



DRY CARGO

international

ISSUE NO. 95 August 2007



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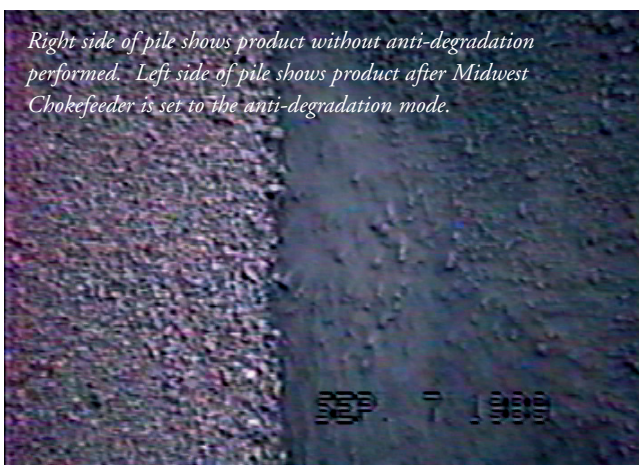
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Midwest Chokefeeder reduces degradation of petcoke

In 1989, Arco Petroleum, now British Petroleum (BP), found its existing shiploader dropped calcined coke a maximum of 60 feet into a ship's hold. This caused degrading of the coke and resulted in excessive unwanted fines and dust. The company therefore installed a new Midwest anti-degradation shiploader that drops the calcined coke fewer than 12 feet. Calcined petcoke is used by most aluminium companies worldwide, and lumpy coke is considered more desirable than fines and dust.

Arco Petroleum Products produces calcined coke which is shipped by rail and deposited in silos at the Port of Longview in Washington State to be loaded onto ships. From the silos, calcined coke is moved by a conveyor belt mounted on a gantry beside the port. A gantry operator can move the conveyor belt both up and down and side to side over a ship's hold while loading calcined coke into the ship. The shiploader pivots on a gimbal that allows the Midwest Chokefeeder® to always suspend vertically, despite the gantry's up-and-down motion.

After research, Arco concluded that its old shiploader, which caused the coke to fall as far as 60 feet into a ship's hold, was degrading the product to an unacceptable degree. To reduce degradation and dust, Arco wanted a shiploader that would reduce the fall of calcined coke and also work with Arco's conveyor belt, gantry, and inlet pivot gimbal with few modifications. The Midwest Chokefeeder® shiploader reduces degradation and dusting of calcined coke. It uses a Chokefeeder® volumetric feeder and programmable logic controller (PLC) to index the controlled column down to a low velocity of approximately 6 FPS/V. A wireless Ethernet interface is available so that a laptop computer can be connected to review detailed operational information. An easy to use HMI (human-machine interface) allows an engineer to view and change the Chokefeeder® parameters and view real time line graphs of product weight inside the Midwest system as it is operating.



Right side of pile shows product without anti-degradation performed. Left side of pile shows product after Midwest Chokefeeder is set to the anti-degradation mode.



Complete Midwest shiploader system shown in the parked position. 45° pivot gimbal allows the Midwest system to hang straight down in all gantry positions.

The Midwest shiploader was modified for use at Arco to deliver a column of material to a feeder through a telescoping tube system. The Midwest telescoping tube assembly extends and retracts from below the gimbal down into a ship's hold. A flexible outer spout, made of tubular sections connected by metal rings, surrounds the telescoping tube and attaches to the Chokefeeder®. Dust is collected from between the flexible outer spout and the telescoping tubes. Four lifting cables and a drive assembly near the gimbal, extend and retract the Chokefeeder®, flexible outer spout and telescoping tube assembly. At the feeder's outlet, six cast ductile vanes open and close pneumatically, to control the flow rate of material. A pneumatic accumulator tank stores air for the vanes. A PLC controls the vanes. The PLC also controls a panel of lights mounted outside the feeder that indicates which vanes are open and how full the telescoping tube is. An anti-static wire protects the PLC from static build-up. Probes suspended on the end of the feeder tilt when they contact either the ship's hold or a mound of material in the ship's hold. The tilted probes send signals to the PLC, which controls the feeder's height. The hanging probes feature a sensitivity adjustment to prevent false signals when tilted by the wind. Level sensors in the feeder and

