

PRE COMBUSTION CATALYST OF AMERICA LLC

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Technical Bulletin - May 2020

**ASTM Test Series of Natural Gas
Treated by the Fitch Fuel Catalyst**

Test requested by: Pre Combustion Catalyst of America LLC (PCCA)
Test performed by: SGS Oil, Gas and Chemical Division Tx USA (**SGS** is the world's leading inspection, verification, testing and certification company.)

Samples taken by: Pre Combustion Catalyst of America LLC
Samples taken from site located in: Winston Salem - NC - USA

Date of samples taken: April 7, 2020

Fitch Fuel Catalyst: Model Number HO-2-3NG

Findings: A 2 to 3% increase in energy and 64% increase in oxygenates.

Confidence level of petroleum testing: Set at 95% confidence level.

OBJECTIVE

The objective of the test is to measure the impact of Fitch Fuel Catalyst on Natural Gas. The ASTM test series performed are **ASTM D7833, ASTM D7423 & ASTM 3588**.

TESTING METHODS

The ASTM test series performed are **ASTM D7833** (Standard Test Method for Determination of Hydrocarbons and Non-Hydrocarbon Gases in Gaseous Mixtures by Gas Chromatography); **ASTM D7423** (Standard Test Method for Determination of Oxygenates in C2, C3, C4, and C5 Hydrocarbon Matrices by Gas Chromatography and Flame Ionization Detection) & **ASTM 3588** (Standard Practice for

Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels).

NG SAMPLING METHODOLOGY

For the purpose of this Test, METHOD 0040 used by EPA (Sampling of Principal Organic Hazardous Constituents from Combustion Sources Using Tedlar® Bags) was used.

Source: <https://www.epa.gov/sites/production/files/2015-12/documents/0040.pdf>

NG SAMPLING PROCEDURE

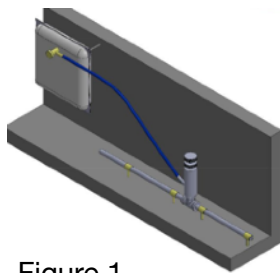


Figure 1

A Dixon Sanitary W Series Stainless Steel Sample Valve - 3/8" NPT w/PTFE Seat was installed into the Natural Gas supply gas line port. Using 6" length of 3/8" nylon tubing (2) Tedlar bags were filled with Natural Gas without exposure to Fitch Fuel Catalyst, up to 80% of its capacity. (Figure 1)

After Natural Gas samples were taken, Fitch Fuel Catalyst: HO-2-3NG was connected to Natural Gas supply line port using a Stainless Steel 316 Nipple 1/2" NPT Male x 3/8" NPT Male Reducing Forged Pipe Fitting Reducer Hex Adapter (2 Pc). A Dixon Sanitary W Series Stainless Steel Sample Valve - 3/8" NPT w/PTFE Seat was installed into Fitch Fuel Catalyst. Using 3/8" nylon tubing (2) Tedlar bags were filled with Natural Gas, up to 80% of its capacity. (Figure 2)

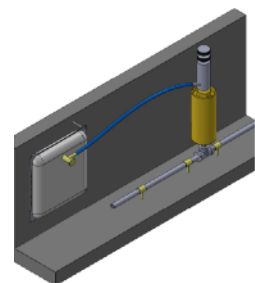


Figure 2

Samples were sent to SGS Labs overnight where analysis was performed within the following 48 hours.

Results Overview:

Significant change in certain components induce a higher heating/energy value of Natural Gas when exposed to Fitch Fuel Catalyst.

