Application Note: Verax™ Analyzer

Critical Data. Real Time.

Gas Plant Balancing

Introduction

Natural gas plant optimization requires detailed real-time analysis of multiple input and product streams, for a variety of reasons. The plant operating company may or may not own all of raw feed stock. Feeds may come from differing sources, and the operating contracts for product fluids may be different for varying sources. Also, the economics of operation are dependent on inlet compositions, flow rates, current prices on various spot markets, and contractual requirements on products.

From a processing perspective, raw inlet gas may be from nearby gas fields, be a product of another type of process, or be associated gas from oil field operations. Each has a different composition and may have different owners. During processing, the facility must be able to account for all compositional changes along the process and how it affects different owners, while also optimizing yields and cash flow.

The goal of plant balancing is to monitor the composition of all inlet and outlet gas and liquid streams and to determine the optimum operating conditions for the facility, which may change over time as the economic value of various products change.

Verax 75M Multi-Stream Analyzer

Gas Processing

There are a wide range of processing schemes employed in the natural gas processing industry. However, each is designed to attempt to remove more valuable products such as propane and butane from the main product or sales gas. This is especially true with the recent expansion of shale gas production in

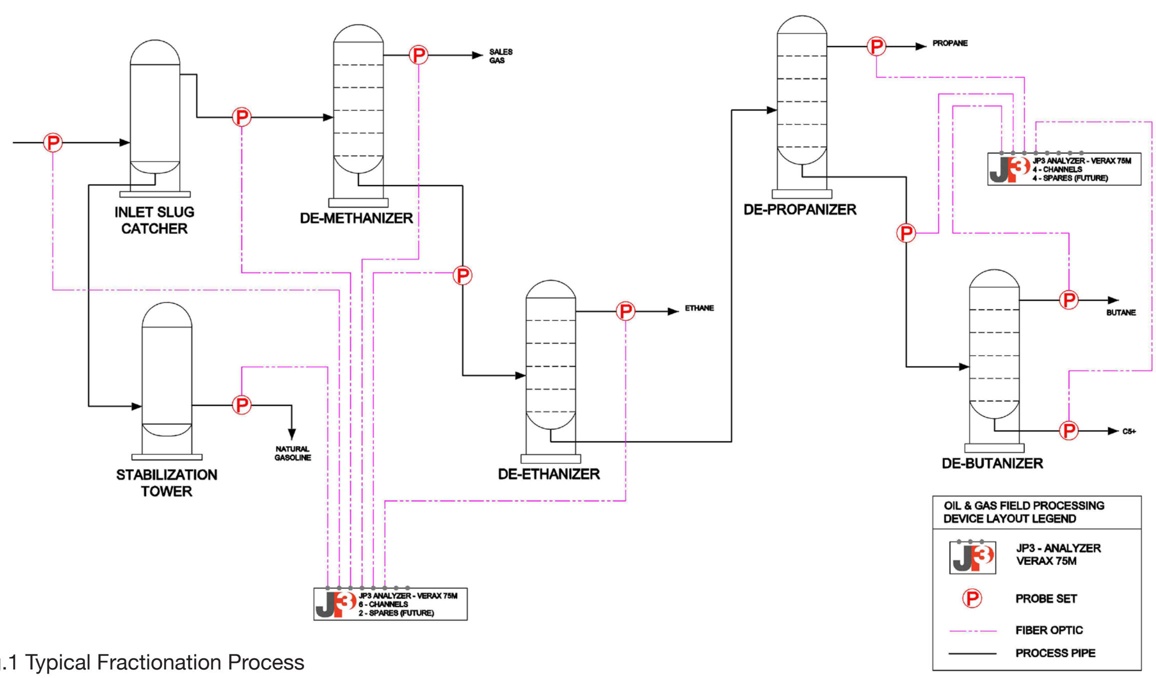


Fig.1 Typical Fractionation Process

North America, where rich natural gas reservoirs are often produced for their valuable liquid products.

