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 (nC₅) has an octane number of 61.7, while its isomer, isopentane (iC₅), 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 C₅ and C₆ feed mixing with the pentane recycle stream. The combined streams enter a deisopentanizer, which sends the iC₅ overhead to the gasoline blending pool. iC₅ is separated out immediately because it is nC₅ and nC₆ that isomerizes. iC₅ is already an isomer of nC₅ and does not isomerize. The iC₅ would only lower unit’s capacity. The bottoms of the deisopentanizer containing nC₅ and C₆’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 C₅/C₆ splitter that sends the iC₅ produced and the unreacted nC₅ back to the feed of the deisopentanizer. The bottoms product contains the C₆’s and is sent to the blending pool. Occasionally, the C₆’s are sent to an additional fractionator that separates the iC₆ from the nC₆ and the nC₆ 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 iC₅ and nC₅ to minimize losses of nC₅. This will maximize the conversion of nC₅ to iC₅.
2. **Deisopentanizer** – measures nC₅ so that reactor conditions can be adjusted to minimize nC₅ impurity in the product.
3. **Stabilizer Tower Overhead** – monitors iC₅ in order to minimize losses of iC₅.
4. **C₅/C₆ Splitter Bottoms** – monitors nC₅ in order to minimize losses of nC₅.
Isomerization Unit

<table>
<thead>
<tr>
<th>Analyzer No.</th>
<th>Stream</th>
<th>Components Measured</th>
<th>Measurement Objective</th>
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<tbody>
<tr>
<td>1</td>
<td>Reactor Effluent</td>
<td>iC₅, nC₅</td>
<td>Maximize nC₅ conversion to iC₅</td>
</tr>
<tr>
<td>2</td>
<td>Deisopentanizer Overhead</td>
<td>nC₅</td>
<td>Minimize nC₅ impurity in the product stream</td>
</tr>
<tr>
<td>3</td>
<td>Stabilizer Tower Overhead</td>
<td>iC₅</td>
<td>Minimize losses of iC₅</td>
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<tr>
<td>4</td>
<td>C₆ / C₇ Splitter Bottoms</td>
<td>nC₅</td>
<td>Minimize losses of nC₅</td>
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</tbody>
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