

# Micro GC Fusion® Natural Gas Analysis for Engine and Appliance Manufacturers

## Introduction

Rapid and precise analysis of the chemical composition and physical properties of natural gas is critical for appliance, boiler, and engine manufacturers. Fuel sources, such as natural gas, are analyzed to determine key performance specifications, such as thermal efficiency. This specification can be obtained by comparing input and output gross heating values in British Thermal Unit per cubic feet (BTU/cu.ft.). Measurement of the BTU value aides in certifying gas appliances for industry and government compliance purposes.

Micro GC Fusion reports gas component data in mole percentage, which is critical for understanding fuel composition. Natural gas streams of pipeline quality may change daily, weekly or monthly. The Micro GC Fusion analysis ensures these changes are tracked. High quality analytical data is beneficial for product development, performance, environmental compliance, and reporting.

The web-based Micro GC Fusion user interface combined with Diablo EZReporter ([www.diabloanalytical.com](http://www.diabloanalytical.com)) software automatically calculates chemical composition and physical properties after each run, allowing accurate determination of thermal efficiency. The EZ Reporter software generates standard reports using industry specific methods from one of the following standards:

- GPA (Gas Midstream Association) 2172, 2145
- ASTM (American Society of Testing and Materials) D3588
- ISO (International Standards Organization) 6976

Micro GC Fusion complies with the precision statement of ASTM 1945 and GPA 2261 Gas Chromatography based methods for natural gas analysis. With its precision, small size, and speed of analysis, Micro GC Fusion is the ideal BTU analyzer and may be considered an advanced technological upgrade to legacy calorimeters.

## Experimental

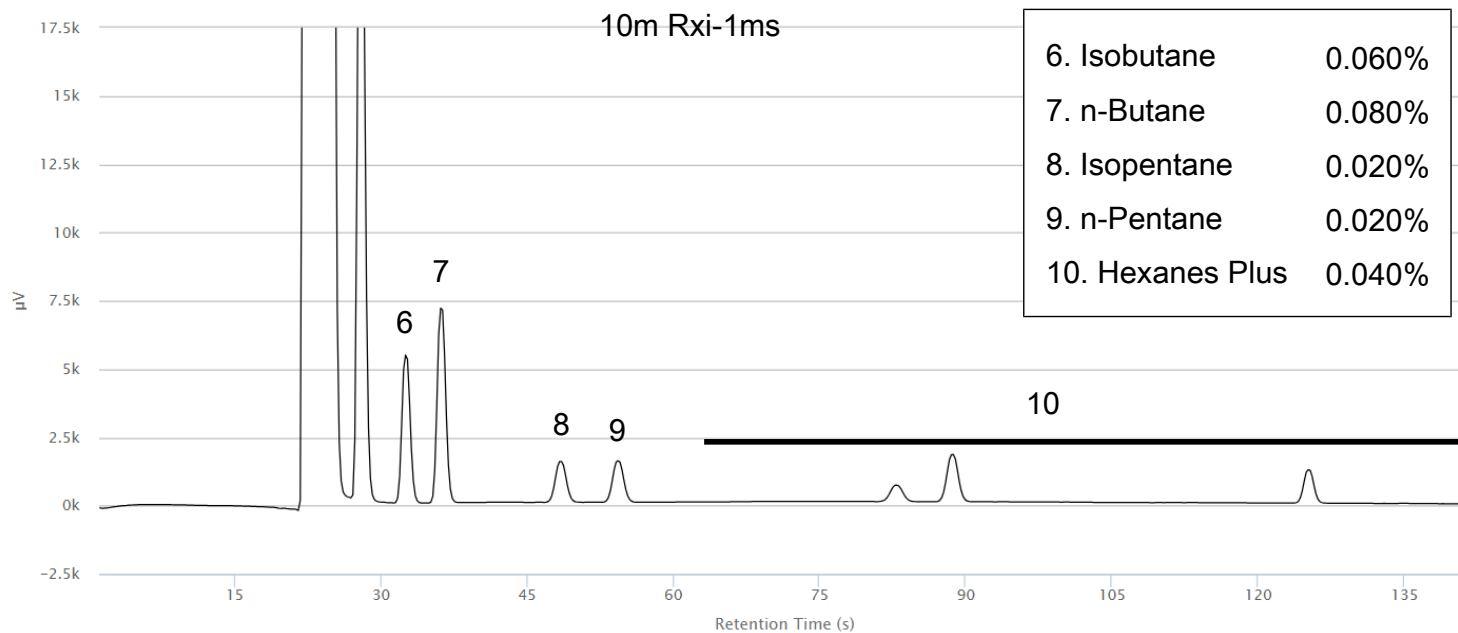
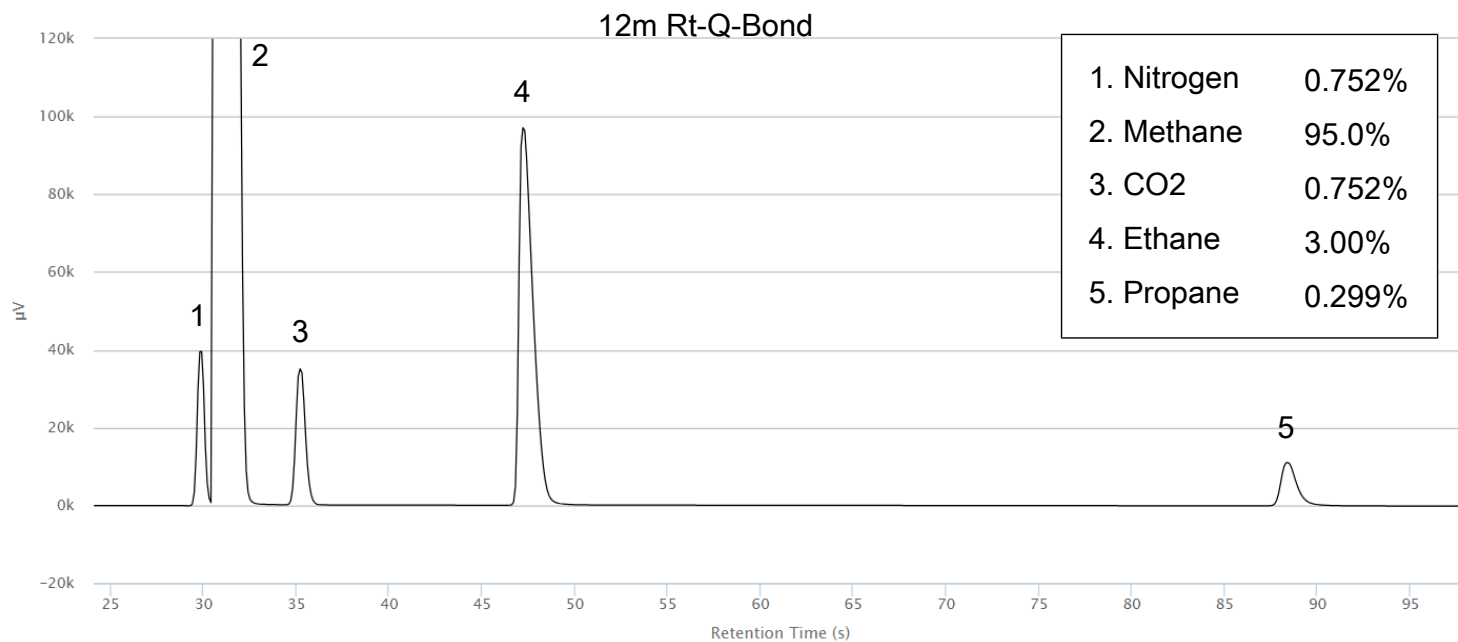
A natural gas calibration standard was analyzed on Micro GC Fusion containing 12m RT-Q-Bond and 10m Rxi-1ms columns with fixed volume injectors. The fixed volume injector provides exceptional precision for both columns.

