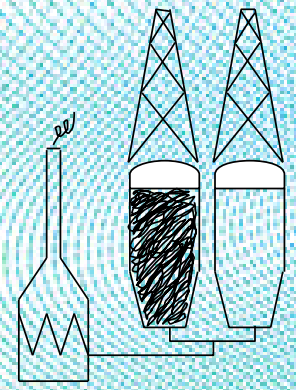
ExxonMobil

Delayed Coker

Coke Drum Bottom Head Safety



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RIO DE JANEIRO
29 Sept – 3 Oct 2014

Coking.com

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Presented by Mitch Moloney of **ExxonMobil Research & Engineering**

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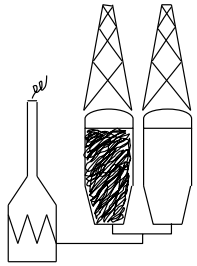
Top and Bottom Head Safety Updates



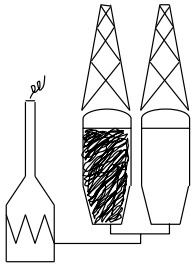
Topics:

(1) Bottom Head & Cart Upgrades

(2) Telescoping Chute Upgrades

(3) Slide Valve & Safety Criticality

Bottom Head Safety Upgrade



Equipment Background:

Example 1 - Two Delayed Cokers

=> **Each has three drum pairs, its own Main Fractionator and Blowdown System operating on 16-hr cycles**

=> **Each coker cuts through a crusher car to a sluiceway and has the following:**

- 3 Deheading Carts
- 2 Crusher Carts

=> **Water and coke are moved by high pressure water pumps to common dewatering bins**

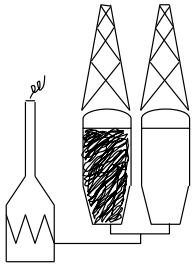
- Coke is loaded on a conveyor and moved offsite
- Water is recycled for reuse

Bottom Head Safety Upgrade

View from Coker Water Settling Basin:

Two Delayed Cokers

Bottom Head Safety Upgrade



Coke Handling System Layout:

Sluiceway – No Carts in View

Bottom Head Safety Upgrade

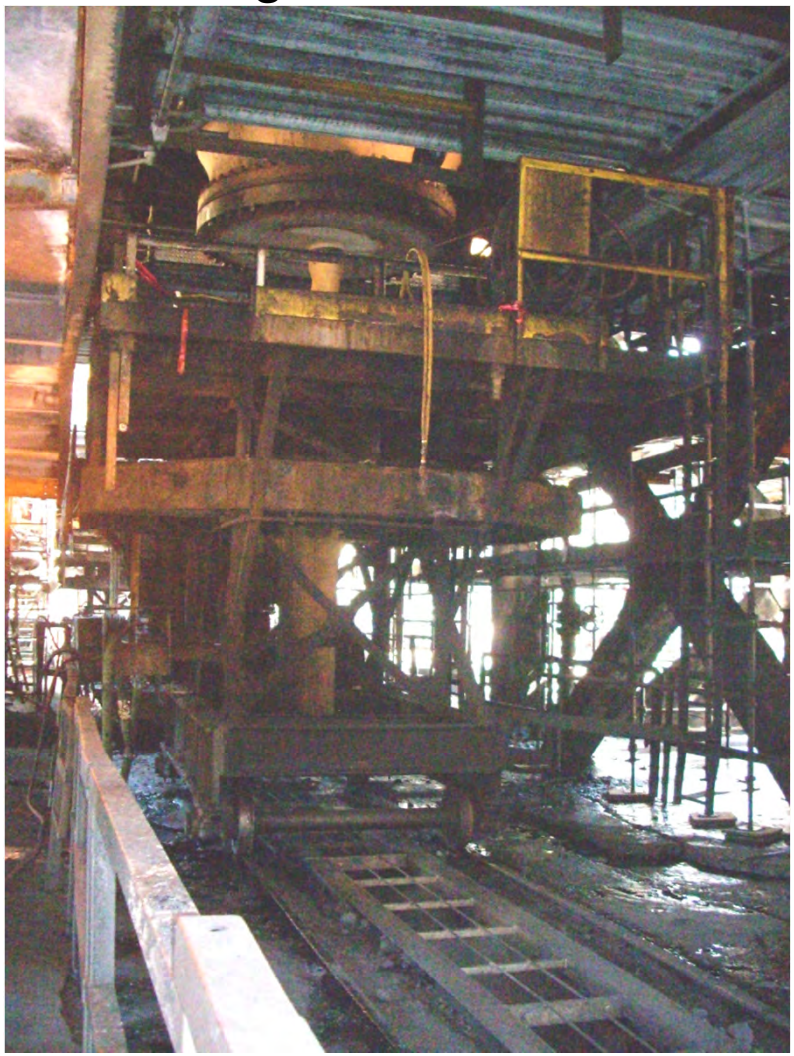
Coke Handling System Layout:

