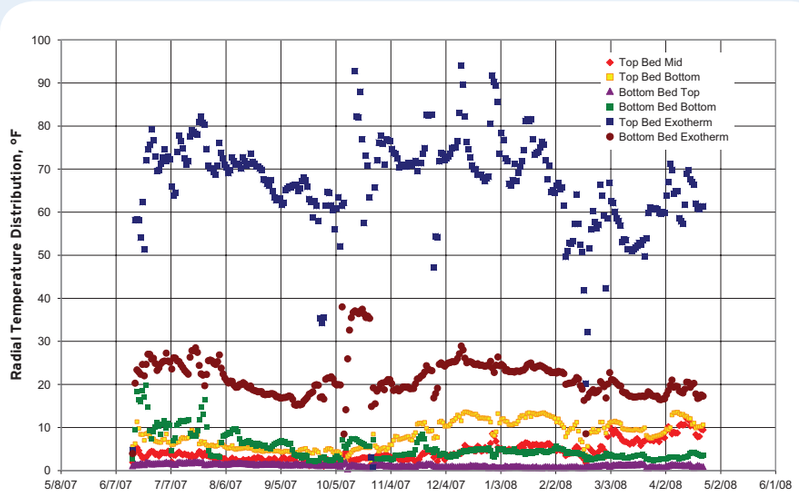
Commercial Grass Roots Installation:

ISOMIX®-e Performance – Radial Distribution and Bed Exotherms

The graph below is an example of challenging heat release management with the top bed exotherm at 70°F to 80°F (39°C to 44°C) and the second bed exotherm at 20°F to 30°F (11°C to 17°C). Despite the significant difference in bed exotherms, the bottom bed inlet (the purple triangles) radial DT is consistently around 2°F (1°C), while the bed outlet radial DTs were at about 10°F (6°C).

Figure 5: Two-bed reactor

ISOMIX®-e reactor internals performance exhibiting the radial DTs and axial catalyst bed exotherms.



CLG has spent more than 50 years developing refining technologies, catalysts and processes that enable refiners to transform the most difficult crudes into the cleanest, safest products possible. We continue to invest millions of dollars annually in research on ways to do it better. Working together we can help protect the environment around us.

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NEW!

Introducing

ISOMIX®-e

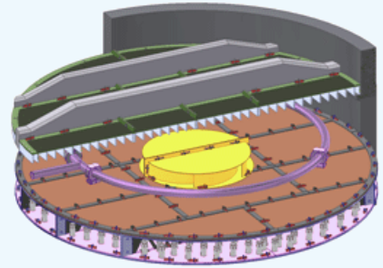
exclusively from Chevron Lummus Global

Chevron Lummus Global's extensive experience in reactor internals design has been setting industry standards for nearly two decades. Today's most innovative design, ISOMIX®-e, offers the following:

Maximum Catalyst Utilization. Data and simulations show a 15°F (8°C) activity advantage with state-of-the-art reactor internals, resulting in an increase in run length or unit throughput.

Safe Operations. Enhances ease-of-temperature management. When paired with proper catalyst selection and loading, the resulting uniform temperature distribution and mitigation of hot spots in the reactor serves to increase catalyst life, run length and operability.

Easier Maintenance. The use of wedge pin closures in ISOMIX®-e reactor internals makes it easier to maintain and provide optimum unit operating flexibility for faster installation, turnarounds and retrofits.



ISOMIX®-e utilizes an optimum truss system structure to support the internals components while the beams holding up the catalyst support panels are oriented upward to increase the catalyst volume.

Reactor internals development is an ongoing process led by Chevron Lummus Global engineers and scientists.

The development effort utilizes large and small cold flow models to test new concepts and to verify performance in large scale operations prior to reactor internals commercialization.

Chevron laboratories employ cold flow test equipment capable of testing the equivalent of a 10 MBPOD unit. Computational tools are then used to scale-up, model and verify reactor internal performance.

