Retractable Center Feed Injection Device

Creates Centralized Flow Patterns
to Minimize Drum Movement
and Associated Stresses

Fully Retracts During
Cutting Operations

DeltaValve

Delayed Coking Products and Services

Bottom and Top Unheading Valves

Retractable Center Feed Injection Devices

Auto-Switch Boring/Cutting Tools

Isolation Valves

Aftermarket / Field Services

EPC Management

The Value of a Trusted Partner

DeltaValve

DeltaValve's extensive experience in designing and building engineered severe-service industrial valves and equipment for delayed cokers has made us a world-recognized industry leader. In 2001, DeltaValve designed, engineered, and installed the world's first fully automated, fully enclosed coke drum unheading valve at the Chevron refinery in Salt Lake City, Utah. This valve revolutionized coke drum unheading by replacing traditionally unsafe and unreliable manual or semi-manual unheading equipment, with a fully automated system. The result has been a safer working environment, reduced downtime, and increased productivity.

Today we offer a full range of products for delayed coking including bottom and top coke drum unheading valves, isolation valves, hydraulic and electric actuation, controls and interlocks, auto-switch coke cutting tools and enclosures, and the retractable center feed injection device. We listen to our customers and strive to provide innovative products that are designed and engineered to meet the critical service requirements of delayed coking.

DeltaValve is a trusted partner; delivering safe, reliable products while providing the best value for our customers. From the moment a customer contacts us, through delivery, installation, and beyond, we are there to provide unparalleled products, service, and support. We continually strive to make our products and services "Best in Class."

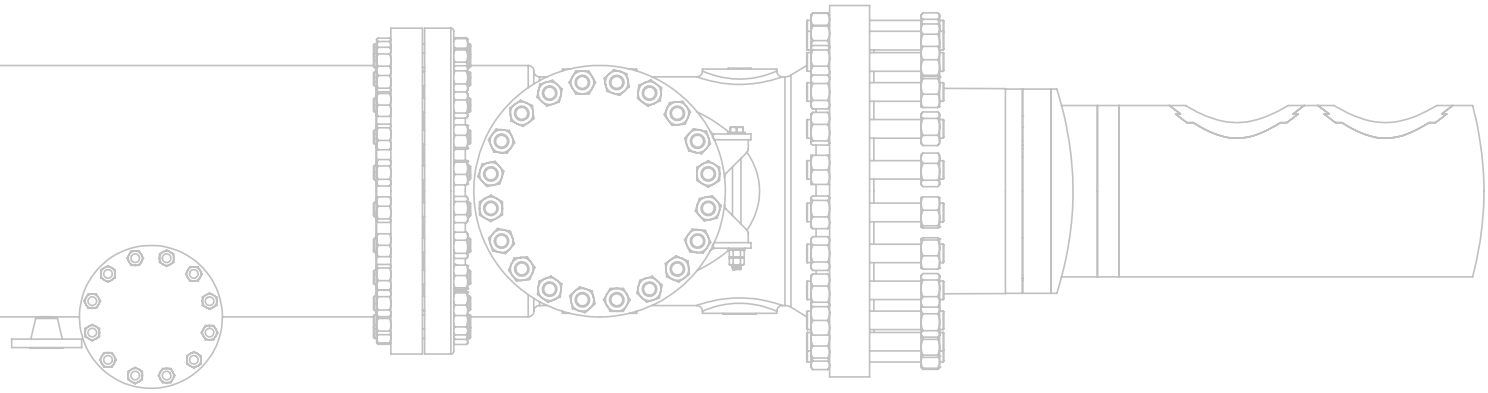
Retractable Center Feed Injection

The introduction of DeltaValve's fully automated coke drum unheading valve in 2001 necessitated the development of side feed entry into the coke drum. No longer was it possible to feed resid into the coke drum through the bottom flange as was standard with traditional manual or semi-automated unheading systems.