Parameter	12m RT-Q-Bond	10m Rxi-1ms
Injection time	35 ms	35 ms
Injector temperature	90°C	90°C
TCD heater	70°C	70°C
Column pressure	23 psi	25 psi
Data rate	100 Hz	50 Hz
Column temperature profile and ramp rate	60°C-->220°C, 2°C/min	60°C-->160°C, 0.8°C/min
Sample pump time	15 s	15 s
Sample inlet temperature	90°C	90°C

## Results

### Chromatograms

Chromatograms were obtained for the analysis of the natural gas calibration standard in under 220 seconds. Pipeline quality gas typically contains large amounts of methane and small amounts of fixed gases and light hydrocarbons up to hexanes plus. Micro GC Fusion quickly separates and analyzes the fixed gases and hydrocarbons present using a 2-module configuration as shown in the example chromatograms of the calibration gas.



## Report

The final report was generated by Diablo EZReporter and includes calculations such as **Gross Heating Value**, **Relative Density**, **Compressibility Factor**, and **Gross Wobbe Index**.

Diablo EZReporter 4.0

File Tools Help

Open Data File Reprocess Print Report Save Report Export Load Configuration Edit Configuration

Sample Results Parameter Monitor Results Database Sample Processing

Sample Information:

Sample Information	
Sample Name	1Pipeline Seq
Method Name	1Pipeline
Injection Date	2019-07-25 16:33:21

Component Results

Component Name	Ret. Time	Peak Area	Raw Amount	Norm%	Gross HV (Dry) (BTU / Ideal cu.ft.)	Relative Gas Density (Dry)	GPM (Dry) (Gal. / 1000 cu.ft.)
Nitrogen	29.910	14274.9	0.7103	0.7110	0.0	0.00688	0.078
Methane	30.740	1429903.1	94.9462	95.0438	959.9	0.52645	16.106
CO2	35.260	17626.8	0.7452	0.7460	0.0	0.01134	0.127
Ethane	47.270	76246.5	2.9787	2.9817	52.8	0.03096	0.797
Propane	88.430	10160.2	0.2962	0.2965	7.5	0.00451	0.082
Isobutane	32.660	4352.9	0.0605	0.0606	2.0	0.00122	0.020
n-Butane	36.300	5921.7	0.0803	0.0803	2.6	0.00161	0.025
Isopentane	48.540	1673.3	0.0201	0.0201	0.8	0.00050	0.007
n-Pentane	54.420	1711.3	0.0200	0.0201	0.8	0.00050	0.007
Hexanes Plus	140.000	4078.0	0.0398	0.0399	2.0	0.00128	0.017
Water	0.000	0.0	0.0000	0.0000	0.0	0.00000	0.000
Total:			99.8974	100.0000	1028.4	0.58524	17.268

Results Summary

Result	Dry	Sat. (Base)
Total Raw Mole% (Dry)	99.9	
Pressure Base (psia)	14.696	
Temperature Base (Deg. F)	60.00	
Water Mole%	-	1.7447
Gross Heating Value (BTU / Ideal cu.ft.)	1028.4	1010.5
Gross Heating Value (BTU / Real cu.ft.)	1030.6	1013.0
Relative Density (G), Real	0.5863	0.5871
Compressibility (Z) Factor	0.9978	0.9975
Gross Wobbe Index, Real	1346.06	1322.08

Fusion Natural Gas.cfgx

## Parameter Monitor

The Diablo EZReporter software provides a parameter monitor to easily view data and calculations. These parameters can be specified in the configuration and customized to suit user needs. The results of the run will populate immediately upon completion of the run.

Parameter	Value
<b>Sample</b>	<b>1Pipeline Seq</b>
<b>Time</b>	<b>2019-07-25 15:51:11</b>
<b>Nitrogen - %</b>	<b>0.712</b>
<b>Methane - %</b>	<b>95.0</b>
<b>CO2 - %</b>	<b>0.746</b>
<b>Ethane - %</b>	<b>2.981</b>
<b>Propane - %</b>	<b>0.296</b>
<b>Isobutane - %</b>	<b>0.061</b>
<b>n-Butane - %</b>	<b>0.080</b>
<b>Isopentane - %</b>	<b>0.020</b>
<b>n-Pentane - %</b>	<b>0.020</b>
<b>Hexanes - %</b>	<b>0.040</b>
<b>Total Raw Amount</b>	<b>99.9</b>
<b>Gross Heating Value, Vol. (Ideal, Dry)</b>	<b>1028.4</b>
<b>Gross Heating Value, Vol. (Real, Dry)</b>	<b>1030.6</b>

## Exporting Data to a CSV File

The Diablo EZReporter software exports data to a customizable, appending CSV file. This file can then be used by other programs to import data from Micro GC Fusion.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Time	SampleName	Total Raw Mol%	GHV Ideal	GHV Real	Nitrogen Norm Mol%	Methane Norm Mol%	CO2 Norm	Ethane Norm	Propane Norm Mol%	Isobutane Norm Mol%	n-Butane Norm Mol%	Isopentane Norm Mol%	n-Pentane Norm Mol%	Hexanes Plus Norm Mol%
1	7/25/2019 15:51	1Pipeline Seq	99.9299	1028.4005	1030.6317	0.7118	95.0444	0.7461	2.9806	0.2958	0.0606	0.0802	0.0203	0.0201	0.0401
2	7/25/2019 16:01	1Pipeline Seq	99.8396	1028.4478	1030.6793	0.7115	95.0413	0.7455	2.9828	0.2979	0.0605	0.0803	0.0201	0.0201	0.04
3	7/25/2019 16:12	1Pipeline Seq	99.8844	1028.4063	1030.6375	0.7117	95.0447	0.7461	2.9799	0.2961	0.0606	0.0804	0.0202	0.0201	0.0402
4	7/25/2019 16:22	1Pipeline Seq	99.8126	1028.4059	1030.6371	0.7118	95.0446	0.7459	2.9805	0.2957	0.0607	0.0803	0.0202	0.0201	0.0402
5	7/25/2019 16:33	1Pipeline Seq	99.8974	1028.4165	1030.6478	0.711	95.0438	0.746	2.9817	0.2965	0.0606	0.0803	0.0201	0.0201	0.0399
6															
7															

## Conclusion

With its speed and precision, Micro GC Fusion is the ideal instrument to analyze natural gas components to calculate physical properties such as the gross heating value. Using Diablo EZReporter software, industry compliant natural gas reports can be automatically generated upon completion of a sample run, providing valuable information for gas appliance or engine development.