

Type PR Online Assurance Program

The Challenge: Today, refiners utilize the ebullated bed hydrocracking process to convert heavy residues and petroleum bottoms into saleable distillate products, thus maximizing plant throughput and equipment performance. Recently, a world class refinery experienced three upsets of their ebullated bed process within a period of five years. Because the refinery was operating with an unspared pump, as is customary in this service, the upsets resulted in 60 days of unplanned downtime, with significant production losses.

The Solution: The Flowserve Type PR Online Assurance program has been implemented at refineries in order to help diagnose these recurring problems within the ebullated bed hydrocracking unit. Utilizing the Flowserve Technology Advantage™ platform, the Type PR Online Assurance program combines equipment performance data acquisition with expertise and advanced diagnostics. This makes it possible for plant operators to not only detect system problems, but to take corrective actions to optimize the ebullated bed process. At the heart of this system is IPS APEX™, an intelligent monitoring, diagnostic and control device developed by Flowserve engineers.

After the installation was complete, the PR Online Assurance program quickly identified the problems and allowed plant personnel to take the necessary actions to improve overall unit performance.

The Type PR “Ebullator” reactor recycle pumping system operates in extremely demanding conditions. High-temperature, high-pressure feed is mixed with hydrogen and reacted within a catalyst bed that is “ebullated” by the Type PR system. This system includes the ebullating pump, variable frequency drive and oil injection pumps.

In the typical ebullated bed conversion process, refiners can potentially be faced with a wide variety of problems. Some of the more common problems encountered are:

- Carryover events: Solids in the catalyst bed enter the suction of the Type PR downcomer and impeller, causing an obstruction in the flow.
- Catalyst bed compression: Catalyst bed becomes filled with solids, causing a dead-head condition within the reactor vessel.
- Impeller jam: Large solids in the system lodge in the impeller inlet, causing it to stall.
- Improper lubrication: Oil condition deteriorates, or incorrect oil grade is used.
- Reverse rotation: Motor incorrectly wired at commissioning

- Gas holdups: Catalyst bed partially fills with trapped gasses, reducing flow through the unit.

Left undetected, these problems can result in decreased efficiencies, damaged equipment and the loss of millions of dollars in costly downtime.



Type PR Reactor Recycle Pump Installation

Recommendations:

As a solution to these harmful conditions, Flowserve has developed the PR Online Assurance Program, offering 24/7 monitoring of the reactor recycle pump. Together with IPS APEX data acquisition and diagnostics, this system:

- Acquires data from the pump and other components via its onboard, sensor-based monitoring and control system
- Analyzes data, diagnosing any problems using advanced algorithms developed by Flowserve engineers specifically for the PR ebullator pump
- Warns plant personnel of current or developing problems within the ebullated bed system or any of its components

Data is then transmitted to the Technology Advantage Web portal. This user-friendly tool allows plant personnel to monitor the ebullated bed unit operations via a secure system accessible from anywhere in the world.



Technology Advantage Web Portal

Results:

After the last pump repairs were made and the Type PR Online Assurance system installed, the refinery was able to:

- Optimize system efficiency
- Maximize productivity
- Reduce or eliminate downtime
- Minimize maintenance costs
- Execute timely implementation of upgrades
- Perform all of the above for minimum investment

Through the application of advanced technologies and with the cooperation of product and industry experts, users of the Type PR Online Assurance program can proactively manage every facet of the life cycle cost of ebullated bed process equipment. In doing so, customers can look beyond traditional equipment and aftermarket purchase agreements for alternative, value-based business relationships.



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