Bottom Head

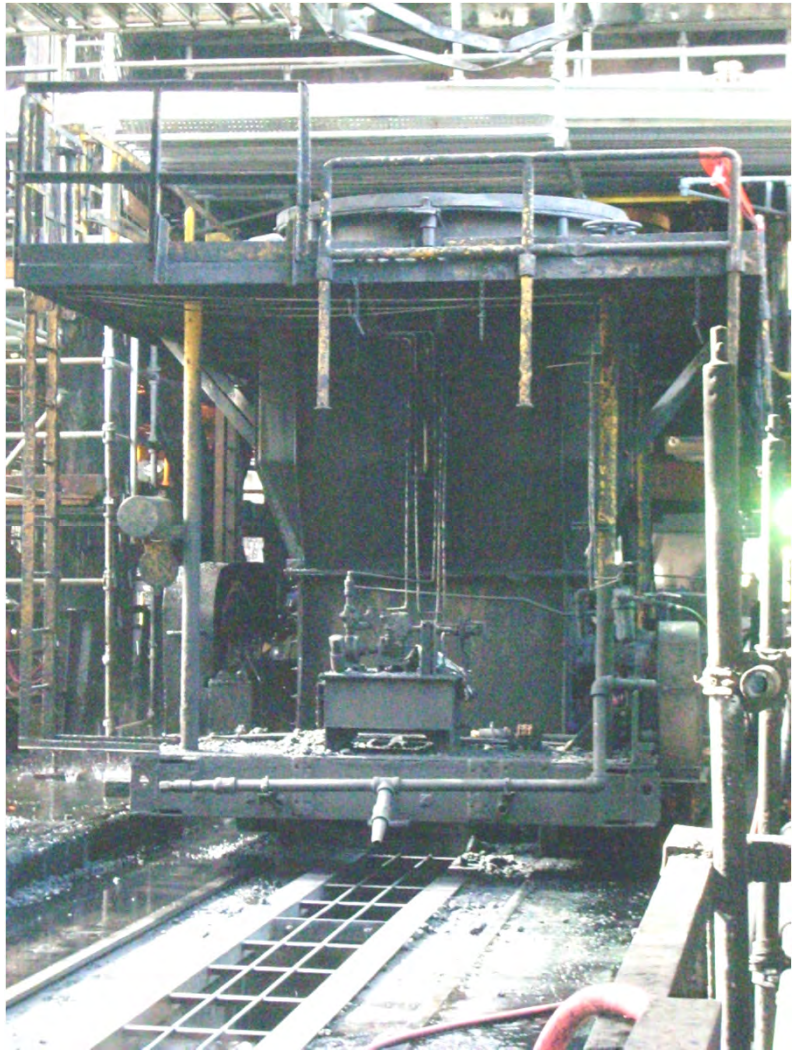
Bottom Head Safety Upgrade

Old Coke Handling System Layout:

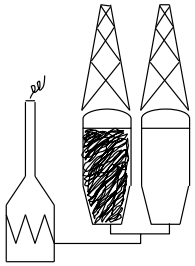
Unheading Car



Crusher Car



Bottom Head Safety Upgrade



Safety Risks & Mitigations

Key Deheading Steps:

(1) Locate Deheading Cart Beneath Drum & Raise Plate Supports
(2) Technicians unbolt feed line & head plate standing under drum
(3) Technicians move to side location and head plate is lowered
(4) Head Cart is replaced with the Crusher Cart
(5) Coke Chute Cylinder raised, technicians bolt chute to flange

Significant Bottom Head Risks to Eliminate:

=> Exposure to coke drum contents during steps 2, 3, 4 and 5

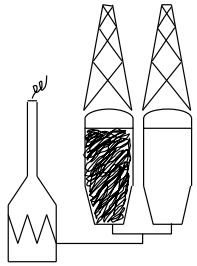
Risk Mitigations:

=> Stronger Carts
=> Stronger Head Flange Support Cylinders with Locks
=> Use of remote-automatic crusher chute clamps
=> Improved perimeter access control to entire sluiceway area

Bottom Head Safety Upgrade

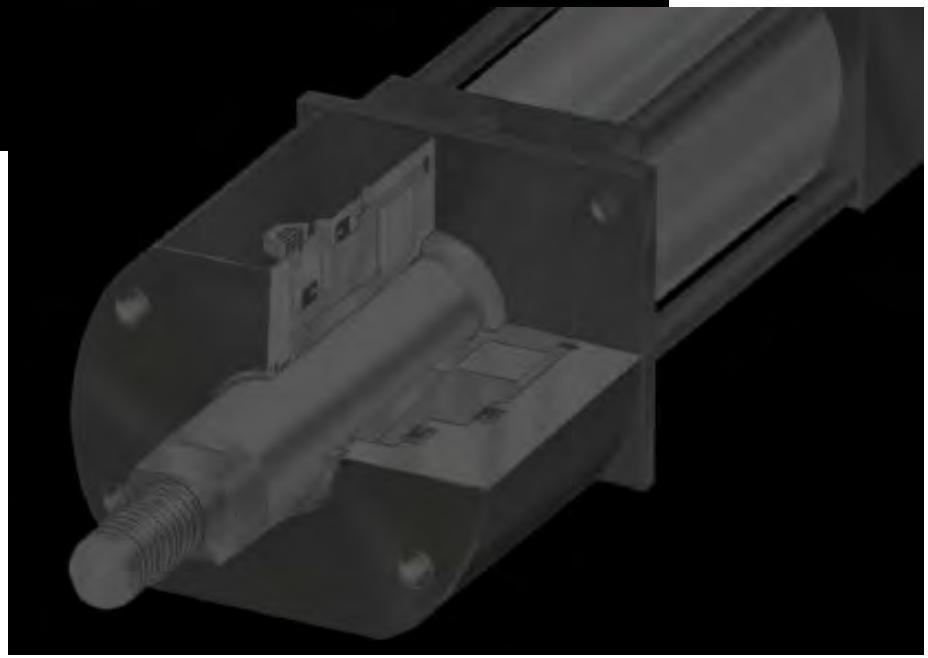
Bottom Head Cart under Construction (Frame)

Bottom Head Safety Upgrade



New Bottom Head Carts with Piston & Cylinder Lock Clamps

Piston & Cylinder Lock Design

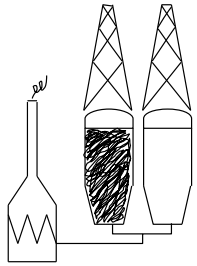


Bottom Head Safety Upgrade

Bottom Head Cart Cylinder Rod Locks

Bottom Head Safety Upgrade

New Bottom Head Carts On-Site:



Galvanized from head to toe

System upgrade that will hold weight of a coke drum full of water.

Installed during May 2013

Bottom Head Safety Upgrade

New Bottom Head Cart Clearance Issue:

Gouges from uncollected bolts

Bottom Head Safety Upgrade

Crusher Cart Latch Upgrade:

