

Hydrotreater Advanced Process Control Improves Control of Product Sulfur Content, Reduces Fuel Gas and Hydrogen Consumption, and Extends Catalyst Life

Due to frequent changes in the compositions and charge rates of mixed middle-distillate streams, the final product sulfur content of a diesel hydrotreating unit was subject to major upsets, thereby jeopardizing the ability of the refinery to maintain final blended diesel within mandated sulfur specification limits. Control of this most important process variable was a constant challenge for the process operators and a source of major frustration.

Main Objective

An operations task force had identified lack of stable control of the hydrotreater–product sulfur content as one of the most bothersome operating problems in the refinery. Under “ultra low-sulfur diesel” operation mandates, the operators were forced to maintain a very low product sulfur content under normal operating conditions because of the high risk of severe off-spec excursions under upset conditions, particularly when increasing unit charge rate or the sulfur content of the feed. Consequently, hydrogen and fuel gas consumption was excessive, and catalyst operating conditions were severe. Maverick was challenged to develop a set of APCs that eliminated this source of operating inefficiency.

Customer Results

Operators are more than satisfied with the results. The operators’ attitude toward the effort went from, “You’re wasting your time—it can’t be done” to “I’m impressed—this is a significant improvement.”

Application Description

- This APC package consists of 3 separate controls working in integrated, cascade fashion to stabilize and regulate the product sulfur content (analyzer input with lab data updating), reactor weighted average bed temperature, and charge heater outlet temperature. There is an additional control to minimize heater–fuel gas consumption by maximizing product heat recovery.
- Feed-forward action is included for total charge rate changes, heater–inlet temperature changes and for changes in the mix of the streams being fed to the unit.
- Controller tuning is adaptive — tuning constants are adjusted as a function of unit charge rate.
- This set of controls is applicable to other hydrotreaters, such as gasoline hydrotreating units.



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