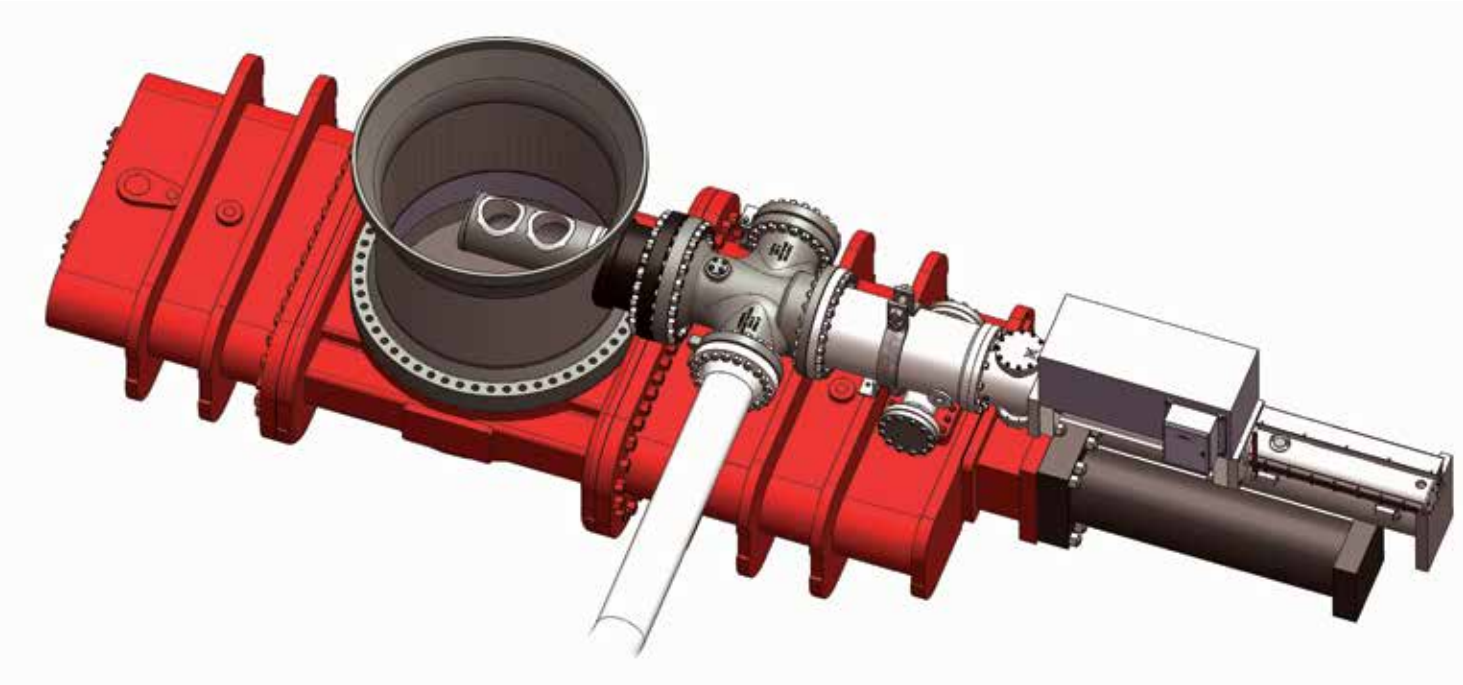
Over the years, various styles of side feed entry technology emerged: single inlet, dual inlet, and others, some with straight feed lines, or angled/curved feed lines, each netting different resid flow pattern results. Questions began to arise in the industry about how new side feed flow patterns compared to the traditional bottom center feed flow patterns. Additional questions were raised regarding the impact on the coke drum wall opposite the side feed inlet. Always the innovator, DeltaValve evaluated these issues and developed the retractable center feed injection device.

Compared to feeding resid directly from the side, independent studies have shown that feeding into the drum directly up the center may contribute to a reduction in overall drum stresses, formation of local hot-spots, and top head blowouts. These theories are based on center feed analysis data which indicates that center feeding develops more centralized flow channels which improves quench water distribution. Improved flow channeling can produce shorter quench cycles while minimizing the thermal stresses experienced by the drum walls. In addition to the safety benefits, the retractable center feed injection device is engineered to maximize coke drum life and minimize downtime and maintenance.

The retractable center feed injection device combined the necessity of side feed entry with the desired results of traditional bottom center feed systems. Data from installed units has confirmed significant improvements in thermal distribution and thermal transients. Additionally, operational data has confirmed improvements to drum movement, drilling profiles, quench times, and structural vibration. In summary, this translates into a significant extension of the calculated operational life of coke drums.