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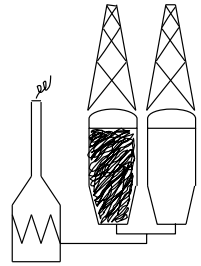
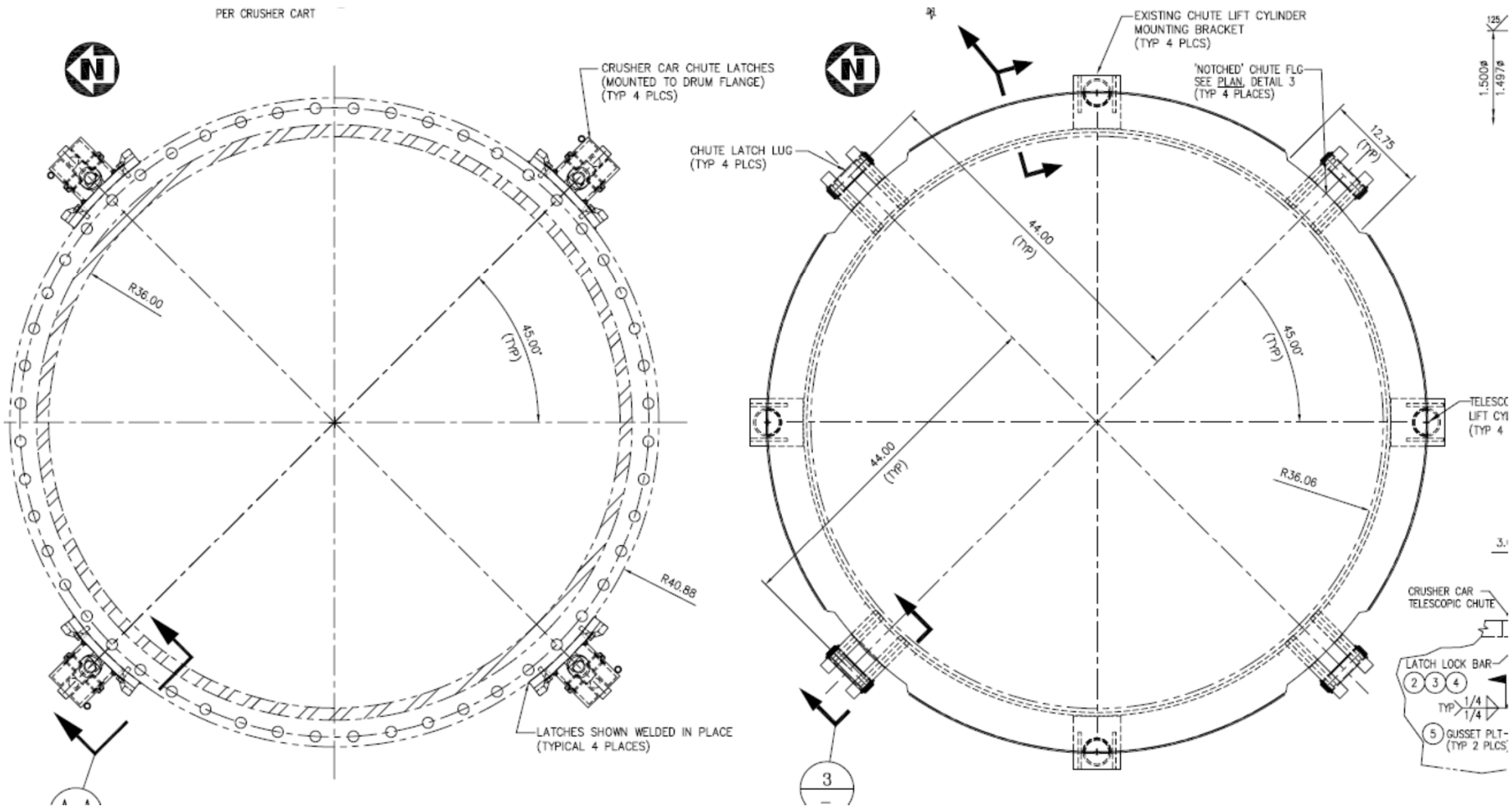
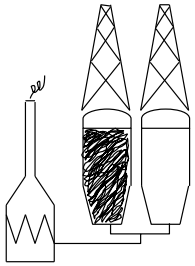




Bottom Head Safety Upgrade

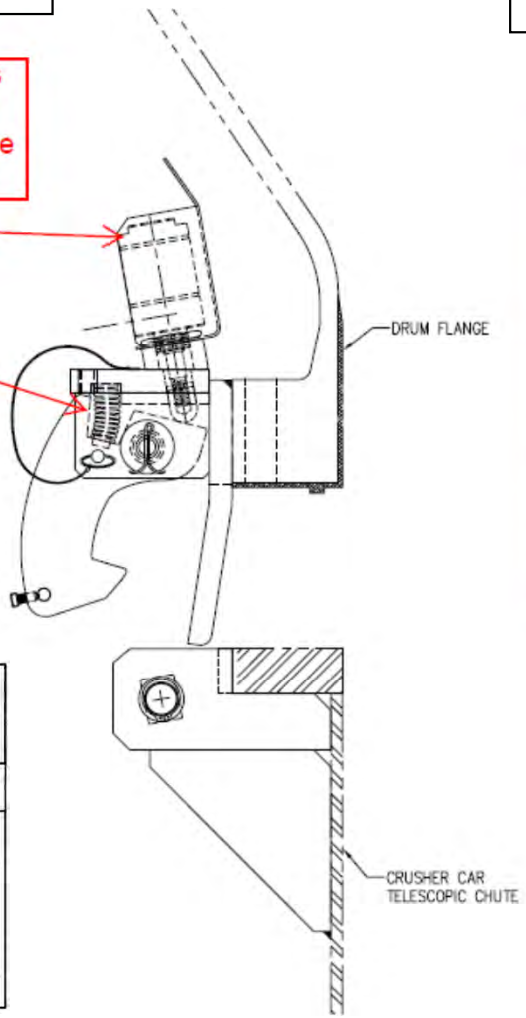


Crusher Cart Latch Upgrade:

Unlatched

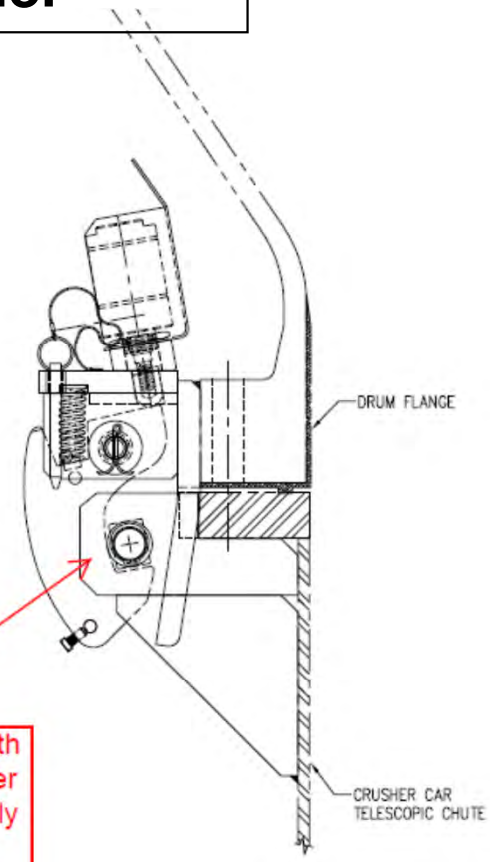
Air cylinder forces latch to open position via remote controls.

