Analysis of Natural Gas

Turnkey configurations for gas chromatographic analysis, including instrumentation, methods, supplies and service.
The process of collecting, processing, transmitting, and distributing natural gas yields an array of analytical needs. Samples from various points along the production train can differ significantly. Some are gas phase, others are pressurized liquids. Accordingly, the compositions of the samples are different, and each poses a unique analytical challenge. These different analytical challenges have resulted in a family of gas chromatograph configurations, each designed to meet task specific needs.

Important benefits ensured by our systems include:
• Reliability
• Speed of analysis
• Resolution between components of interest
• System flexibility
• Guaranteed turnkey operation

Agilent Technologies’ analyzers for natural gas and natural gas liquids are based on the 6890 gas chromatograph, with standard or customized subsystems and software optimized for this application.

A variety of chromatograph detectors is used, depending on the configuration. A thermal conductivity detector (TCD) is used to quantify all components in the samples at concentrations greater than 200 ppm. A flame ionization detector (FID) is used for the quantification of hydrocarbons from 10 ppm upward and in conjunction with a capillary column for maximum resolution. A flame photometric detector (FPD) is used for the quantification of sulfur-containing components in the 1 – 1000 ppm range. Some configurations employ multiple detectors operating simultaneously to quantify separate aspects of the same sample. This process gives flexibility to address a broad range of analytes using a single instrument. This also provides efficiency, by reducing analysis time via parallel separation trains.

We have broad expertise in these analyses, and extensive experience in valved gas chromatography, with standard and customized configurations. Our capability is complemented by the industry-specific experience of our partner, Wasson-ECE, Inc. All systems use Windows®-based software, with full data handling capabilities to facilitate communication within laboratory and plant-wide data systems.
Analysis Examples
This booklet contains some examples of specific analyzer configurations. Many more are possible, including the one that will fit your particular analytical needs.

Configuration Selector
This table lists the different sample components or analytes that are frequently quantified in natural gas and natural gas liquid samples, along with the various instrument configurations as identified by their respective Application Number. Other configurations are available upon request.

Industry Standards
Methods are compliant with current industry standards as approved by the following organizations:
- ASTM
- GPA
- ISO
- EN
- IP
- DIN

Contact your Agilent representative or authorized distributor for information about a specific method.

<table>
<thead>
<tr>
<th>Component</th>
<th>Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Methane</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td></td>
</tr>
<tr>
<td>i-Butane</td>
<td></td>
</tr>
<tr>
<td>n-Butane</td>
<td></td>
</tr>
<tr>
<td>i-Pentane</td>
<td></td>
</tr>
<tr>
<td>n-Pentane</td>
<td></td>
</tr>
<tr>
<td>C_6+ composite</td>
<td></td>
</tr>
<tr>
<td>CO_2</td>
<td></td>
</tr>
<tr>
<td>C_6 – C_12 Separated</td>
<td></td>
</tr>
<tr>
<td>O_2/Ar/CO/N_2 Composite</td>
<td></td>
</tr>
<tr>
<td>O_2/Ar Composite</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td></td>
</tr>
<tr>
<td>N_2</td>
<td></td>
</tr>
<tr>
<td>H_2S, % Level</td>
<td></td>
</tr>
<tr>
<td>Sulfurs, ppm</td>
<td></td>
</tr>
</tbody>
</table>
**System Configuration**

This system utilizes a TCD and packed columns to separate and quantify methane, ethane, propane, i-butane, n-butane, i-pentane, n-pentane, a composite peak of all hydrocarbons hexane and heavier (C₆⁺), carbon dioxide, nitrogen, oxygen/argon composite, carbon monoxide, and hydrogen sulfide. The minimum detection limit for any single component is 0.04%. Analysis time is less than 45 minutes. Customized reports containing calorific and physical parameter information are available.

**Natural Gas Application 192–00**

This application can be ordered for use with gas and/or pressurized liquid samples.