Engineering and Design

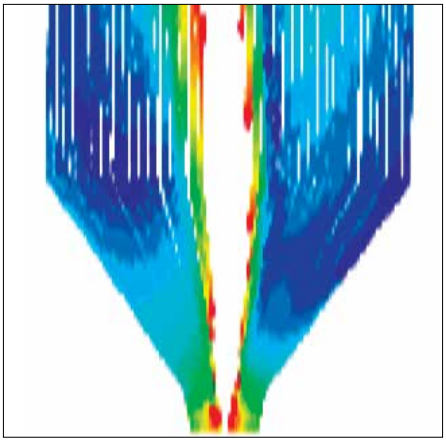


- **Fully Retractable:** The center feed nozzle assembly extends into the center of the coke drum and retracts completely out of the drum during cutting operations.
- **Engineered Nozzles:** The nozzles are designed to direct flow upward into the center of the coke drum, reducing or eliminating hotspots, top head blowouts, and drum distortion.
- **Space Saving Connection:** The retractable center feed attaches to the side of the coke drum spool directly above the unheading valve with a bolted flanged connection.
- **Feed Line Versatility:** To conform to refinery standards, the feed line connection flange can be configured to accommodate any size feed line from 6 to 18 inches.
- **Easy Internal Inspection:** There are three clean-out ports on the center feed; one opposing the feed inlet and two on either side of the device allowing for quick inspection of the internals.
- **Multiple Actuator Options:** Depending on the desired configuration, the center feed can be supplied with either electric, electro-hydraulic or hydraulic actuation. These options allow full flexibility for specific refinery standards.
- **Safety Features:** The center feed is fully enclosed, inherently safe, and comes standard with a visual position indicator, positive lockout with sensors, and full safety interlocks.

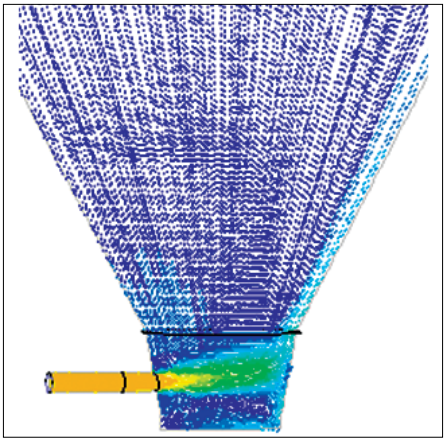
Feed Nozzle Configuration

At the heart of the DeltaValve retractable centerfeed injection device design is the dual nozzle configuration through which feed enters the coke drum. Significant effort was required to engineer these nozzles to replicate or even improve flow patterns of a bottom feed configuration. A test site was selected where the temperature, pressure, flow parameters, viscosity, specific gravity, and other physical properties of the feed stock were identified. This information was used to construct a kinetic model of the feed stock to determine its fluid properties (vapor phase) at the point of entry into the drum.

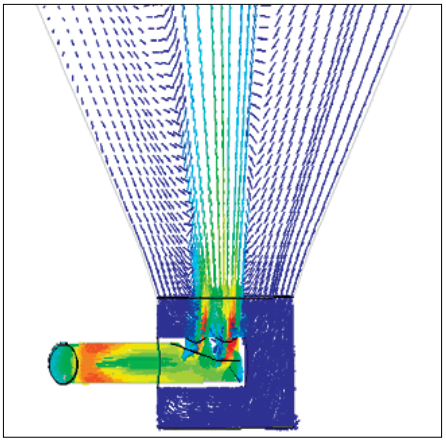
The calculated fluid properties were introduced as a boundary condition into a computational fluid dynamics model for the purpose of designing and analyzing various geometric configurations of the flow nozzles. The object of the analysis work was to arrive at a nozzle configuration which would deliver the flow of feed into the drum at its center line with a similar or improved flow stream distribution pattern as compared with traditional bottom feed entry.