Spring forces latch to closed position once air cylinder is turned off.



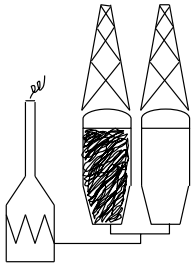
Latched using a remote-actuated air cylinder

MOC 201208097
- Install mechanical latches on Drums 22C-7 and 22C-8.
- Install latch lock bars on Crusher Car 22J-15.
- Install remote controls for pneumatic release of latches to disengage Crusher Car from Drum flange.



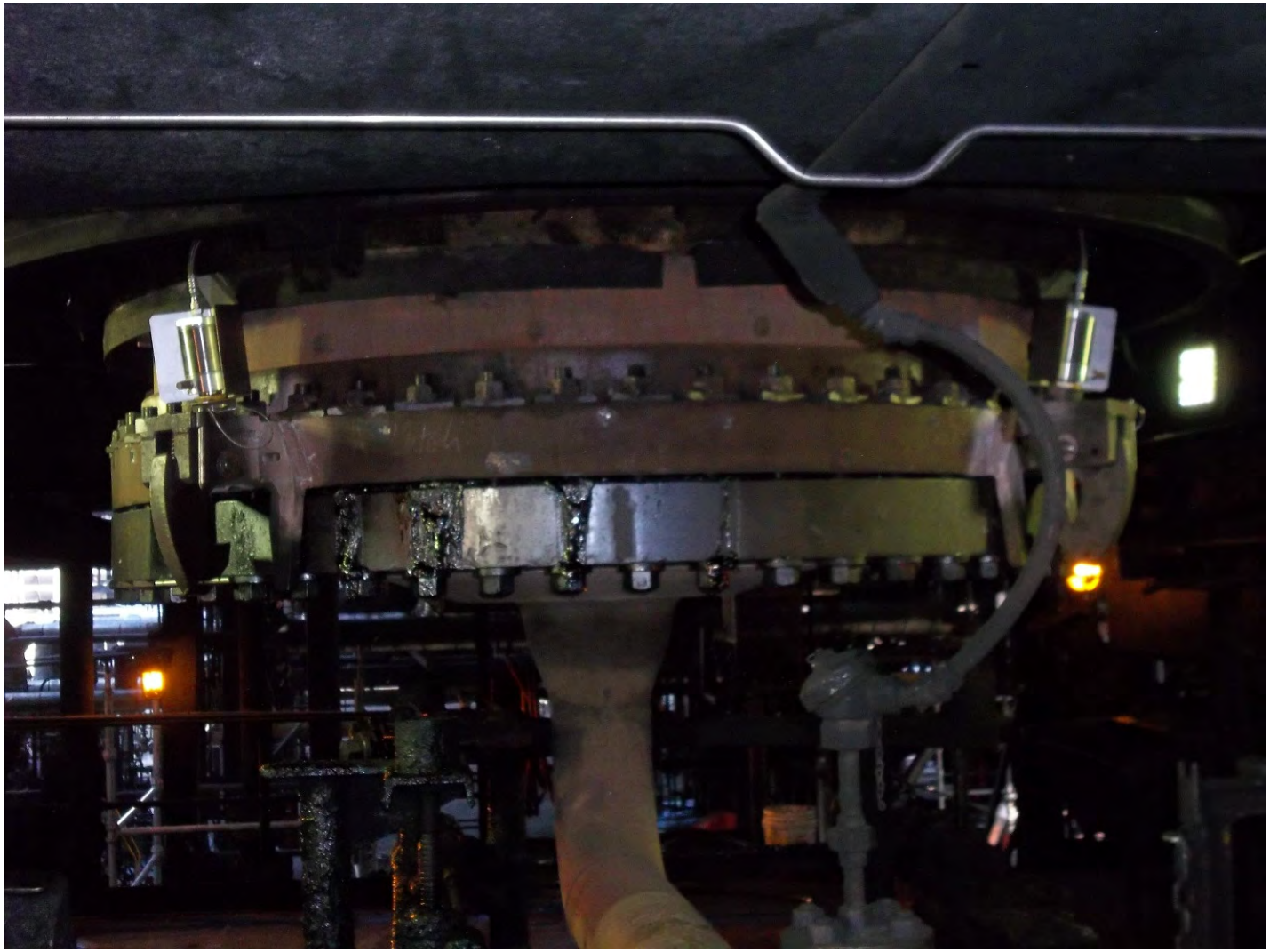
Latch engages with lock bar on crusher car to mechanically hold the drum flange to the crusher car flange for the cutting cycle.

Bottom Head Safety Upgrade



Crusher Cart Latch Upgrade:

Photo of the detached chute latches with bottom head in place



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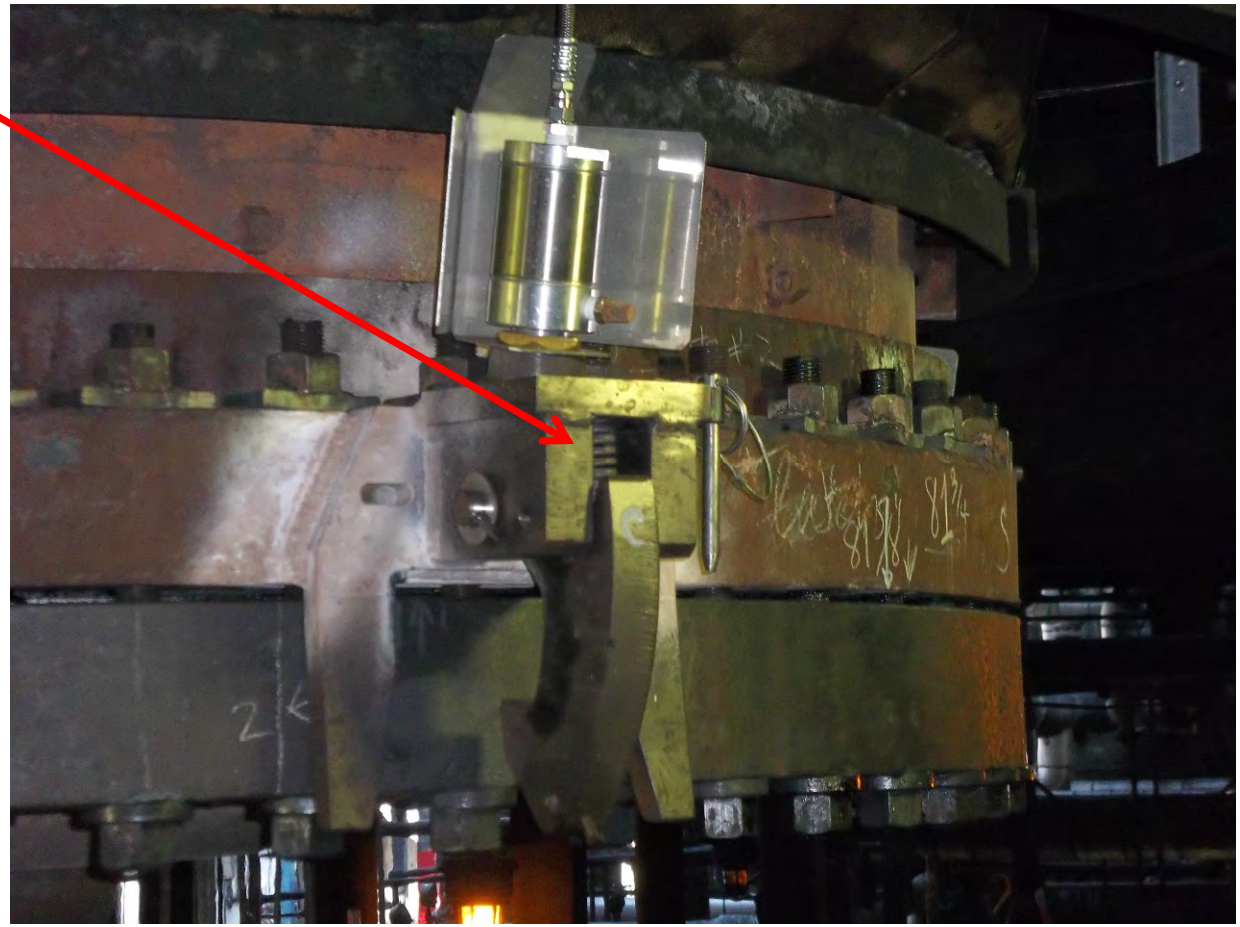
Bottom Head Safety Upgrade

Crusher Cart Latch Upgrade:

A coil spring is used to set the tapered latches and self-lock them as the grizzly is moved up. The springs are sized such that a maintenance person can pull them away, if needed.



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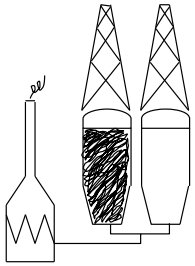
Bottom Head Safety Upgrade



Crusher Cart Latch Upgrade:

Latches engaged on the crusher car chute

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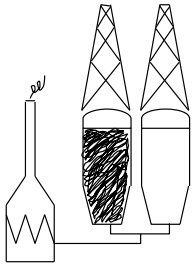
Bottom Head Safety Upgrade

Crusher Cart Latch Upgrade:

Side-View
Crusher Chute locked in place

Bottom Head Safety Upgrades – Examples 2 & 3



Safety Risks & Mitigations

Significant Bottom Head Risks to Eliminate:

=> Exposure to coke drum contents because the telescoping chute would not raise completely

=> Exposure to coke drum contents because the telescoping chute would drop after being raised

Risk Mitigations:

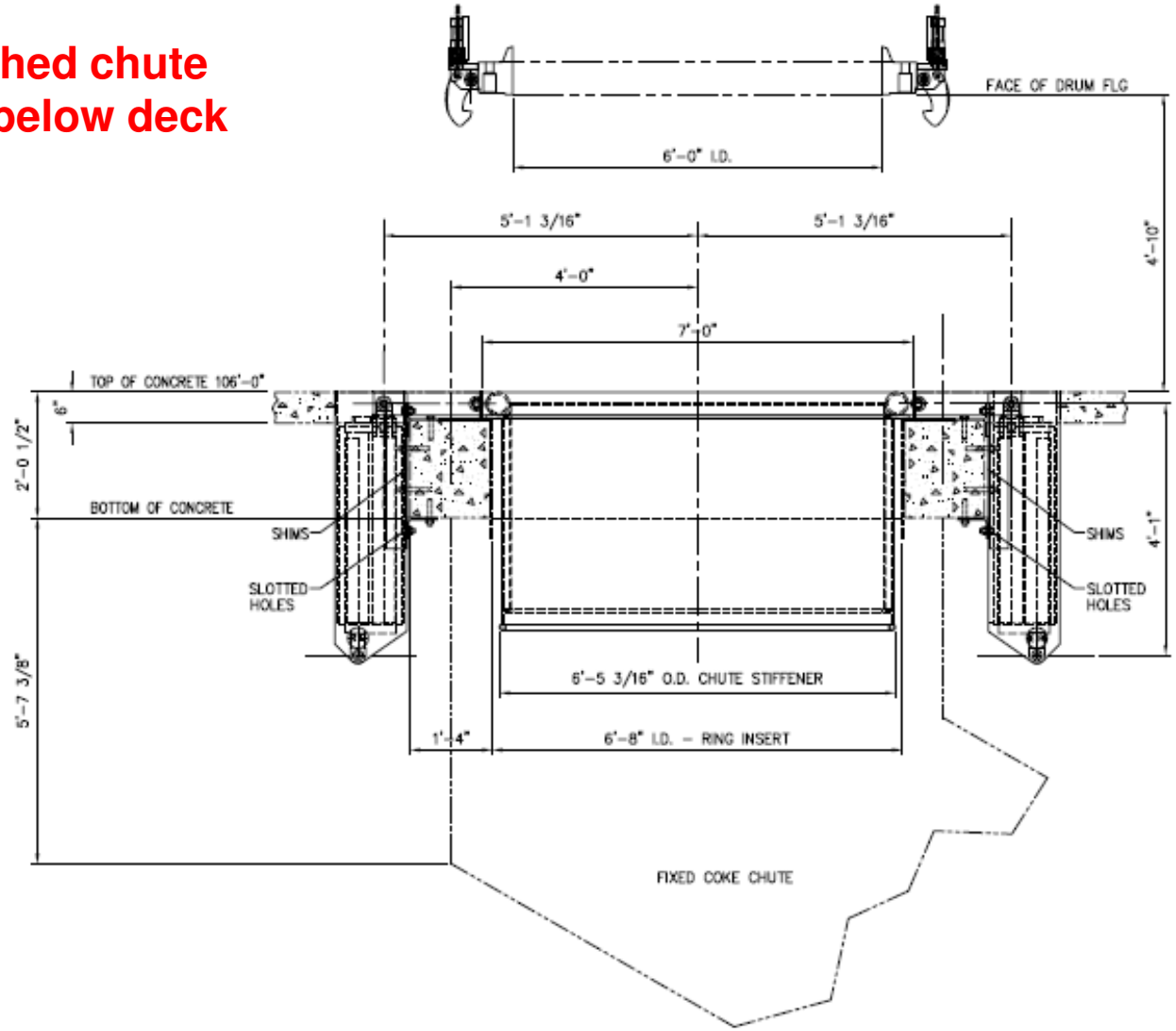
=> New, stronger hydraulic piston-in-cylinder design for Chute