The strength of this application is its ability to separate oxygen from nitrogen. Since oxygen is rarely present in natural gas, analysts use the presence of an appreciable oxygen/argon content as a sign that the sample has been contaminated with air, and must be resampled to be accurate.
System Configuration
This system utilizes a TCD and packed columns to separate and quantify methane, ethane, propane, i-butane, n-butane, i-pentane, n-pentane, a composite peak of all hydrocarbons hexane and heavier (C₆⁺), carbon dioxide, nitrogen, oxygen/argon composite, carbon monoxide and hydrogen sulfide. An FID with a capillary column separates and individually quantifies the hydrocarbons from C₅ to C₁₂. Note that n-pentane can be used as the bridging component between the two detectors. The minimum detection limit for any single component on the TCD is 0.04%. The minimum detection limit for any single component on the FID is 10 ppm. Analysis time is less than 45 minutes; both the TCD and the FID chromatograms are produced simultaneously for efficiency.

A single, combined report results when ChemStation Ver. 6, or later, is used. Customized reports containing calorific and physical parameter information are available.

This application can be ordered for use with gas and/or pressurized liquid samples.

It has the ability to separate oxygen from nitrogen. Since oxygen is rarely present in natural gas, analysts use the presence of an appreciable oxygen/argon content as a sign that the sample has been contaminated with air, and must be resampled to be accurate.

N-paraffins and BTEX by Extended Natural Gas Analysis

Analysis of Natural Gas
Simple Natural Gas and Natural Gas Liquids
Plus Trace Sulfur Components

Application 241

System Configuration
This system utilizes a TCD and packed columns to separate and quantify methane, ethane, propane, i-butane, n-butane, i-pentane, n-pentane, a composite peak of all hydrocarbons hexane and heavier (C6+), carbon dioxide, nitrogen, oxygen/argon composite, and carbon monoxide, as well as an FPD with a capillary column to separate and individually quantify hydrogen sulfide, carbonyl sulfide, methyl mercaptan, and ethyl mercaptan. The minimum detection limit for any single component on the TCD is 0.04%. The minimum detection limit for any single sulfur component on the FPD is 1 ppm. Analysis time is less than 45 minutes; both the TCD and the FPD chromatograms are produced simultaneously for efficiency. A single, combined report results when ChemStation Ver. 6, or later, is used. Customized reports containing calorific and physical parameter information are available.

This application can be ordered for use with gas and/or pressurized liquid samples.

This system can also be configured per ASTM Method 6228 to analyze for odorants in natural gas and liquefied petroleum gases.

Trace Sulfur Contaminates by FPD

1. Methane
2. Ethane
3. H2S
4. COS
5. Methyl mercaptan
6. Ethyl mercaptan
This instrument utilizes a TCD and packed columns to separate and quantify methane, ethane, propane, i-butane, n-butane, i-pentane, n-pentane, a composite peak of all hydrocarbons hexane and heavier (C₆⁺), carbon dioxide, and air (nitrogen plus oxygen, argon, and carbon monoxide). The minimum detection limit for any single component is 0.04%. The C₆ component must be less than 25%. Analysis time is typically 20 minutes. Customized reports containing calorific and physical parameter information are available.

This application can be ordered for use with gas and/or pressurized liquid samples.
Industry-Specific Answers
Take advantage of the industry expertise that’s available to you from Agilent Technologies and our partners. We can provide the answer to your chemical analysis requirements.

Ask Agilent Technologies
Let’s talk about your analysis requirements for natural gas and natural gas liquids. Contact your Agilent representative or authorized distributor. Or for more information, visit www.agilent.com/chem. Help us help you analyze your world.

A Solution Partnership
Agilent Technologies’ channel partners complement our expertise in the hydrocarbon processing industry. Wasson-ECE is an Agilent Technologies Premier Solution Provider, a partnership that helps provide you with the most comprehensive analyzer solutions. Wasson’s expertise in producing innovative solutions to support the hydrocarbon processing industry will greatly complement Agilent Technologies’ products and knowledge.

Windows® is a registered trademark of Microsoft Corporation

© Copyright 2001
Agilent Technologies
January 26, 2001
5988-1942EN