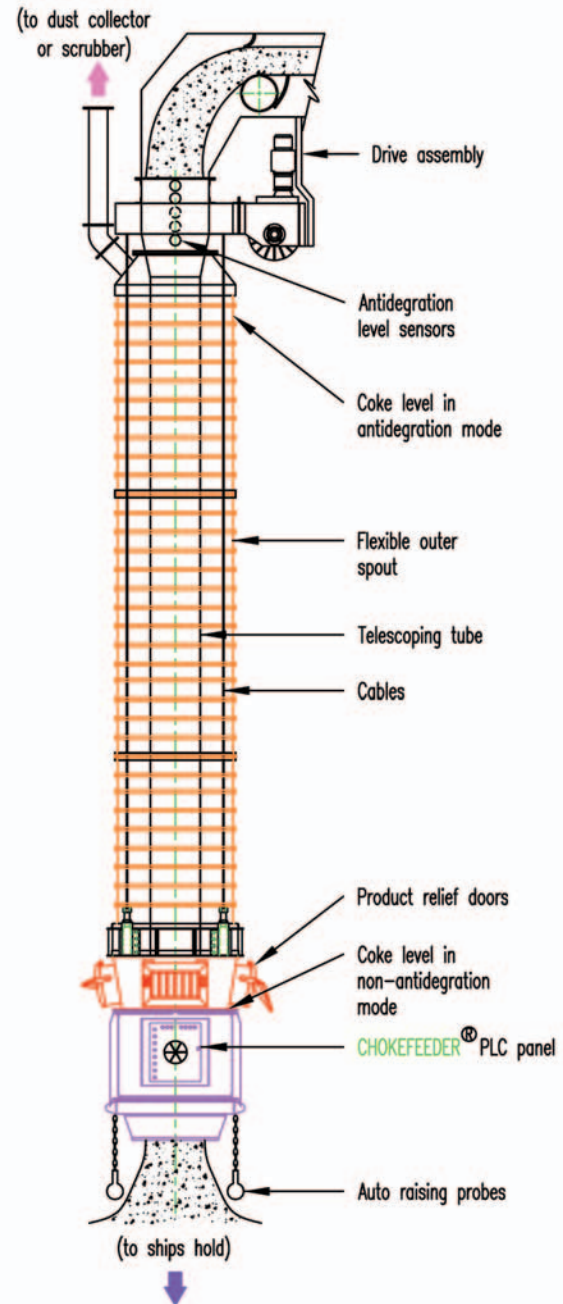
in the telescoping tube not only detect how full the telescoping tube is, but also signal the PLC to initiate the opening of the vanes for loading. The uppermost level sensor in the retractable tube protects against possible overflow by signalling the PLC to open pneumatically actuated product relief doors on the sides of the feeder if the telescoping tube is too full. The product relief doors also open if the feeder ever loses air or electrical power.

To load a ship with calcined coke, the cables and drive assembly extend the feeder until the hanging probes detect the ship's hold. Calcined coke enters the extended telescoping tube and is detected by pressure sensors in the feeder, which send signals to the PLC. The PLC opens some of the feeder vanes, which release calcined coke into the ship's hold.

In 12 to 15 seconds a column of calcined coke forms in the telescoping tube and more vanes open until the feeder begins to discharge at between 900tph (tonnes per hour) and 1,000tph.

When a pile of calcined coke builds up beneath the feeder, the hanging probes tilt and the feeder raises a few inches until the desired pile height is reached. The gantry operator controls the feeders side to side motion so calcined coke loads evenly across the ship's hold. As the ship's hold fills, the feeder continues to rise until the hold is full. As the feeder rises, the

PLC controlled modulating vanes allow the Chokefeeder® to discharge product at a slower velocity thus reducing dust emissions and degradation of product.



telescoping tubes retract and the flexible outer spout folds together like an accordion.

The feeder can extend about 60 feet vertically and when retracted, the Chokefeeder® and retracted components are about 20 feet long. A neoprene dock bumper around the feeder protects it in case it bumps into the ship while loading.

Arco purchased the shiploader in 1989 and has been operating successfully for 18 years. It was installed and commissioned within two days. The new shiploader also reduced the amount of degraded dust by 20% thus saving Arco approximately US\$40,000 in what would have been lost revenue during the first months of the shiploader's operation, according to sources. A video of this system is available to view online at www.midwestmagic.com/movies.php