Traditional Bottom-Feed



Traditional Side-Feed

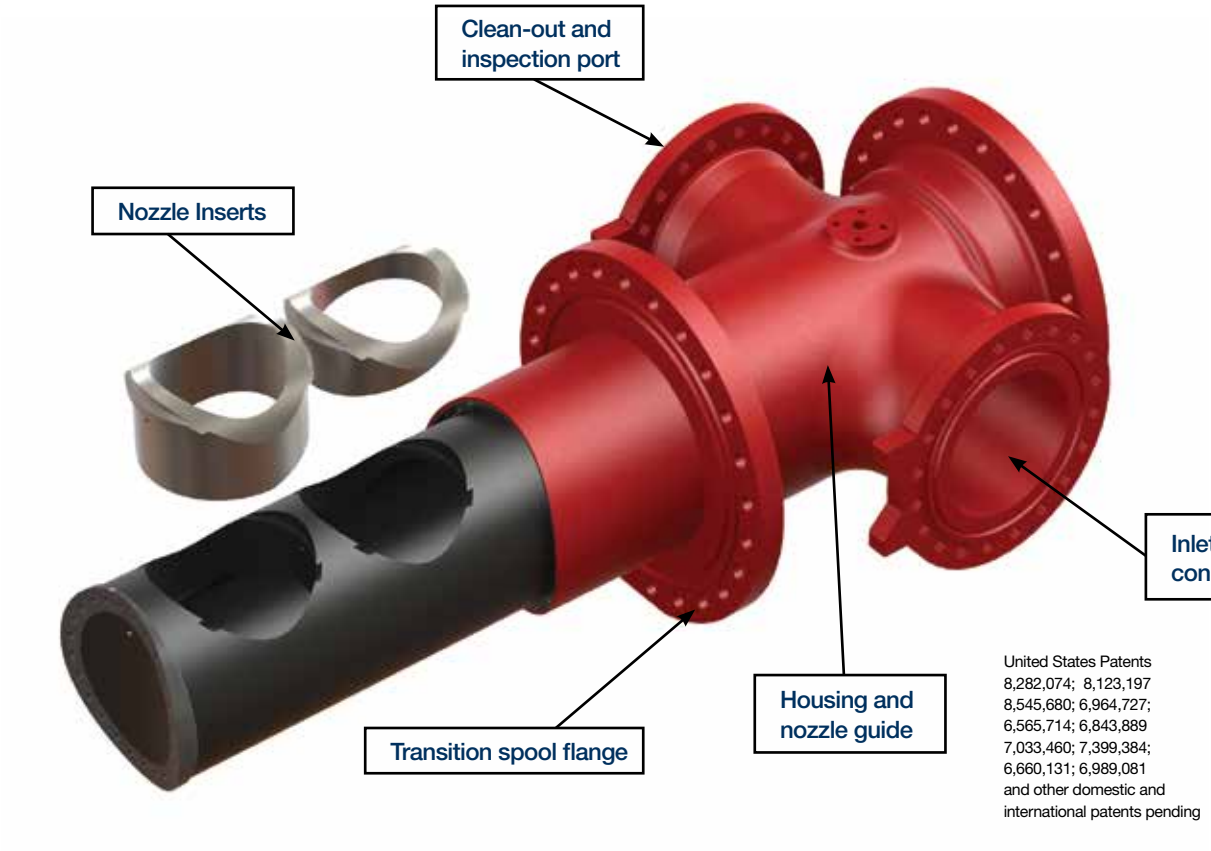


Center-Feed Injection

Nozzle Design

The specific geometry of each of the two nozzles has been highly engineered to efficiently direct flow upward into the center of the drum, and numerous computational fluid dynamic studies were performed to optimize this geometry. It has been noted that no change to flow trajectory is observed when experiencing varying fluid properties.

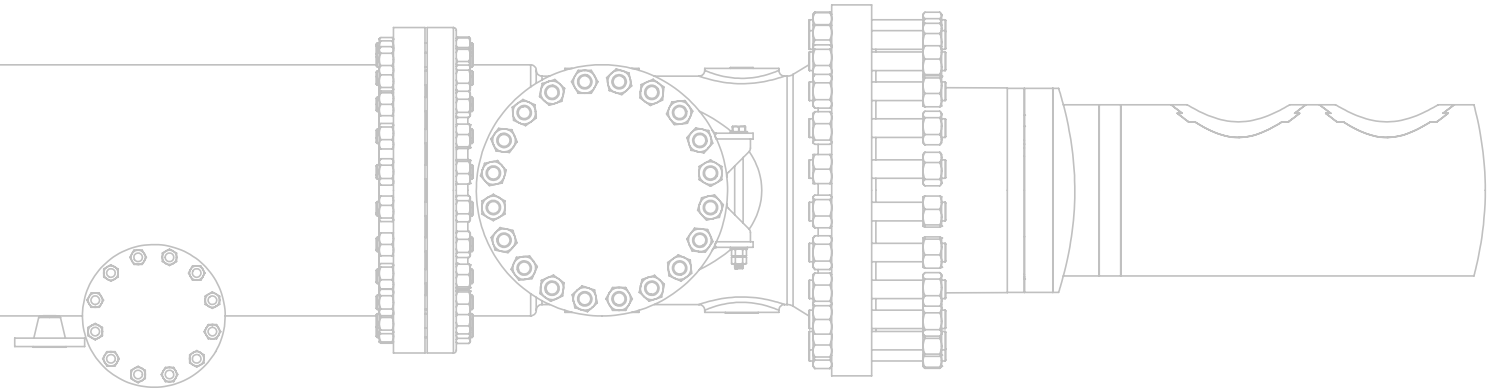
The inner diameter of the nozzle matches the inner diameter of the piping from the furnace to the drum, allowing for consistent flow through the center feed injection device. In the extended position, the nozzle assembly is sealed by a spring loaded dynamic seat which uses the same sealing principals as DeltaValve's unheading valves.



