

## ADVANTAGES OF SINGLE STAGE CYCLONES IN A HIGH EFFICIENCY COMBUSTION REGENERATOR

- **Performance** - based on the performance of single stage cyclones, which replaced two stage cyclones, in Reactors with the "elephant trunk" risers similar to the risers in Combustion Regenerators, cyclone losses will be reduced.
- **Initial Cost** - the material cost of 8 single stage cyclones is about 2/3 the cost of 8 two stage cyclones (16 cyclones). There will be an even greater savings in the installation cost, because there are only 8 cyclones to install. The elimination of need for support nozzles in the vessel head and the elimination of the need to increase the vessel height 5 feet are additional cost savings.
- **Maintenance Costs** - The need to inspect 8 cyclones, instead of 16 cyclones, during each turnaround will reduce inspection costs and the time required for inspection. In a two stage system, most maintenance is required in the second stage cyclones. By eliminating the second stage cyclones, 2/3 or more of the maintenance costs are eliminated.

## Disadvantages of Single Stage Cyclones in a High Efficiency Combustion Regenerator

- **No backup for high losses from the first stage cyclones** - the reality is that any cause of significant high losses from first stage cyclones in a Combustion Regenerator will force a unit shutdown, because second stage diplegs will not be able to discharge the high additional catalyst loading. The first or single stage cyclone diplegs are sized to discharge an inlet catalyst loading that is 2.5 times the normal loading.
- **High losses due to deaerated catalyst in the diplegs during startup** - this has been a problem in units, mostly Reactors, when the diplegs discharged through trickle valves. Except for one or two cases where valves did not operate properly, Buell Refinery Cyclones is not aware of problems where diplegs discharge through counterweighted valves. Operation of Buell Refinery Cyclones 45 degree counter weighted valves to date indicate that both flow and valve sticking problems have been eliminated.

## Combustion Regenerators with Single Stage Cyclones

Buell Refinery Cyclones is aware of four currently operating units, two of which are Buell Refinery Cyclones units. One of those systems is in the Regenerator in the Valero Texas City Refinery. There is also a single stage system for another Combustor Regenerator. The cyclones in the Texas City Regenerator are a more efficient design than the cyclones in the other 3 operating units. The single stage cyclones offered for the Paulsboro Refinery are a more efficient design than the cyclones in the Texas City Refinery.

Fifteen or more single staged systems have been installed in Reactors where the riser discharged into the vessel. While the losses from these systems were low, most have been replaced with short contact systems.

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# Buell®

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