



Introduction

The accuracy of the Natural Gas Cylinder Standard used to calibrate BTU analyzers can have a significant impact on your company's bottom line. Inaccurately measured BTU content can add up to tens of thousands of dollars in lost revenue when applied to millions of cubic feet of natural gas. (Request Matheson Technical Bulletin 362 for more details).

Matheson offers five grades of Natural Gas BTU and Component Standards designed to meet utility, gas processor, and natural gas pipeline calibration needs.

- **MaxiTherm™:** Statistically valid 1 BTU uncertainty with both NIST traceable analytical and gravimetric validation.
- **UniTherm™:** Four to one hundred identical cylinders to calibrate every pipeline BTU analyzer equally.
- **Primary Grade:** Emphasis on high-resolution gravimetrics and research grade hydrocarbons with qualifying analysis provides minimal BTU uncertainty.
- **Gravimetric Grade:** Reliance is on the gravimetric blending of research purity raw materials to provide reliable natural gas standards.
- **Certified Grade:** High precision analysis is used to assign component concentrations to natural gas mixtures.

See the following section "Custom Natural Gas BTU Mixtures" for elaboration of grade specifications. Also reference Matheson Technical Bulletin 360.

Matheson's Advances and Innovations

- **MaxiTherm™:** Dual certification of 1 BTU uncertainty.
- **UniTherm™:** Batch quantities of identical natural gas cylinders
- **NIST NTRM for Natural Gas:** Direct NIST Traceable natural gas standard for Matheson's laboratories.
- **Certificates of Analysis:** Full documentation of traceability, certified concentration, calculated values, and uncertainty.
- Matheson calculates the MaxiTherm™ 1 BTU uncertainty with reference to GPA 2145-00 and ASTM 1945-96. These documents indicate the physical constants of listed hydrocarbons that do not have accuracies greater than 1 part in 1000, which Matheson includes in BTU uncertainty propagation of error calculations.

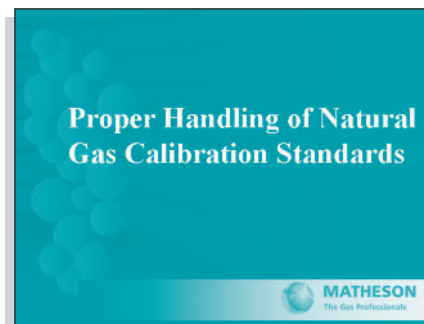
Matheson Natural Gas Mixture Engineering

Reliable natural gas mixtures require specification of key variables:

- **Minor components**
- **Minor component concentrations**
- **Hydrocarbon Dewpoint Temperature (temperature below which one or more components may condense from gas to liquid phase.)**

Every new natural gas mixture is entered in to Matheson's advanced phase prediction software. From the specified mixture variables, Matheson will recommend an optimum cylinder fill pressure that will ensure that no component will condense above the desired hydrocarbon dewpoint temperature. Matheson will provide a copy of the phase diagram upon request so that the user can verify the mixture phase behavior by monitoring the cylinder pressure versus ambient temperature curve.

When cylinders may be subjected to ambient temperature below the hydrocarbon dewpoint temperature, a Therma-Cal™ Gas Cylinder Warmer is recommended.



A Matheson training CD "*Proper Handling of Natural Gas Calibration Standards*," is available for a nominal fee. Contact your sales or customer service representative.

Natural Gas Standards can be ordered as custom blended mixtures (following section), and as Standard Natural Gas Mixture formulations.



Custom Natural Gas BTU Mixtures

Natural Gas Standards can be ordered as custom blended mixtures (following section) and as Standard Natural Gas Mixture Formulations. Choose from the Natural Gas Components Tables, and Mixture Grade. Matheson will engineer the optimum mixture concentrations, hydrocarbon dewpoint, and cylinder fill pressure to meet your requirements.

Table 1: Natural Gas Components

Usual Natural Gas Components	Extended Analysis Mixture	Most Common Additions
Methane	C ₆ Plus Components	Neo Pentane
Ethane	2,2 Dimethylbutane	Hydrogen
Propane	2,3 Dimethylbutane	Helium
iso-Butane	Heptane	Oxygen
n-butane	Octane	Oxygen
iso-Pentane	Nonane	Hydrogen Sulfide
n-Pentane	Decane	Argon
n-Hexane		Water
Carbon Dioxide		Methyl Mercaptan
Nitrogen		Thiophene

Table 2: Natural Gas Available Range of Concentrations

Component	Available Range of Concentrations
Methane	64-100%
Ethane	1-8%
Propane	0.03-3%
iso-Butane	0.1-0.5%
n-Butane	0.1-0.5%
iso-Pentane	0.05-0.25%
n-Pentane	0.05-0.25%
neoPentane	0.05-0.50%
Carbon Dioxide	0.5-5%
Helium	0.01-10%
Hexane	0.02-0.2%
Hydrogen	0.01-10%
Hydrogen Sulfide	0.30-30%
Nitrogen	0.5-5%
Octane	0.005-0.05%
Oxygen	0.01-20%



Custom Natural Gas BTU Mixtures *(continued)*

MaxiTherm™ BTU Calibration Standards

Matheson proudly produces MaxiTherm™, the most advanced BTU calibration standard available today. If accurate, consistent BTU measurement is of the highest importance to you, you will appreciate MaxiTherm's™ features:

- BTU uncertainty of ± 1 BTU validated by both gravimetric process and analysis
- NIST NTRM Natural Gas Standards to calibrate analyses
- High resolution gravimetric preparation using Matheson's Research Grade hydrocarbons
- Certification accuracy $\leq 0.1\%$ for Methane and Ethane
- Certificates of analysis with documented traceability to NIST NTRM, NIST Weights, and GPA methods

MaxiTherm™ is available in a number of minor components, concentrations and cylinder sizes. Please contact Matheson for pricing and availability.

