MODCON

BUTANE BLENDING IN GASOLINE

BEACON 3000
IN
GASOLINE BUTANE BLENDING

Gasoline consists of a blend of a broad range of different chemical compounds. Partially these are dissolved gasses, like C1—C4, partially these are higher and branched paraffins, and aromatics.

⇒ Each component contributes to the physical properties that are required for gasoline, according to the local standards that are mandatory at the place consumption.

⇒ Blending of gasoline with butane, is a common practice that is performed at refineries, blending stations and terminals.

⇒ Butane is a low cost by-product of crude oil distillation, which is partially sold at low cost as gas for heating purposes.

The RVP, Reid Vapor Pressure is an important factor in the combustion process of gasoline in vehicles. Especially in areas with high temperatures, the permitted RVP is easily achieved in summer periods, since liquid gasoline components contribute enough partial pressure to reach the required pressure properties. However, during the winter, poor cold weather drivability (CWD), is caused by engine misfires or poor combustion. As the CWD is negatively affected by cold weather higher RVP limits are required during cold months. Commonly, butane is used to increase the RVP in gasoline blends, especially during the winter season.

Each gasoline blending plant, in terminals or in refineries has the target to maximize the volumes of butane in gasoline without affecting its specification.

Why Butane Blending

Blending of gasoline with butane is a common procedure to increase the RVP. The desired volatility of a gasoline blend is entirely linked to the ambient temperature. In hotter climates, gasoline components with lower volatility than in cold climates should be used. In cold climates insufficient volatility results in cars failing to start. Excessive volatility in hot climates causes a “vapor lock”. Here combustion fails to occur, because in the fuel lines the liquid fuel changes into a gaseous fuel, that operates the fuel pump ineffectively and starves the engine of fuel.

Aside from affecting the engine performance, there is also a safety aspect connected to a low RVP. When the RVP is too low, a fire danger exists when gasoline vapor–air mixture in the gasoline tank reaches its flammability limits.

When the RVP is too high volatile components will increase the emission of unburned volatile compounds, having an environmental impact.

The US EPA (US Environmental Protection Agency) standards, European standards and other local regulations regulate the RVP limits of gasoline to be adapted during summer and winter seasons, while taking into account the geographical area and climate conditions.

Aside from the technological point of view, blending with butane has also a commercial aspect. In order to increase the profit of a terminal or a refinery, they are obliged to blend as much butane as possible into the gasoline blend.

The quantity of butane that is produced during crude oil distillation depends on the crude oil composition that is refined.

Excessive butane, that cannot be brought to the market as fuel, is combusted in refinery flares. Especially during the winter season the refineries and terminals are interested to blend highest possible quantities of gas in a gasoline blend.

In the summer season, due to its low boiling point and resulting high vapor pressure (52 psi), as compared to the other gasoline components, the butane concentration that is permitted in a gasoline blend is drastically reduced, also to prevent boiling of the gasoline.

RON and MON values of gasoline, are normally defined by local or international regulations. Predominately aromatics, iso-paraffinic compounds oxygenates contribute to increase the knock properties of gasoline.

RON and MON are reduced by the influence of butane in a gasoline blend. In many cases it is required to add octane boosting compounds to the final blend to adjust the knock properties within the required range.

Optimized Butane Blending

Optimized blending of gasoline requires continuous control of quality parameters to ensure that the gasoline complies with its required specification and is produced at minimum cost. Optimized butane in gasoline blending is dictated by a compromise between different quality properties that are mandatory for the final gasoline blend.

This requires various ASTM based process analyzers, such as density analyzers, RVP analyzers, Distillation curve analyzers and RON/MON analyzers to be installed on-line.