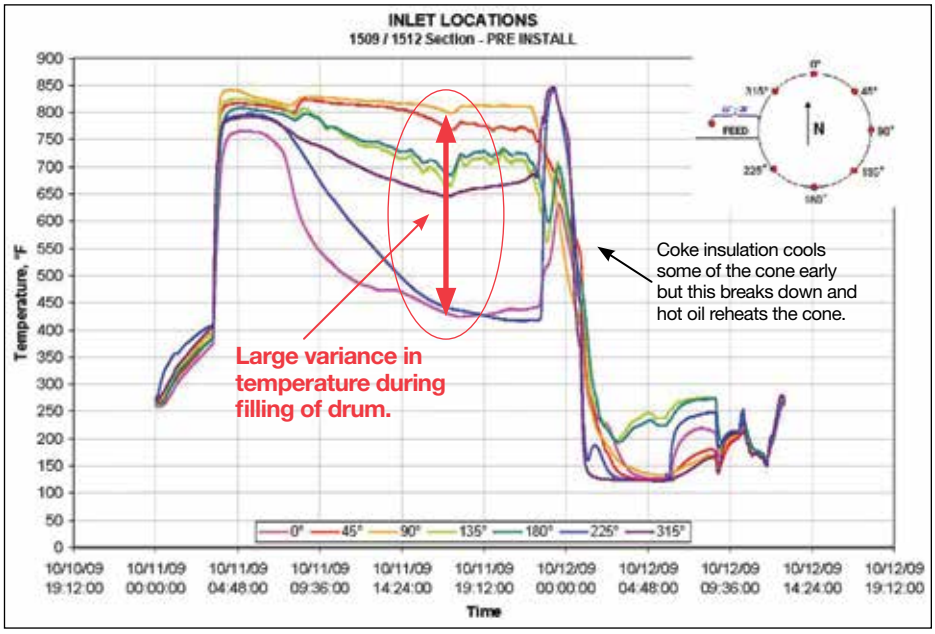
United States Patents
8,282,074; 8,123,197
8,545,680; 6,964,727;
6,565,714; 6,843,889
7,033,460; 7,399,384;
6,660,131; 6,989,081
and other domestic and
international patents pending

