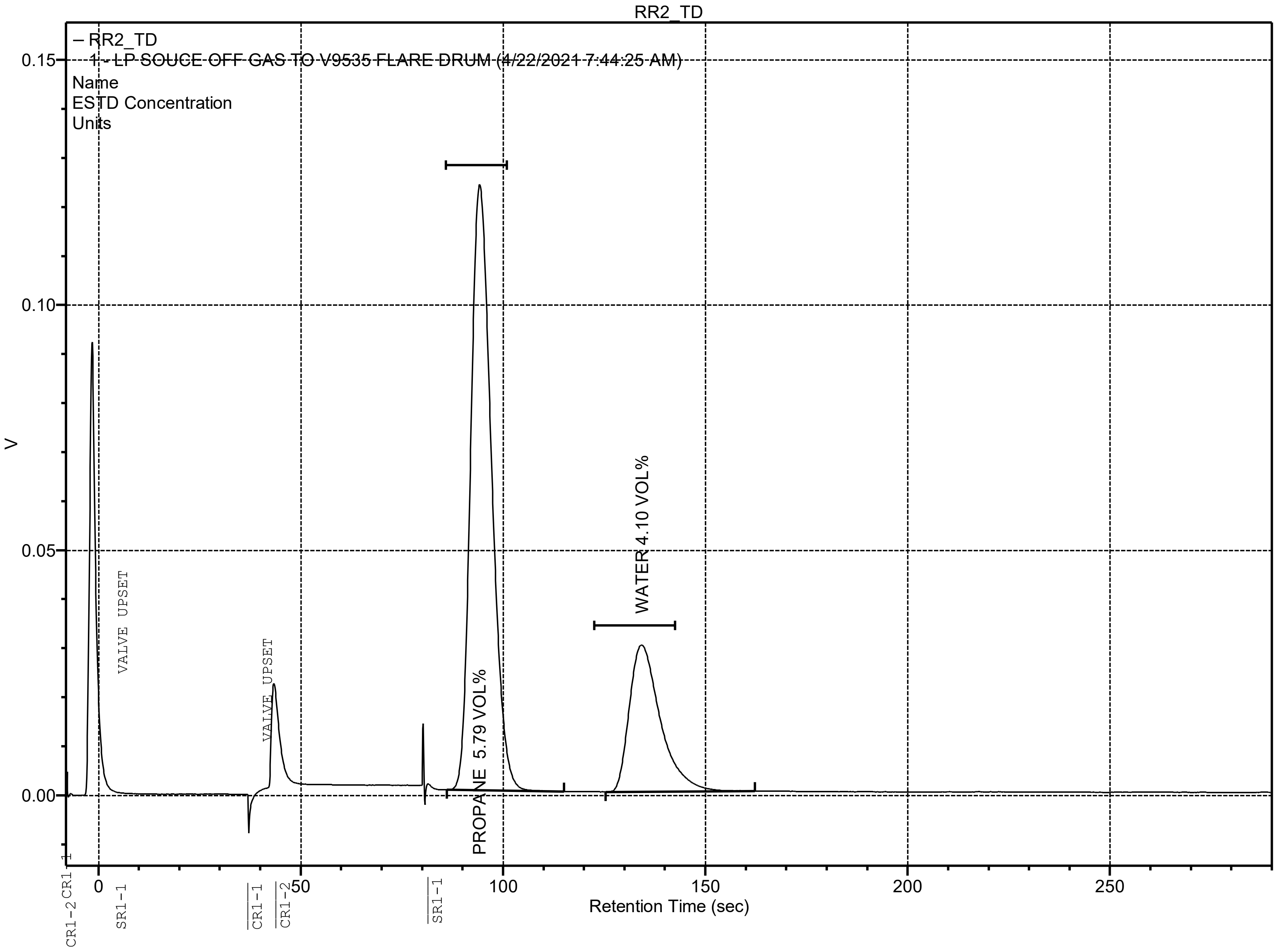

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30086393340010	0010	
Stream 1	**Blend 2**	
	Mole %	**HAZ**
ARGON	10	
NITROGEN	50	
METHANE	25	
CARBONDIOXIDE	5	
ETHANE	5	
PROPANE	5	
4/16/2021	100 PSIA	