Innovative Advancements in Delayed Coking Equipment

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Technology Applications

- Isolation Valves
- Drill Stem Guide
- Blowout Diverter
- Cutting Tool Enclosure
- Auto-Switch Coke Cutting Tool
- Top Unheading Valve
- Retractable Center Feed
- Bottom Unheading Valve
- HPU and Controls

Image courtesy of FlowServe
Traditional Unheading
DeltaValve’s Unheading Solution

Fully Automated Bottom Unheading Valve
DeltaValve’s Unheading Solution

Fully Automated Bottom Unheading Valve

- Safe: operate the valve from a remote location
- Fully automated: unhead/rehead with the push of a single button
- Simple design: one major moving part
- Totally enclosed from the top deck through to the discharge chute
- Ultra tight seal
- Smallest overall footprint of any bottom unheading valve worldwide
DeltaValve’s Unheading Solution

Fully Automated Bottom Unheading Valve

- Over 350 bottom unheading valves in 20 countries worldwide
- Over 14 years installed service
- In excess of 1,500,000 combines cycles
- Zero recordable injuries
- Zero incidents
- No downtime

Most preferred fully automated coke drum bottom unheading valve worldwide
Bottom Unheading Valve

Electric Actuation

• Designed to replicate the performance of the hydraulic actuator used on the DeltaValve’s bottom unheading valve
  – Max load of 750,000 lbf.
  – 3 minute or less stroke time
  – Minimize physical size to near that of the hydraulic cylinder
  – Reaction bearings integrated into gear reducer for compact package
  – Based on Planetary Roller Screw Technology
Electric Actuation

• What is a Planetary Roller Screw?
  – First Developed in the 1950’s
  – Very low friction
  – Highly efficient (>90%)
  – Very high load (15x a ball screw)
  – Very long, predictable life, able to be calculated using bearing theory L10 calculations
  – Based on 24 hour cycle and actual field data life is 18-36 years!
  – Can be operated at very high speeds (up to 6000 RPM)
    • Used extensively in critical demanding applications
    • Under sea valves and mechanisms for the oil and gas industry
    • Down hole drilling applications
    • High speed passenger train tilting mechanism
    • North Sea oil drilling platform stabilizers
Electric Actuation

• Reliability
  – Screw and gear reducer designed for a minimum seven year life
  – One open, one closed stroke daily 365 days a year
  – Minimal maintenance required
  – Change lube oil once per year
  – Fully sealed housing, to prevent contamination and optimize lubrication

• Backward compatibility
  – Compatible with all previous hydraulically operated bottom unheading valves
Delayed Coking

Side Feed Entry
Delayed Coking

Typical Side Feed Injection

• Side feed entry has contributed to:
  – Localized hot spots
  – Higher rates of temperature change with a negative impact on fatigue life of affected drum sections
    • Lower transition cone
    • Drum wall
    • Coke drum support skirt
  – Perimeter channeling against the drum wall, causing:
    • Unsteady coke drum during feed
    • Drum tilt (banana effect)
    • Top head steam geysers, blowouts
Initial design objectives were to provide:

- Same flow properties and benefits as bottom feed
  - Better flow channeling
  - Reduction of hot spots
  - Reduced rate of local temperature change
  - Improved fatigue life
  - Improved top head process safety
- High reliability
- Simple cost effective installation
- Easy removal for maintenance during turnarounds
- Low cost of operation and maintenance
- Total isolation of feed line from solids during drum cutting
Coke Drum Side Feed Analysis

The simulations represent the beginning of the coking process when vapor is injected into an empty drum. Flow impinges upon the drum wall.

The diagrams show the distribution of flow rates, with values ranging from $7.22 \times 10^{-3}$ to $8.32 \times 10^{1}$. The color scale indicates the intensity of flow, with red representing the highest values and blue the lowest.
Coke Drum Center Feed Analysis

Consistent central flow

The simulations represent the beginning of the coking process when vapor is injected into an empty drum.
DeltaValve Retractable Center Feed Injection
DeltaValve Retractable Center Feed Injection
• Nozzle design results in a well centered feed stream
• Better thermal distribution during feed results in:
  – Maximizing coke-drum life and minimize down-time and repairs
  – Minimizing pressure spikes during quench cycle
  – Does not require flush water to keep feed-line clean during cutting
  – Improving top head safety by minimizing blowouts and geysers
  – Reducing local hot-spots

• First installation in October 2011
  – 7 units have been installed
  – 18 units in production
  – 43 units in proposal stage
DeltaValve’s Solution

Coke Drum Top Unheading

- Fully automated
- Totally enclosed
- Single gate design
- Two independent floating seats
- Valve remains sealed in the event of HPU power loss or actuator failure
- Steam purged valve body
  - Regulates valve body temperature
  - Creates barrier against coke migration into the valve
  - Used for diagnostic trending
- Actuation
  - Electric
  - Hydraulic
DeltaValve’s Solution

Cutting Tool Enclosure/Drill Stem Guide

- Protects operators/equipment in the event of coke drum top head blow-out
- Contains auto-switch coke boring/cutting tool
- Correctly aligns drill stem
Auto-Switch Cutting/Boring Tool

- Heavy duty sealed nitrogen spring, helically splined switch mechanism
- Adjustable switch pressure 13.8b – 27.6b (200 – 400 PSI)
- Nozzles are optimized for each pump pressure and drum diameter combination
- Standard with flange lock top flange
- Adaptable to any connection
- Competitively priced
Isolation Valves for DCU Service
• Design Overview
  – Double block and purge isolation
  – Static purge for ultra low purge steam consumption
    • 0.2 lbs. per hour per inch of diameter
  – Fully bi-directional isolation
  – Dual, live loaded, self cleaning metal seats
  – Fully in-line serviceable
    (valve removal is not necessary for maintenance or repair)
  – Available in lugged and standard B16:10
double flanged face to face configurations
  – Available in two seal configurations
    • GV851 – Open Body Cavity
      – For use in clean service; water, steam, vapors, etc.
    • GV852 – Sealed Body Cavity
      – For use in dirty service; solids, high temperature, etc.
Model GV852 – Sealed Body Cavity
- Fully sealed body cavity at all times
- Zero cross valve leakage with purge
- Designed for continuous static purge
- Can be tested in partially open position
- Seats extend into lower bonnet
- Seat extensions:
  - Cover both surfaces of gate over full stroke
  - Fully live loaded and purge pressure assisted
  - Ground and polished to valve seat tightness
DeltaValve Isolation Valves – Model GV852

- **Recommended DCU Service**
  - Overhead vapor to blow down
  - Overhead vapor to fractionator
  - Hydrocarbon liquids/vapor bypass to fractionator
  - Manifold isolation valve
  - Coke condensate
  - Drain to coke pad
  - Wax tailings/steam
- **For Use In**
  - Hydrocarbon liquids near coking temperature
  - Solids laden hydrocarbon liquids
  - Dirty hydrocarbon vapor streams
  - On/off, throttling service
DeltaValve Isolation Valves

- Top Entry / In Line Serviceable
  - All internal parts accessible while installed
  - Easy disassembly and re-assembly
  - No special tools or equipment required
  - Optional maintenance jib
Actuation Options

- DeltaValve isolation valves for DCU service are available with the following actuation options:
  - Electric
  - Hydraulic
  - Electro-hydraulic
  - Manual
- DeltaValve recommends Planetary Roller Screw (PRS) for the electric actuation option.
Thank You

Questions?