Product Testing

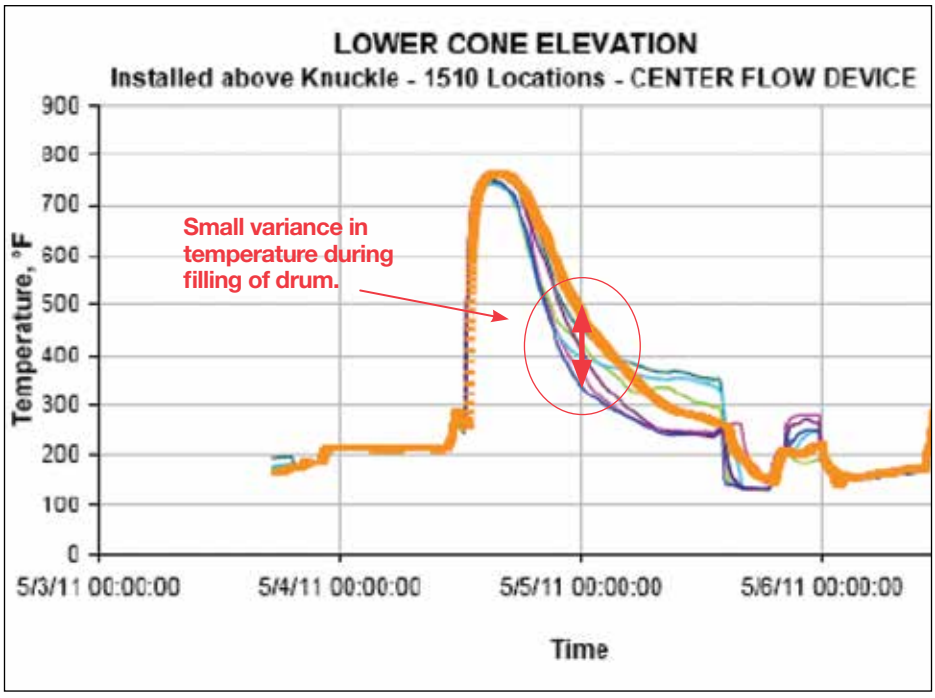
When comparing pre-installation versus post-installation circumferential temperatures recorded at the elevation of the weld seam just above the lower skirt, the post-installation temperatures were within a close range. Data revealed significantly reduced temperature variance within coke drum skin temperatures from 825°F to less than 350°F, an overall reduction of approximately 500°F. As shown in the charts on the following page, the reduction in temperature can be attributed to the formation of an insulating layer of coke on the walls of the drum, this layer of coke also reduces the drum skin temperature change when quench water is introduced. The most notable benefit of utilizing the center feed occurs during the quench cycle where it dramatically reduced stresses in the coke drum, reducing the potential of drum cracks and bulges and allowing for a significant calculated increase in coke drum life.



Full DCU Cycle with Side-Feed

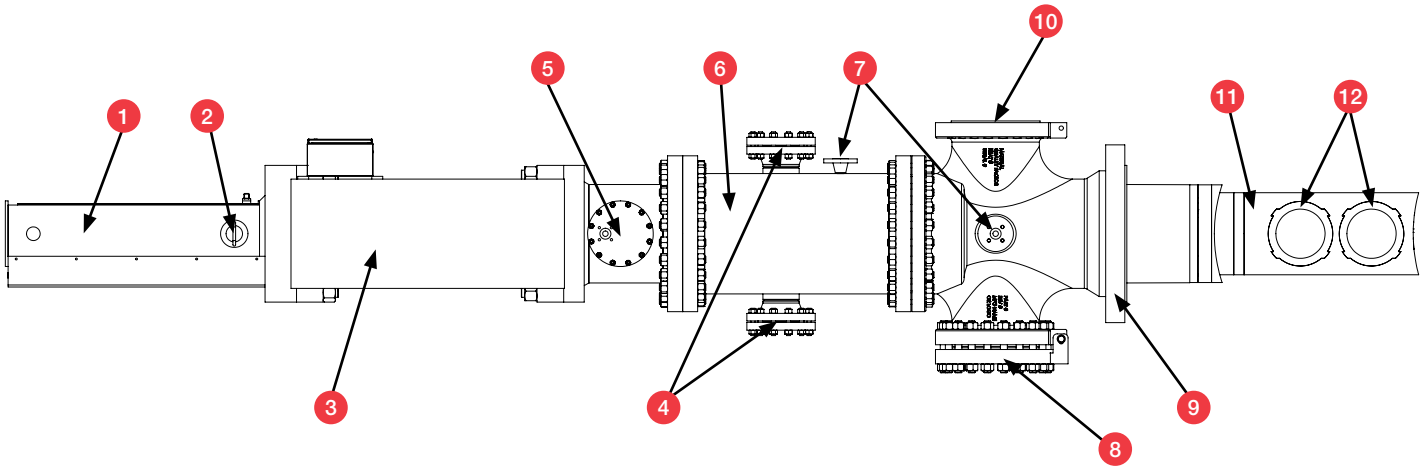


Full DCU Cycle with Retractable Center-Feed



Technical Specifications

Construction	Cast, fabricated
Body Housing Material	ASME SA217 WC6
Nozzle	ASME SA335 P11 and 182 F11
Actuation	Electric, electro-hydraulic, or hydraulic
Interlocks/Controls	Engineered to plant specifications
Positive Lockout	Removable lockout pin
Purge Media	Steam
Typical MAWP	154 PSIG (10.8 kgf/cm^{2}g @ 940°F (505°C)
Design Pressure	Maximum Furnace Discharge Pressure
Inlet Feed Sizes	6” to 18” diameter