=> Use of remote-automatic crusher chute clamps

Bottom Head Safety Upgrades – Example 2

Telescoping Chute Latch Upgrade (1):

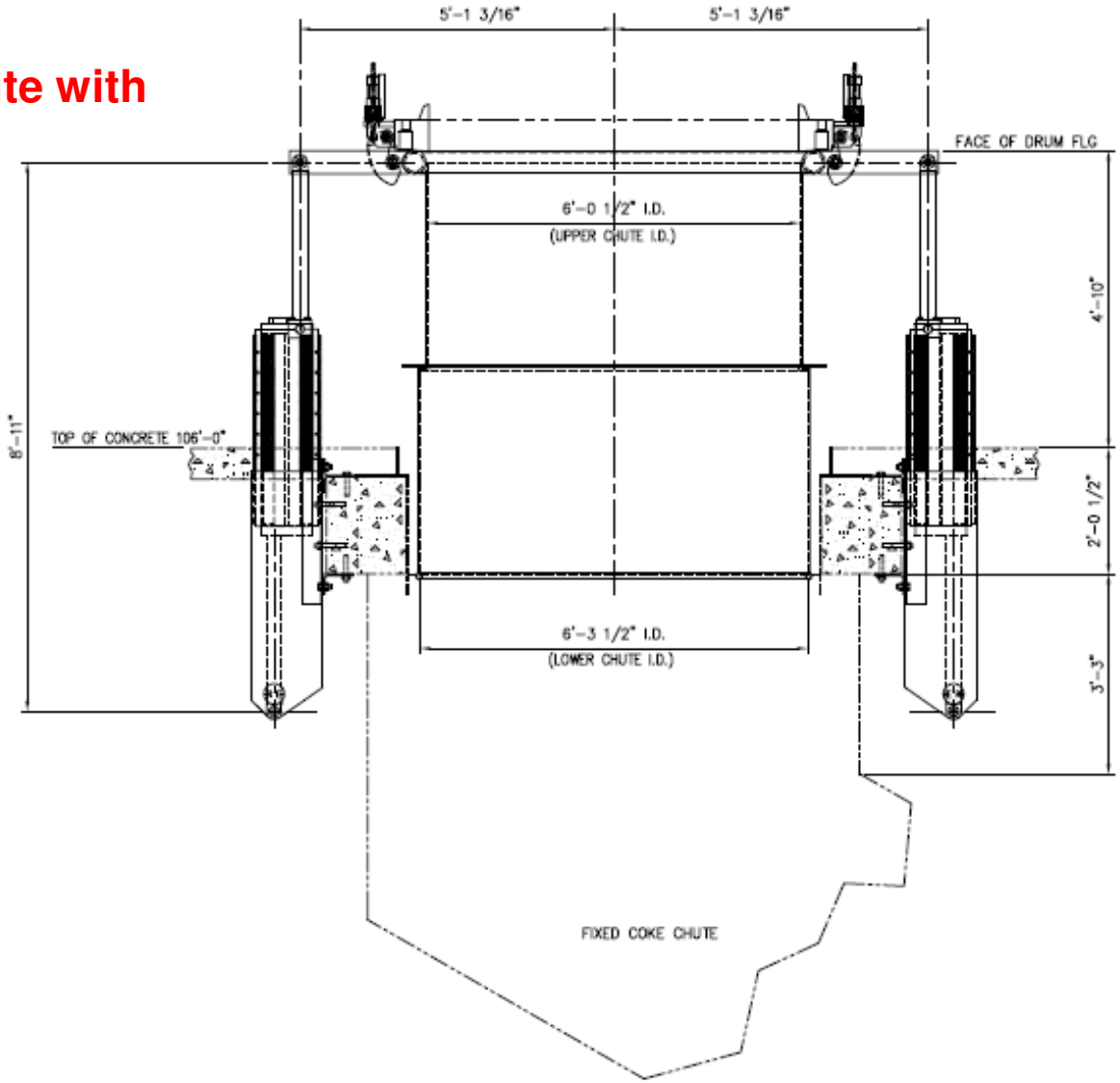
Photo of the detached chute latches with chute below deck



Bottom Head Safety Upgrades – Example 2

Telescoping Chute Latch Upgrade (2):

