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Analytical Products and Solutions

Refining Industry
Catalytic Reformer Unit

Process Gas Chromatograph Application Note

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In the catalytic reforming unit of a refinery, the objective is to convert lower octane value naphtha into higher octane reformate that can be used for gasoline blending. The reformer unit is also a prime supplier of hydrogen for the entire refinery and in some refineries, the unit supplies the Benzene-Toluene-Xylene (BTX) for sales to chemical plants.

The typical feedstocks to catalytic reformers are heavy straight run (HSR) gasolines and naphthas from the crude unit. The reason these two cuts are primarily used is because the ease and probability of the proper reactions occurring increases with the number of carbon atoms in the molecules. However, if the stream is much heavier than HSR, then the reformer will be subjected to excessive carbon buildup on the catalyst.

The feed enters the feed fractionator where the pentane (C_5) and lighter components are removed overhead and the hexane (C_6) and heavier components leave out the bottom. The C_6 stream has hydrogen added to it and this mixture then feeds into a series of process heaters and reactors.

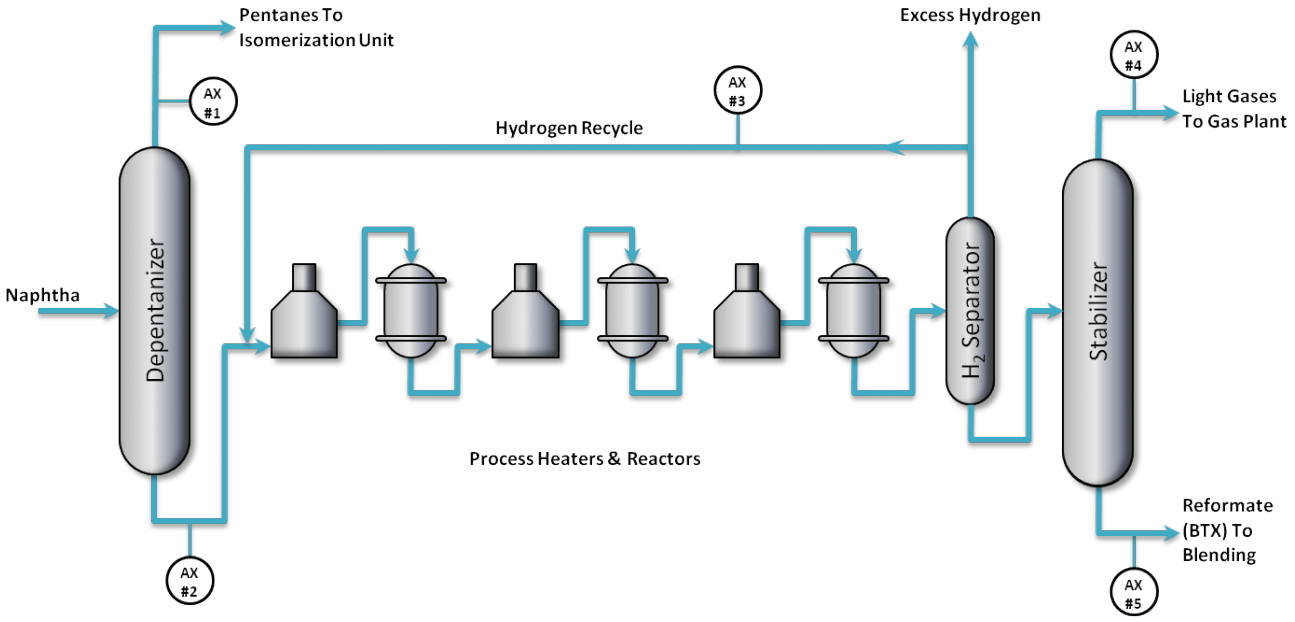
The basic purpose of the reactors is to reform the "straight chain" molecules into aromatic and branched aromatic molecules. For example, the reactors would convert the straight chain hexane into ring shaped benzene which has a much higher octane value.

There are four major reactions that occur. They are: 1) dehydrogenation of naphthenes to aromatics, 2) dehydrocyclization of paraffins to aromatics, 3) isomerization, and 4) hydrocracking. The first two reactions are the ones desired. These reactions also produce more hydrogen than they consume. Some of the hydrogen is recycled but the bulk of the hydrogen is available for other units in the refinery; i.e., the hydrocracker unit and the hydrodesulphurization unit.

After the hydrogen is separated out, the stream is sent to a stabilizer where butanes and lighter are separated from the reformate. The C_5 and lighter stream is sent to a gas plant or vapor recovery unit. The reformate is either sent to the gasoline blending pool for blending into gasoline or to the aromatics unit for purification of the Benzene, Toluene and mixed Xylenes.

The first two analyzers used in a reformer unit are used to monitor the purification of the naphtha feed to insure that only the C_5 and lighter components are stripped out without allowing any of the C_5 components into the reactors. The third GC monitors the purity of the hydrogen recycle stream that is being added to the feed to the reactors. The fourth analyzer monitors the overhead of the stabilizer to minimize the amount of aromatics that are carried overhead. The final analyzer is only used if the reformate is headed for an Aromatics Separation (BTX) Unit. In that case, it is important to know the levels of benzene, toluene and xylenes that are going to enter the BTX Unit for feed forward control or for mass balances calculations.

Catalytic Reformer Unit



Analyzer No.	Stream	Components Measured	Measurement Objective
1	Depentanizer Overhead	C_6	Minimize losses of C_6+
2	Depentanizer Bottoms	nC_5	Minimize light hydrocarbons in the reactor feed stream
3	Hydrogen Recycle	CO, CO_2, C_1- C_5	Monitor hydrocarbon impurities in the hydrogen recycle stream
4	Stabilizer Overhead	Benzene	Minimize losses of the aromatics in the overhead stream
5	Stabilizer Bottoms	Aromatics (BTX)	Monitor the purity of the aromatics (BTX) in the reformate stream

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