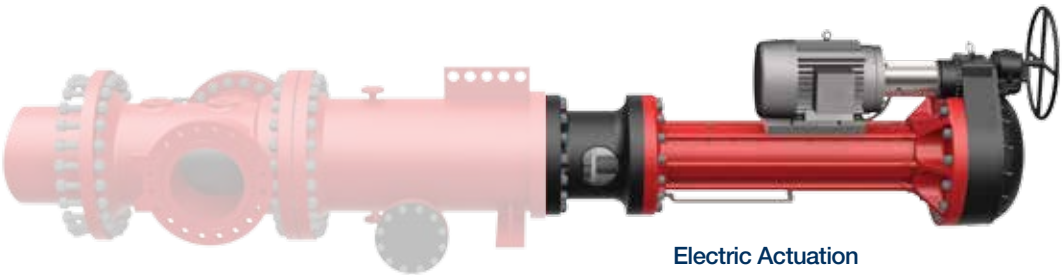


Item	Description
1	Lockout Tower
2	Lockout Pin
3	Electro-Hydraulic Actuator
4	Clean-out Ports
5	Actuator Rod Stuffing Box Access
6	Bonnet

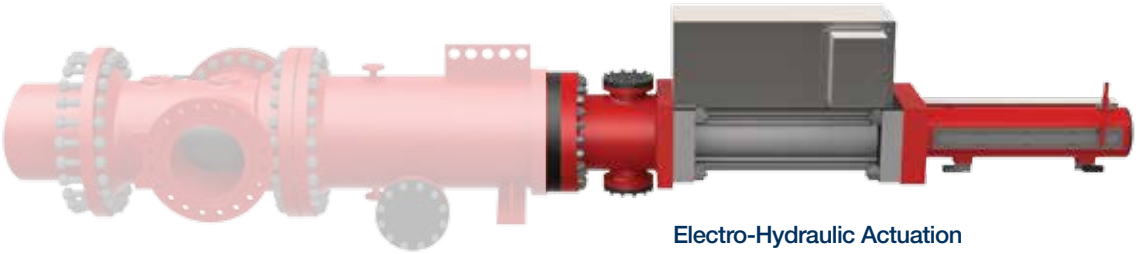
Item	Description
7	Steam Purge Ports
8	Inspection/Clean-out Port
9	Transition Spool Flange
10	Inlet Feed Connection
11	Feed Nozzle
12	Nozzle Inserts

Actuator Options

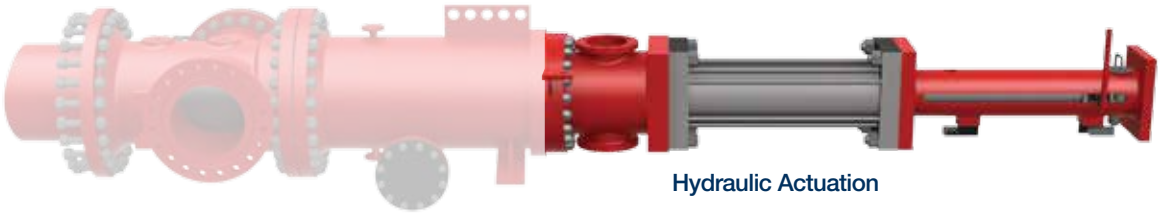
The center feed device is designed for use with electric, electro-hydraulic, or hydraulic actuation systems. Electric actuators offer a shorter overall length and minimize ongoing maintenance. Electro-hydraulic and hydraulic configurations utilize a standard double rod hydraulic cylinder, where one rod is attached to the center feed nozzle, and the opposite rod is connected to a visual indicator on the lock-out shaft. The electro-hydraulic version uses a stainless steel box mounted directly on top of the hydraulic cylinder that contains the motor, hydraulic pump, reservoir, and controls.



Electric Actuation



Electro-Hydraulic Actuation



Hydraulic Actuation

Complimentary Products

Transition Spool

The DeltaValve transition spool is designed to create a permanent connection between the bottom unheading valve and the coke drum bottom flange. Single flanged weld-in transition spools incorporate a permanent side inlet feed connection where the retractable center feed injection device can be attached.