Number Of Components	Available Cylinder Sizes		
	1R Product Code	2R Product Code	1F Product Code
9	G2659009	G2659069	G2659070
10	G2659010	G2659071	G2659072
11	G2659011	G2659073	G2659074
12	G2659012	G2659075	G2659076
13	G2659013	G2659077	G2659078

Primary Grade

Matheson's Primary Natural Gas Grade is for users who prefer high resolution gravimetric process and concentrations plus analytical confirmation. Mixture specifications are patterned after MaxiTherm™, and component concentrations plus calculated BTU content are from the gravimetric component concentrations.

Primary Natural Gas Standards offer:

- BTU calibration uncertainty of < 1.5 BTU from gravimetric values
- Certification by NIST NTRM Natural Gas Standards
- High resolution gravimetric preparation using highest grade raw material
- Cylinder to cylinder reproducibility of ≤ 1.5 BTU
- Certificates of analysis with documented traceability to NIST NTRM, NIST Weights, and GPA methods

Number Of Components	Available Cylinder Sizes				
	1A Product Code	1F Product Code	1R Product Code	2 Product Code	2R Product Code
9	G2659127	G2659128	G2659129	G2659130	G2659131
10	G2659108	G2659109	G2659110	G2659111	G2659112
11	G2659113	G2659114	G2659115	G2659116	G2659117
12	G2659118	G2659119	G2659120	G2659121	G2659122
13	G2659123	G2659124	G2659125	G2659205	G2659126

UniTherm™ Grade

Matheson can provide up to one hundred identical natural gas standards containing hexane and lower molecular weight compounds. Identical standards ensure consistency of instrument calibration for pipeline analyzer applications. UniTherm™ Grade blends offer the following specifications:

- Homogeneous batches of 4 - 100 cylinders
- < 1.5 BTU uncertainty by dual certification
- NIST NTRM & gravimetric dual certifications
- Mixture preparation with UniBlend™ technology
- Batch homogeneity ≤ 0.7 BTU

Number Of Components	Available Cylinder Sizes					
	1R Product Code	2R Product Code	3R Product Code	6R Product Code	1A Product Code	1F Product Code
9	G2659079	G2659080	G2659081	G2659082	G2659083	G2659084
10	G2659085	G2659086	G2659087	G2659088	G2659089	G2659090
11	G2659091	G2659092	G2659093	G2659094	G2659095	G2659096
12	G2659097	G2659098	G2659099	G2659100	G2659101	G2659102
13	G2659103	G2659104	G2659204	G2659105	G2659106	G2659107



Custom Natural Gas BTU Mixtures *(continued)*

Gravimetric Grade

Matheson's Gravimetric Natural Gas Standards offer BTU quality without the premium pricing of our MaxiTherm™. Emphasis is on the gravimetric process without confirming laboratory analysis. Our Gravimetric Grade specifications are as follows:

- ± 2 BTU uncertainty
- Gravimetric preparation using highest grade raw materials
- Certificate of analysis emphasizes gravimetric weight traceability

Gravimetric Natural Gas Custom BTU Mixtures

Number Of Components	1A Product Code	1F Product Code	1R Product Code	Available Cylinder Sizes		3 Product Code	3R Product Code	6R Product Code
				2 Product Code	2R Product Code			
9	G2659194	G2659195	G2659196	G2659197	G2659198	G2659199	G2659200	G2659201
10	G2659162	G2659163	G2659164	G2659165	G2659166	G2659167	G2659168	G2659169
11	G2659170	G2659171	G2659172	G2659173	G2659174	G2659175	G2659176	G2659177
12	G2659178	G2659179	G2659180	G2659181	G2659182	G2659183	G2659184	G2659185
13	G2659186	G2659187	G2659188	G2659189	G2659190	G2659191	G2659192	G2659193

Certified Grade

Matheson's Certified Natural Gas Grades are engineered for less critical calibration requirements. Care is taken to ensure that each standard meets and exceeds the requirements established for Certified Grade material. Our Certified Grade's specifications are as follows:

- No BTU uncertainty provided (< 2 BTU is typical)
- Lab certification using NIST NTRM traceable lab standards
- Gravimetric or volumetric preparation
- Meets GPA raw material specifications
- Certification accuracy ± 0.2% for Methane and Ethane
- Certificate of analysis emphasizes laboratory concentrations
- Certification of Pipeline Natural Gas is available

Please request Matheson Technical Bulletin TB-360 and TB-362 for more information.

Certified Natural Gas Custom BTU Mixtures

Number Of Components	1A Product Code	1F Product Code	Available Cylinder Sizes			
			2 Product Code	3 Product Code	4 Product Code	6 Product Code
9	G2659156	G2659157	G2659158	G2659159	G2659160	G2659161
10	G2659132	G2659133	G2659134	G2659135	G2659136	G2659137
11	G2659138	G2659139	G2659140	G2659141	G2659142	G2659143
12	G2659144	G2659145	G2659146	G2659147	G2659148	G2659149
13	G2659150	G2659151	G2659152	G2659153	G2659154	G2659155

Contents and pressure will vary depending on components and concentrations.