Chevron Lummus Global's (CLG) reactor internals development started in the 1960's with the advent of modern hydrocracking and continues to this day. CLG's development efforts resulted in sequential advancements in reactor internals:

- Chimney Trays
- Bubble Cap Trays
- Nautilus Trays
- ISOMIX®

This work has now culminated in state-of-the-art ISOMIX®-**e** reactor internals for fixed-bed hydroprocessing reactors.

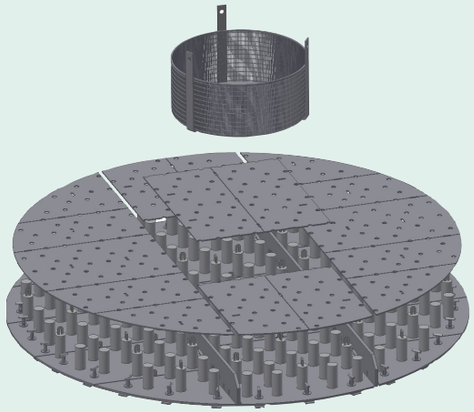


Figure 1: Inlet distribution basket and top nozzle tray assembly

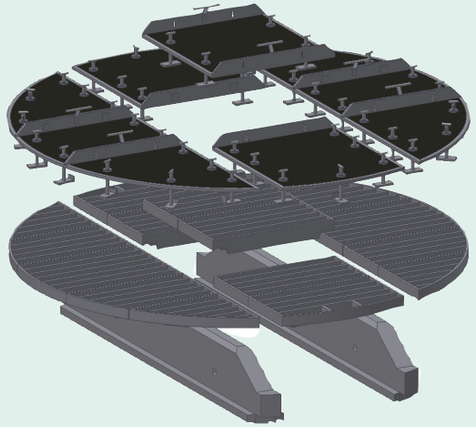


Figure 2: Advanced design features

The ISOMIX®-**e** top tray reactor internals utilize several advanced design features including an inlet distribution basket and a top nozzle tray assembly that promote ease of maintenance and facilitate optimum catalyst loading (Figure 1).

The advanced design features include wedge pins at screen splices for quick access through uncluttered manways. The wedge pins also facilitate the quick removal of the screen and grid panels (Figure 2).

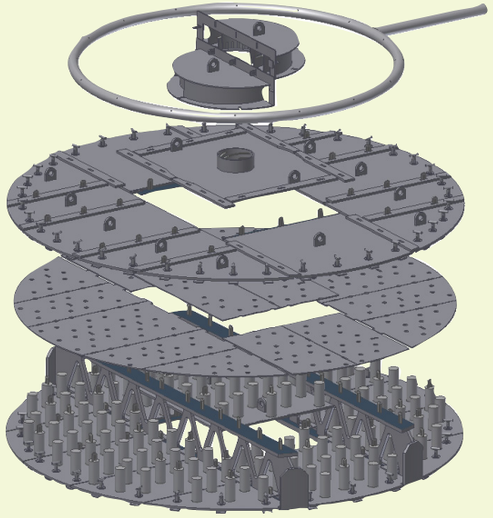


Figure 3: Interbed reactor internals

Similarly, the CLG ISOMIX®-**e** interbed reactor internals utilize several advanced design features that promote easy maintenance and excellent performance.

The interbed reactor internals employ wedge pin connectors throughout, and includes a two piece, lightweight mixing box. As with the top tray reactor internals, the catalyst support grid is supported by upward-oriented support beams with tapered ends. Thinner tray plates are used without the need for additional support hanger brackets or rods (Figure 3).

CLG's reactor internals offering also includes a low profile, state-of-the-art outlet collector (Figure 4). Both the interbed reactor internals and the outlet collector independently increase catalyst volume.

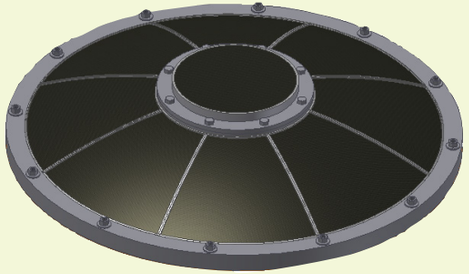


Figure 4: Outlet collector