Gas plants commonly fractionate the raw gas into sales gas, ethane, propane, butane and natural gasoline products. A typical processing facility might be laid out as shown in Fig.1. The Verax near infrared analyzer can support up to eight sample probes, each placed at various locations in the process to provide valuable analyses of the stream composition and product quality on a real-time basis. The sample points can be gas phase or liquid streams and a single analyzer can support both gas and liquid phase applications.

Compositional analysis (along with flow measurement) plays a critical role in allocating resources and revenue, optimizing plant performance, de-bottlenecking and maximizing economic payback from processing operations. Without reliable, actionable data, it can be difficult to achieve the maximum economic performance in an operating gas plant.

Engineering Economics

One of the first aspects of gas plant balancing is to account for various input streams and determine the compositional characteristics of these inputs. Streams may vary in the amount of heavier hydrocarbons present and these have a significant impact on the economic value. Such differences must be correctly accounted for to assign product yields according to suppliers and inlet feed streams.

Once the inlet streams have been mixed, the existing liquids are removed as NGLs or light oil fraction. These condensates are often stabilized by flashing off just enough of the light compounds to ensure that the final product meets pipeline specifications for vapor pressure, one of the many applications where the Verax excels in a gas plant.

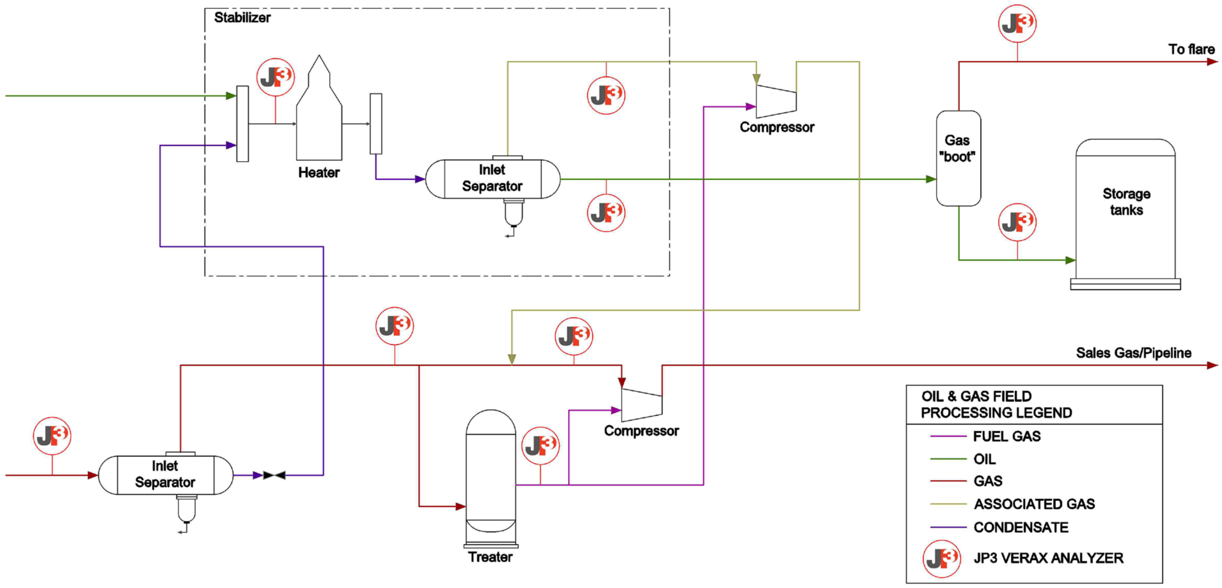
The gas then passes through a series of fractionation towers where various components are removed as final product, while others are transferred further along through the process. Incorrect operation of any stage of the process may result in reduced performance and yields. Such limitations may then result in reductions in overall plant throughput if one unit operation becomes the plant bottleneck. Critical performance parameters, such as how many light hydrocarbons are carried over in the condensate from the bottoms, or how many heavies are carried over in the lighter vapors at the top of the column, need to be monitored to ensure optimized performance.

