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Refining Industry Isomerization Unit

Process Gas Chromatograph Application Note

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Light straight run (LSR) gasoline, which is mostly pentanes and hexanes, can have its octane number improved by the isomerization process which converts normal paraffins into their isomers. This results in a significant octane increase as normal pentane (nC_5) has an octane number of 61.7, while its isomer, isopentane (iC_5), has an octane number of 92.3. In a single-pass isomerization, the octane number of LSR gasoline can be increased from 70 to 84.

The isomerization process begins with the C_5 and C_6 feed mixing with the pentane recycle stream. The combined streams enter a deisopentanizer, which sends the iC_5 overhead to the gasoline blending pool. iC_5 is separated out immediately because it is nC_5 and nC_6 that isomerizes. iC_5 is already an isomer of nC_5 and does not isomerize. The iC_5 would only lower unit's capacity. The bottoms of the deisopentanizer containing nC_5 and C_6's are dried and hydrogenated. The bottoms stream is dried because HCl is present, which is used for maximum catalyst activity, and hydrogen is added to minimize carbon deposits of the catalyst.

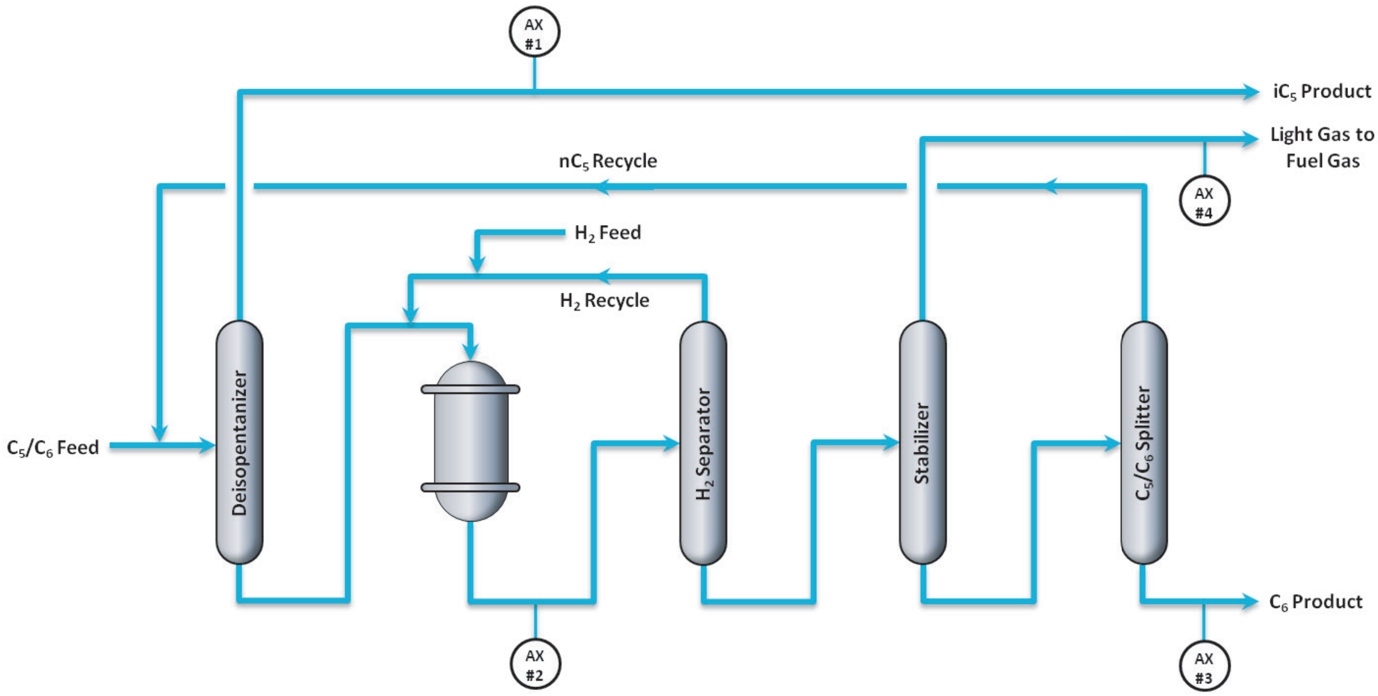
This stream is passed through the reactor to isomerize the hydrocarbons. After the reactor effluent has the hydrogen removed, it enters a stabilizer where the propane and lighter hydrocarbons are removed to be used as fuel gas. Finally, the reactor effluent enters a C_5/C_6 splitter that sends the iC_5 produced and the unreacted nC_5 back to the feed of the deisopentanizer. The bottoms product contains the C_6's and is sent to the blending pool. Occasionally, the C_6's are sent to an additional fractionator that separates the iC_6 from the nC_6 and the nC_6 is recycled to the front of the unit. This will increase the octane number by four.

Typical GC Measurements

The gas chromatographs used in this unit monitor the separation in the distillation towers and the reactor efficiency:

1. Reactor Effluent – monitors iC_5 and nC_5 to minimize losses of nC_5. This will maximize the conversion of nC_5 to iC_5.
2. Deisopentanizer – measures nC_5 so that reactor conditions can be adjusted to minimize nC_5 impurity in the product.
3. Stabilizer Tower Overhead – monitors iC_5 in order to minimize losses of iC_5.
4. C_5/C_6 Splitter Bottoms – monitors nC_5 in order to minimize losses of nC_5.

Isomerization Unit



Analyzer No.	Stream	Components Measured	Measurement Objective
1	Reactor Effluent	iC_5, nC_5	Maximize nC_5 conversion to iC_5
2	Deisopentanizer Overhead	nC_5	Minimize nC_5 impurity in the product stream
3	Stabilizer Tower Overhead	iC_5	Minimize losses of iC_5
4	C_5 / C_6 Splitter Bottoms	nC_5	Minimize losses of nC_5

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