Additional Specialized Equipment

Bottom Unheading Valve

The bottom unheading valve connects to the transition spool and creates a totally enclosed system from the coke drum to the discharge chute. With the push of a single button from a remote location, safe and reliable unheading can be achieved. The bottom unheading valve is inherently safe, easy to operate, and designed to be maintenance-free from turnaround to turnaround.

Top Unheading Valve

The DeltaValve top unheading valve mounts directly to the drum to create a permanent top head connection. Just like the DeltaValve bottom unheading valve, the top unheading valve uses patented dynamic seating technology that is tight-sealing, robust, and highly reliable.

Auto-Switch Coke Cutting Tool

The innovative DeltaValve auto-switch coke cutting tool provides a high level of safety during de-coking operations by allowing the tool to remain in the drum during switching between cutting/boring modes. The auto-switch tool and enclosure, in combination with the DeltaValve top unheading valve, provides maximum coker safety on the top unheading deck by removing personnel from the area.

Isolation Valves

DeltaValve isolation valves are reliable, low-maintenance, tight shut-off valves, designed for extreme temperatures and harsh applications. These valves are designed for easy in-line removal of all internal components. Additionally, the valve is capable of operating continuously in the partially open (throttling) position, while isolating body internals from the process. This product line is available with a complete suite of electric and hydraulic actuator options and complete PLC-based isolation valve control systems with safety interlocks and sequence controls.

Safety Instrumented Systems

Designed in compliance with IEC 61508 to provide an independent layer of protection to mitigate coker safety risk.

Coker Automation

DeltaValve's programmable logic controller (PLC) provides unparalleled safety, performance and reliability. The custom-built PLC can be manufactured with simplex or redundant hardware configurations, configurable function blocks, internal sequence controls, interlocks, permissives, and more. For hydraulic systems, the PLC logic manages the hydraulic power unit circuits to only allow hydraulic pressure to the appropriate unheading device when the process is verified safe. Additionally our high-performance Hydraulic Power Unit (HPU) incorporates redundant equipment such as pump trains, and filters to maximize reliability. The hydraulic circuit is fully instrumented to provide real time status and includes alarms to facilitate preventative maintenance for a longer lasting robust system.

Contact Sales

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Email: sales@deltavalve.com
Web: www.deltavalve.com

Quality

Customer satisfaction is critical to our success. DeltaValve provides its customers with the highest level of quality in products and services by complying with, and continually improving all aspects of our ISO 9001:2008 certified quality management system.

Design Standards

DeltaValve center feed devices are designed per ASME B31.3.

DeltaValve maintains the following stamps/design certifications:

- ASME
- “U” Stamp, Division I
- “R” Stamp
- National Board Registration

Center feed devices include but are not limited to the following certifications per international requirements:

- Pressure Equipment Directive (PED) (97/23/EC)
- Canadian Registration Number (CRN)
- GOST-R
- KHK

DeltaValve has experience installing equipment in Flameproof/Explosion Proof, Non-Incendive, Intrinsically Safe hazardous areas utilizing the following standards:

- IECEx
- NEMA
- UL
- ATEX
- CSA
- GOST
- InMetro
- PESO
- TIIS
- KOSHA
- JIS
- NEPSI

DeltaValve complies with international certifications and standards, and has unheading valves installed in over 100 refineries in approximately 20 countries around the world.

Quality Assurance Documentation

- Quality assurance manual
- ISO 9001:2008 certificate
- Additional international certifications as required

Field Services

Our field service technicians provide a superior level of service, providing 24-7 coverage to reduce downtime by responding to our customers' needs in a timely and efficient manner. DeltaValve's network of technicians are highly trained to evaluate, troubleshoot, and resolves issues. They are backed by our engineering group allowing for quick access to technical expertise, drawings, bills of material, and other relevant data to expedite practical and reliable solutions.

Core services of the DeltaValve field service team are:

- DeltaValve equipment installations
- Site acceptance tests
- Commissioning supervision
- Site audits
- Turnaround service
- Maintenance and repair
- Equipment rebuilds
- Equipment storage
- Hydraulic flush services
- Electrical loop checks
- On-site training
- Bolt tensioning/torquing
- General valve/equipment maintenance and service
- Engineering, Procurement and Construction Management services

In order to respond to our customers' requirements, DeltaValve has service facilities staffed with our certified, dedicated technicians to meet the demands of our growing list of worldwide customers.

Contact Field Services

Toll free in USA/Canada: 1.888.DELTAVALVE (1.888.335.8282)
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