Each tower must be optimized for performance, and the optimization criteria change for different products and economic criteria. For example, ethane market prices may be low, in which case it is beneficial to send as much ethane as possible into the sales gas stream to optimize BTU content of that product. In such a case it becomes important to have an analyzer which can measure the ethane content in the overhead vapor space of the de-methanizer and ensure the right amount is being allowed to slip.

In contrast, the propane product is typically more valuable than the ethane product, but is allowed to contain some ethane. In this case, the de-ethanizer may be operated to ensure the correct amount of ethane is inserted into the condensate bottoms and is sold into the product propane stream.

The ideal operating conditions may change as the value of each of the commodity products change with time. An ideal control system allows for compositional and physical property analysis of all the product streams and tower bottoms and allows the plant operator to monitor and optimize performance to maximize economic yield from the facility.

Verax 75 Single Stream Analyzer



Typical Gas Processing Plant

Solutions

The JP3 Verax process analyzer can be used to perform compositional analyses on all of the gas and liquid phase streams in a gas plant. The device is designed for field use, does not require a shelter and is designed for use in hazardous areas. The composition of each gas or liquid stream (C1-C9+), along with physical properties such as RVP, TVP, BTU, API gravity and others, are reported in a matter of seconds for each point throughout the plant.

As shown in Fig.1, a single Verax supports up to eight fiber optic-coupled system measurement points in the facility. Each fiber terminates at a field located sample cell, where the sample of gas or liquid is allowed to flow between two optical windows through which the infrared beam of light passes. The sample points are operated at line temperatures and pressures up to 1500 psi.

High Pressure Probe Set

The Verax performs real time measurement at each sample point, and all eight sample points may be cycled through in a manner of seconds. Each point generates compositional and physical property data which may be fed back to plant operations through a single Modbus connection.

Real time data analysis and results allow for optimization of the plant performance, calculating material balances, and facilitate de-bottlenecking operations and maximizing plant physical and economic performance by improving the control of towers, separators, and stabilizers.

Summary

The JP3 Verax is a quantum leap forward in both principle and application. Removing as many variables as possible from the analysis equation results in a solution that delivers more actionable information faster to the customer. Safety is also enhanced, as no corrosive, hazardous or combustible gases are transported to an enclosure or analyzer house. The bottom line also benefits from low to no maintenance costs and negligible infrastructure and utility costs.

Specifications: Verax 75M Analyzer

SPECIFICATIONS	
Fluid Streams (Max 8 per Analyzer)	Type: natural gas, NGLs, LPG, condensate, crude oil; Phase: liquid or gas
Composition & Property Analyses	C1-C6+ Mol% ±0.5% repeatability ; RVP & TVP ±0.5 psi ; API Gravity or BTU ±0.5% repeatability
Moisture(H2O)	>1%
Carbondioxide (CO2)	>1%
Sample System	None
Calibration Gas	None
Verification Fluid	Varies by application
Line Pressure	0-1500 psig
Line Temperature	-10°to 150°F
Line Flow Rate	1.0 gpm minimum; no maximum
Response Time	10-30 seconds per analysis point
Detection Method	NIR spectroscopy with inline optical probes
ELECTRICAL	
Input Power	3.5A @ 24VDC standard; 100-240 VAC optional
Communications	TCP/IP, MODBUS TCP and Serial (others available upon request)
Outputs	8 solid state relays for process control; 2 analog 4-20 mA /0-10 VDC outputs standard; configurable alarms/controls
PHYSICAL	
Enclosures	NEMA 4X IP 67 powder coated aluminum
Dimensions	Top Control Panel: 24”W x 30”H x 10”D; Bottom Control Panel: 24”W x 24”H x 10”D
Weight	Combined Top & Bottom Control Panels:90 lbs.; Probe Assembly: 5 lbs.
Ambient	-20°to 50°C (-4°to 122°F). No environmental control required; sunshade required if >90°F
Classification	Control Panel with Z-Purge: Class 1 Div2; Control Panel without Purge: General Purpose; Probe Assembly: Intrinsically Safe /Class 1 Div1

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