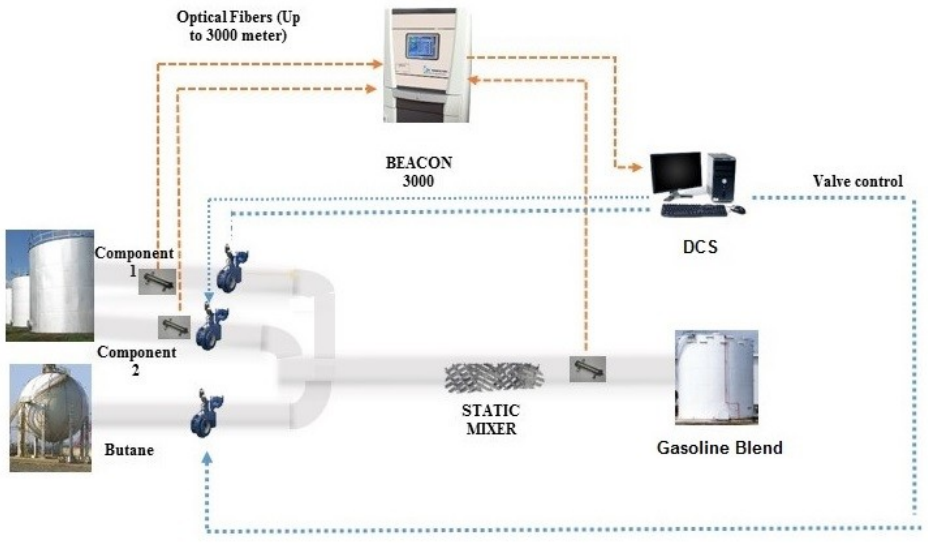
Alternatively, the Beacon 3000 NIR process analyzer has the capability to measuring this scope of different physical properties, also where butane is added to the gasoline. NIR process analyzer allows to measure these and other physical properties throughout the entire blending operation.

Incorporated FreeTune software guards the NIR measured properties to comply with measurements performed according to ASTM based methods.

In the DCS, a software will use the measured analytical data of the gasoline blend, like RVP, RON, MON, Density etc., before and after adding butane. Based on these data the maximized quantity of butane is calculated, that will provide optimized RVP at lowest cost. Simultaneously the system also calculates the required volume of octane booster that is required to maintain proper knock properties of the butane blended gasoline.

The fast response time of the Beacon 3000 NIR process analyzer forms the platform that allows immediately to correct any of the quality parameters by automatically opening valves and adjusting the feed whenever deviations within the specification occur, to prevent production of off-spec gasoline.

Valves that add butane or other components are opened and closed automatically according to the analyses to produce instantaneously only gasoline that complies with its specification.



BENEFITS

Advantage of the BEACON 3000 NIR process analyzer in Butane-Gasoline blending.

- ***Multiple quality property analyses*** by ***one single instrument*** and by ***one single measurement.***
- Each Beacon 3000 NIR process analyzer measures ***simultaneously up to 8 different process streams.***
- Analyzer measuring probes are ***intrinsic safe for Ex Zone,*** no electricity, no moving parts.
- Analyzer is connected to its measuring probes by ***telecommunication optical fibers, with a distance of up to 3000 meters.***
- Analyzer is ***located in the Safe Area***. Only ***measuring probes are in Ex Zone***. No need for expensive ATEX enclosure**.**
- ***Fast response*** allows immediate fine tuning of process feed-ratio between different components.
- ***Low Cost of maintenance***.

Modcon Systems' BEACON 3000 NIR Process analyzer provides a ***total solution for blending butane in gasoline***, at lowest cost and at maximum efficiency. This can be established by incorporation of the Beacon 3000 NIR process analyzer to analyze physical properties of raw materials and blend, to control and automatically adjust the flow rate of gasoline or its components and butane into the blender.

Even with today's extremely low prices of crude oil and refinery products, it remains still cost attractive to blend the highest possible amounts of butane in gasoline.

Depending on the annual volume of gasoline that is produced, optimized blending of butane and octane boosters in gasoline reduces RVP and octane giveaways annually by millions of dollars.

Azerbaijan
Heydar Aliyev avenue 74/17
Baku AZ 1033
Tel: +994-12-4189859
Fax: +994-12-4929859

United Kingdom
145-157 St John Street, EC1V 4PW
Tel: +44-207-5043626
Fax: +44-207-5043626

Россия
Перовская улица 61/2, стр. 1
Москва 111394
Тел.: +7 (495) 9891840
Факс: +7 (495) 9891840

USA
2000 Broadway Street, Suite #1203
San Francisco, CA 94115
Tel: +1-917-5916880
Fax: +1-360-2375906