

# 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

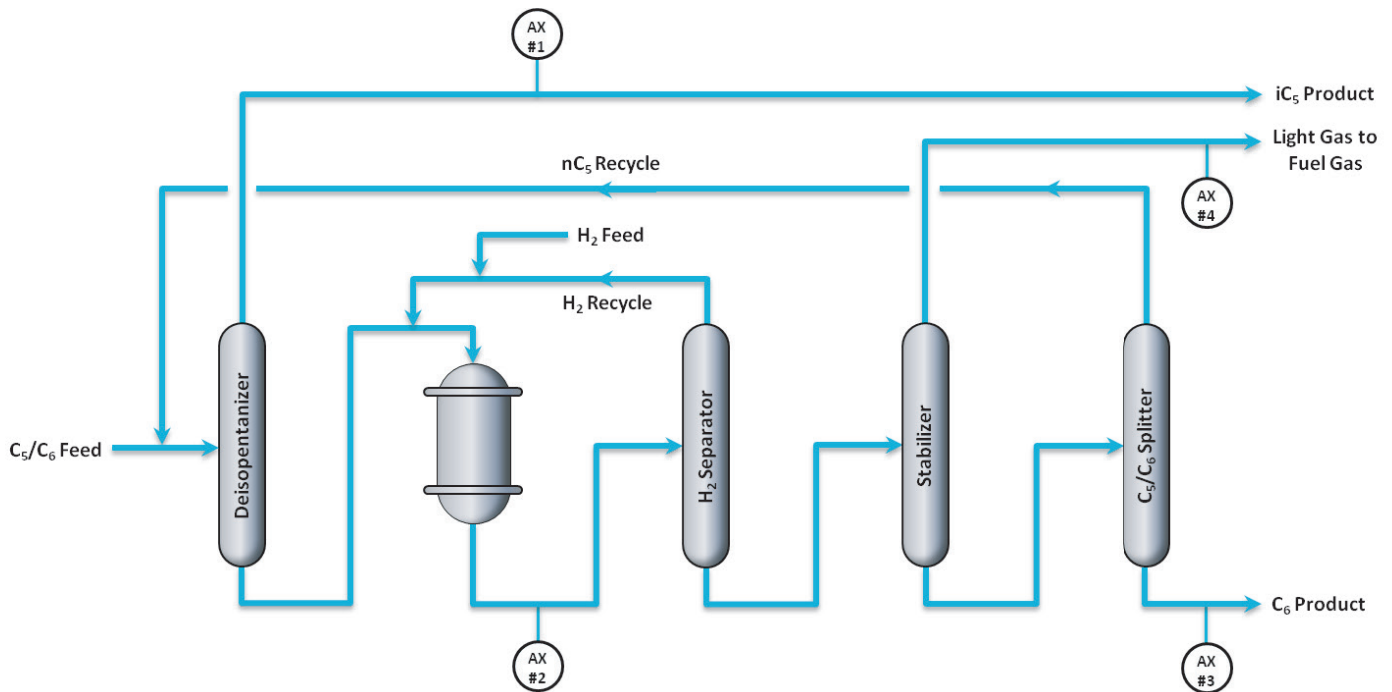
hydrocarbons are removed to be used as fuel gas. Finally, the reactor effluent enters a  $C_5/C_6$  splitter that sends the  $iC_5$  produced and the unreacted  $nC_5$  back to the feed of the deisopentanizer. The bottoms product contains the  $C_6$ 's and is sent to the blending pool. Occasionally, 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 <sub>5</sub> , nC <sub>5</sub>	Maximize nC <sub>5</sub> conversion to iC <sub>5</sub>
2	Deisopentimizer Overhead	nC <sub>5</sub>	Minimize nC <sub>5</sub> impurity in the product stream
3	Stabilizer Tower Overhead	iC <sub>5</sub>	Minimize losses of iC <sub>5</sub>
4	C <sub>5</sub> / C <sub>6</sub> Splitter Bottoms	nC <sub>5</sub>	Minimize losses of nC <sub>5</sub>

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