Photo of the raised chute with latches engaged



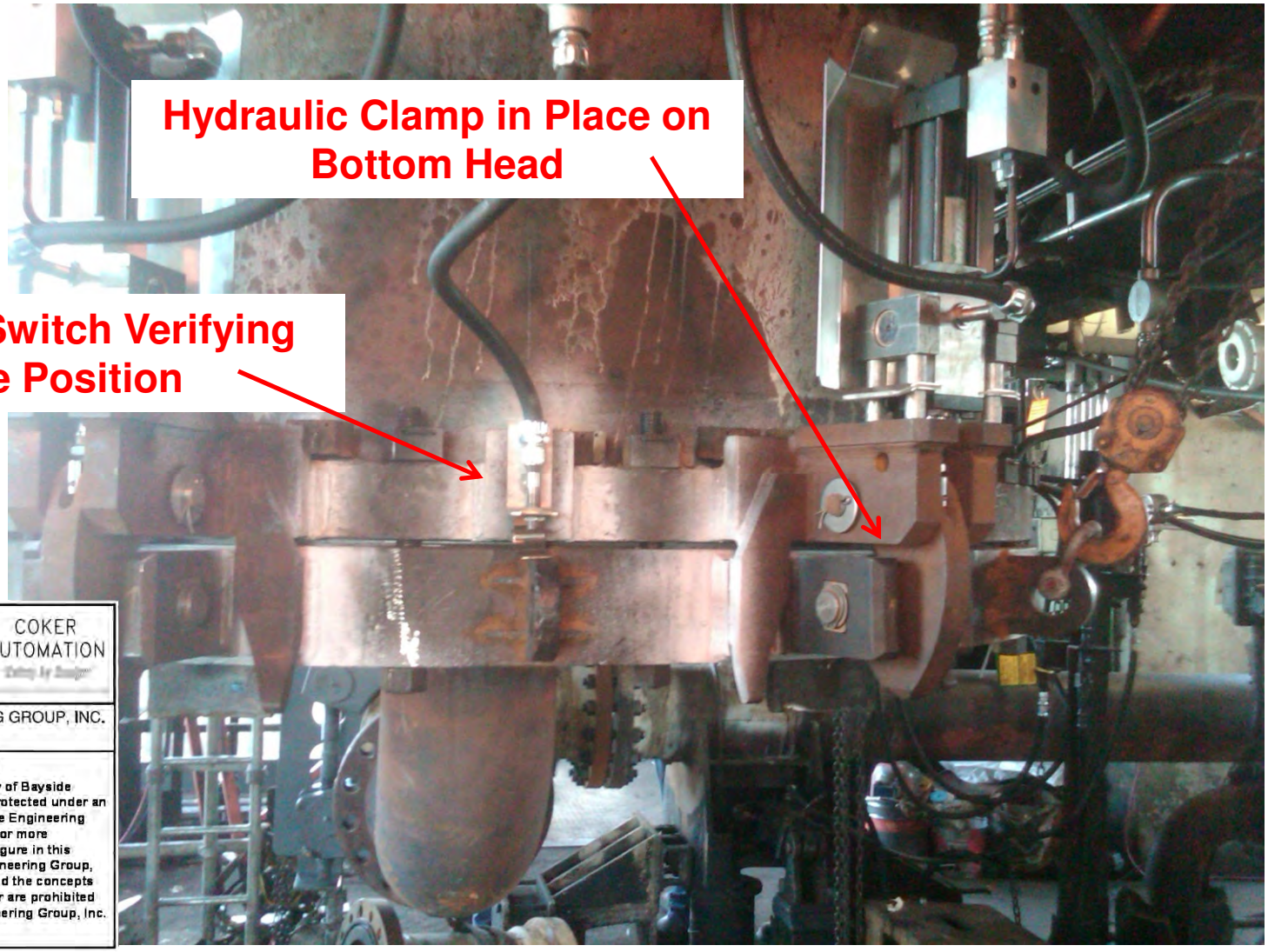
Bottom Head Safety Upgrades – Example 2

Latch Upgrade (3):

New Hydraulic Power Unit

Bottom Head Safety Upgrades – Example 2

Latch Upgrade (4):



Bottom Head Safety Upgrades – Example 2

Telescoping Chute Latch Upgrade (5):

Close Up of Proximity Switch Verifying Chute Position

Bottom Head Safety Upgrades – Example 3

Telescoping Chute Piston & Cylinder Upgrade:

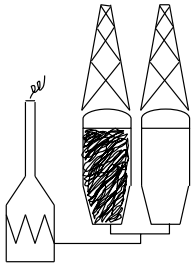
Bottom Head Safety Upgrades – Example 3

Telescoping Chute Cover Upgrade:

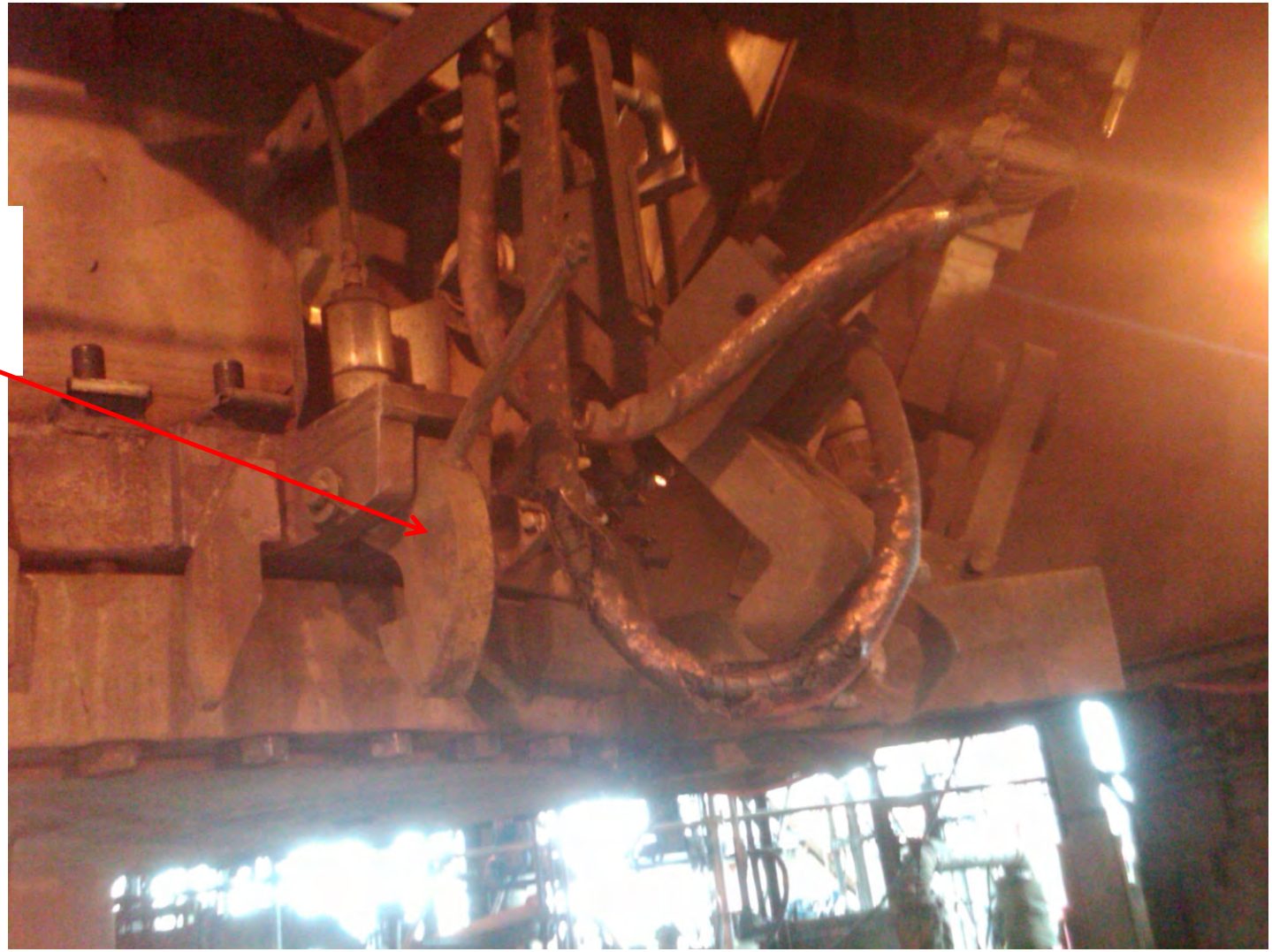
Ergonomic Chute Cover Upgrade

Bottom Head Safety Upgrades – Example 3

Telescoping Chute Latch Upgrade:



Hydraulic Clamp Retracted and Telescoping Chute below floor



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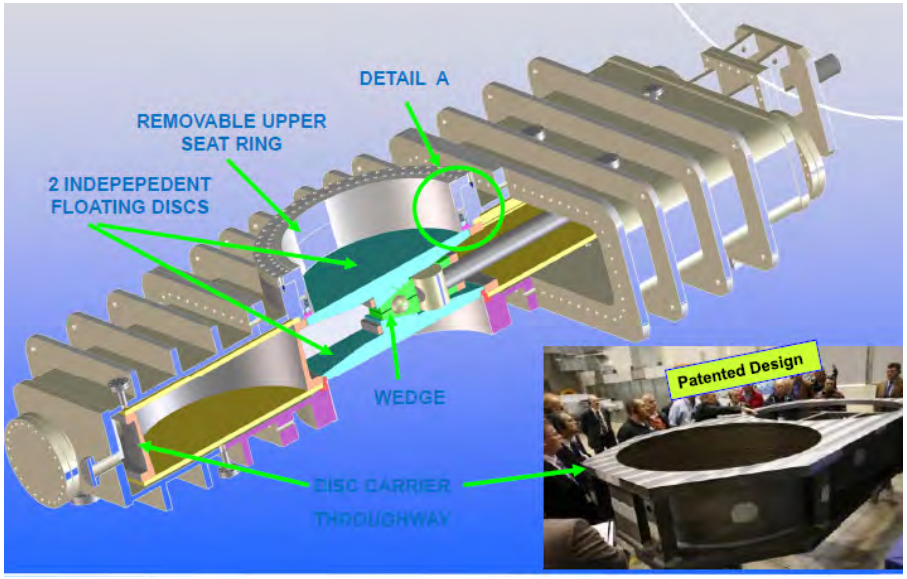
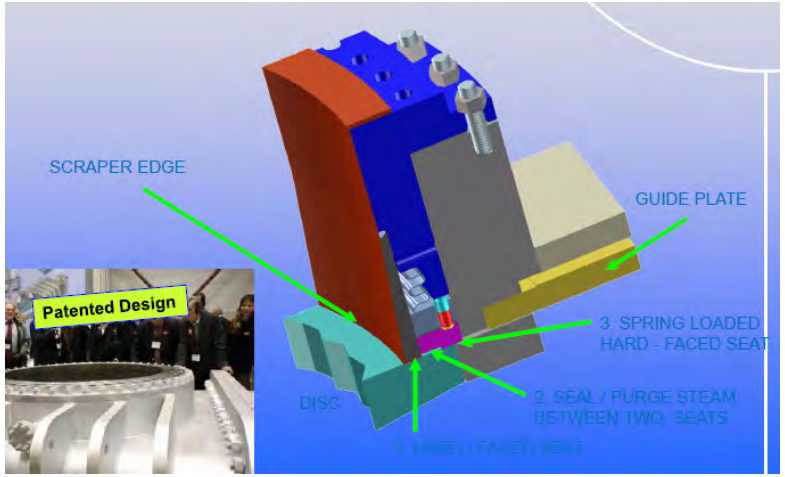
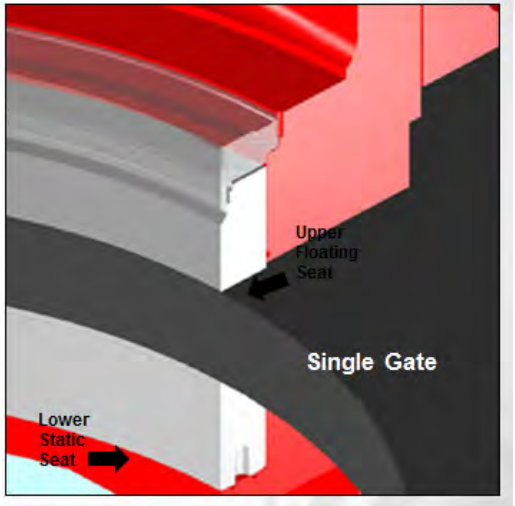
Slide Valve Safety

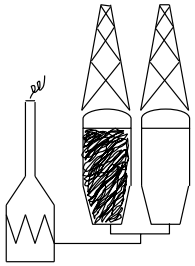
Loss of Containment Risk & Mitigations







Slide Valve Safety



Loss of Containment Risk & Mitigations

Slide Valves Rely on Two Methods to Prevent Loss of Containment:

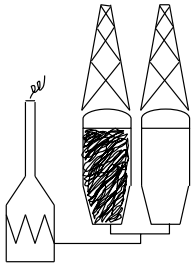
=> Metal-to-Metal Sealing
=> Maintaining Steam Pressure in the Valve Body above the Process Pressure in the Coke Drum (nominally 20 psi)

Leakage Across the Valve Sealing Surface is a Significant Probability

=> Given that, most slide valves could have only the steam differential to prevent loss of containment

Leakage rate based on Steam Flow monitoring and Dispersion Modeling could create a significant risk of H2S Exposure to workers on the top deck.

Slide Valve Safety



Loss of Containment Risk Mitigations

Risk Mitigations:

(1) Make the steam flow and pressure differential controls Safety Critical (meaning they require quarterly calibration and receive high priority when not functional)

(2) Track steam usage as a gauge for valve seat maintenance

(3) Inspect seating surfaces on planned unit shutdowns or on an opportunity basis as dictated by monitoring variables