HORIZONTAL SPLASH PLATES SHOWN TO DECREASE EROSION IN REFINERY SYSTEMS

Inclined Splash Plates and Erosion

For over 15 years, cyclone providers have been providing inclined splash plates on the bottom of primary cyclone diplegs to:

- deflect gas bubbles rising from the air grid away from the dipleg outlet
- promote some horizontal circulation in the bed for better catalyst regeneration

For this same period, there have been reports of severe erosion in primary diplegs, the crossover ducts to the secondary cyclones and in the upper section of the secondary cyclones in units with inclined splash plates on primary cyclone diplegs. These incidents indicate a higher than normal catalyst carryover to secondary cyclones caused by gas leakage up the primary diplegs and/or the creation of a dead zone in the bed in from of each dipleg due to catalyst discharging on only one spot.

When Buell first learned of the erosion described above (design by process licensor and provided by cyclone suppliers), the existing splash plate design was reviewed. Based on this review, Buell modified the original splash plate design:

- The arc of the opening was reduced from 210 degrees to 180 degrees. Since the catalyst was flowing in one direction, the opinion was that gases would leak into the dipleg in the 15 degree wide space past the 90 degree point on each side of the discharge centerline.
- Because the perimeter discharge area on inclined splash plates was much less than that of horizontal and conical splash plates previously used, the vertical height at the front of the opening was nearly doubled.
- The inclination angle of the plate was increased.

Buell Refinery Cyclones installed a number of cyclone systems with splash plates incorporating these design changes; however, when these units came down for scheduled turn-arounds, erosion patterns were observed similar to those of the original design.

Horizontal Splash Plates Replace Inclined Splash Plates On Primary Diplegs

Based upon this information, in units where superficial velocity exceeded 2.8 ft/s (0.85m/s) and the outside diameters of the primary diplegs were over 20 inches (500 mm), inclined splash plates were replaced with horizontal splash plates. Using the original horizontal splash plate design basis (outside diameter should be twice the outside diameter of the pipe), the splash plates were covering over 15% of the vessel cross-sectional area. A detailed analysis of the original horizontal splash plate design found that for larger diplegs the plate diameter could be less than twice the pipe diameter. Small diameter plates allow reduction of the covered cross-sectional area covered by the plates to less than 10% of the vessel cross-sectional area.

Successful Results

Inspections during several turnarounds of units in which inclined splash plates were replaced with horizontal splash plates revealed there is little or no erosion in primary diplegs, the crossover ducts to the secondary cyclones or in the upper section of the secondary cyclones.

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Buell® REFINERY CYCLONES
FISHER-KLOSTERMAN
A CECO Environmental Company

200 North Seventh Street, Suite 2
Lebanon, PA 17046
Deliveries to:
203 N. 5th Street

Phone: 717.274.7154
Fax: 717.274.7342
buell@fkinc.com
www.buellrefinery.com

CECO Environmental

CECO Environmental Corp.
3120 Forrer Street
Cincinnati, OH 45209
Phone: 513.458.2600
Fax: 513.458.2647
Toll Free: 800.333.5475
cecoenviro@cecoenviro.com
www.cecoenviro.com
NASDAQ: CECE