ASTM D7833 (Standard Test Method for Determination of Hydrocarbons and Non-Hydrocarbon Gases in Gaseous Mixtures by Gas Chromatography)

ASTM D7833	NG without Catalyst % Mole	NG with Catalyst % Mole	Change
Hydrogen by TCD	<0.03	<0.03	0%
Nitrogen by TCD	21.64	20.56	-5%
Oxygen by TCD	8.50	8.04	-5%
Carbon Monoxide by TCD	<0.03	<0.03	0%
Carbon Dioxide by TCD	0.10	0.09	-10%
Hydrogen Sulfide by TCD	<0.03	<0.03	0%
Methane by FID	67.83	69.33	2%
Ethane by FID	1.81	1.87	3%
Propane by FID	0.08	0.09	13%
Propylene by FID	<0.005	<0.005	0%
Iso-Butane by FID	<0.005	<0.005	0%
n-Butane by FID	0.006	0.007	17%
Iso-Pentane by FID	<0.005	<0.005	0%
n-Pentane by FID	<0.005	<0.005	0%
Neopentane by FID	<0.005	<0.005	0%
C5-Olefind by FID	<0.005	<0.005	0%
Cis-2-Butene by FID	<0.005	<0.005	0%
Trans-2-Butene by FID	<0.005	<0.005	0%
1,3 Butadiene by FID	<0.005	<0.005	0%
Benzene by FID	<0.005	<0.005	0%
n-Hexane by FID	<0.005	<0.005	0%
Heptanes and Heavier by FID	<0.005	<0.005	0%
C8 Plus by FID	<0.005	<0.005	0%
Acetylene by FID	<0.005	<0.005	0%
Ethylene by FID	<0.005	<0.005	0%
1-Butene by FID	<0.005	<0.005	0%
Methyl Acetylene by FID	<0.005	<0.005	0%

ASTM D7423 (Standard Test Method for Determination of Oxygenates in C2, C3, C4, and C5 Hydrocarbon Matrices by Gas Chromatography and Flame Ionization Detection)

ASTM D7423	NG without Catalyst ppm (m/m)	NG with Catalyst ppm (m/m)	Change
Acetaldehyde	<0.5	<0.5	0%
Allyl Alcohol	<0.5	<0.5	0%
Isobutanol, Tert-Butyl Alcohol, Sec Butanol	<0.5	<0.5	0%
Butylaldehyde	<0.5	<0.5	0%
Diethyl Ether	<0.5	<0.5	0%
Dimethyl Ether	<0.5	<0.5	0%
Diisopropyl Ether	<0.5	<0.5	0%
Ethyl tert-butyl ether	<0.5	<0.5	0%
Ethanol	<0.5	<0.5	0%
Isobutylaldehyde	<0.5	<0.5	0%
Isovaleraldehyde	<0.5	<0.5	0%
2-Butanone (MEK)	<0.5	<0.5	0%
Methanol	2.2	3.6	64%
Methyl tert-Butyl Ether	<0.5	<0.5	0%
n-Butanol	<0.5	<0.5	0%
N-propyl alcohol and Isopropanol	<0.5	<0.5	0%
Propionaldehyde	<0.5	<0.5	0%
Propyl Ether	<0.5	<0.5	0%
Tert-Amyl Alcohol	<0.5	<0.5	0%
Tertiary Amyl Methyl Ether (TAME)	<0.5	<0.5	0%
Valeraldehyde	<0.5	<0.5	0%
Total Oxygenates tested	2.2	3.6	64%

ASTM 3588 (Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels).

ASTM D3588	NG without Catalyst	NG with Catalyst	Change
Ideal Gross Heating Value (IGHV) BTU/ft3	719.7	736.0	2%
Ideal Net Heating Value (INHV) BTU/ft3	648.5	663.2	2%
Ideal Gross Heating Value (IGHV) kJ/mol	635.0	650.0	2%
Ideal Net Heating Value (INHV) kJ/mol	572.0	585.0	2%
Ideal Gross Heating Value (IGHV) Btu/lbm	13,456.0	13,893.0	3%
Ideal Net Heating Value Btu/lbm	12,125.0	12,519.0	3%

Results extracted by PCCA from Certificate of Analysis # DP20-04072.002 & DP20-04072.003
(Complete Analysis available upon request)