

VIBRA SCREW CASE HISTORY



C-241

H-Coal Pilot Plant Converts Coal to Oil and Gasoline Aided by Vibra Screw Equipment

Customer

H-Coal Pilot Plant, Catlettsburg, Ky. Joint project of Department of Energy, Commonwealth of Kentucky, and six participants from industry. Objective: to convert coal into hydrocarbon liquids, such as gasoline and fuel oil. Process: H-Coal® process, developed by Hydrocarbon Research, Inc., a subsidiary of Dynallectron Corporation. Plant Operator: Ashland Synthetic Fuels, Inc., a subsidiary of Ashland Oil, Inc.

Problem

Coal liquefaction is accomplished at the H-Coal Pilot Plant by use of a patented process featuring an "ebullated" or fluidized catalyst bed in a reactor supplied with pulverized coal. The coal in the test has a bulk density of about 30 lbs. per cu. ft. This coal bridges in storage and it will not flow unaided. Once flow has been accomplished, the coal must then be accurately metered and weighed against the end products to determine the efficiency of the process. Pulverized coal is very hard to meter because of its fine particle size and tendency to fluidize. The accuracy of the feed system is critical to the entire operation, which is currently running at 220 tons a day.

Solution

4 Vibra Screw Bin Activators, 10 ft. diam., carbon and stainless steel construction, preassembled mounting rings.
2 Vibra Screw Heavy Duty Feeders, HD-2, carbon steel construction, 14 in. diam. flight screws, 304 stainless steel.

Preliminary work in process development units indicated that coal stored in 60-ton hoppers was bridging and disrupting production. So when the H-Coal Pilot Plant was designed and constructed, Bin Activators were installed at the outset.

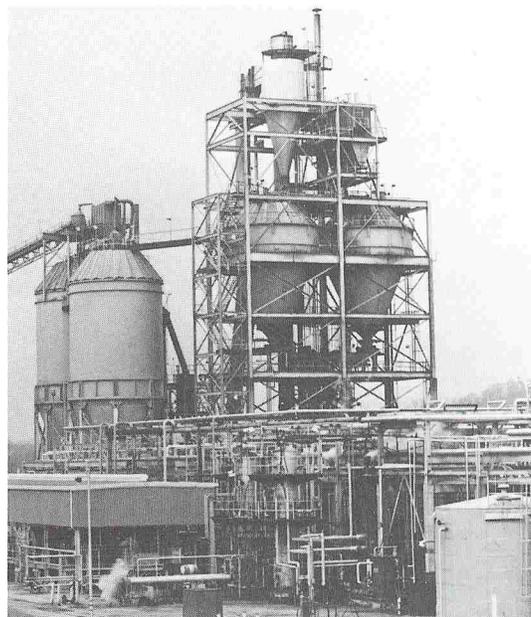
Four 10-ft. diameter Bin Activators are mounted to the bottom of four carbon steel silos, two of 950-ton capacity containing wet crushed coal, and two of 250-ton capacity containing dry pulverized coal. Coal is brought in by rail car and conveyed to storage piles, where it is crushed, then sent to a bowl mill where it is ground and dried. It is pulverized to 98%-100 mesh, and dried to 2% moisture. It is then put into the storage hoppers where bridging is no longer a problem. Controlled vibration employed by the Bin Activators keeps the coal moving uninterrupted into Vibra Screw Heavy Duty Feeders whose purpose is to deliver the coal accurately onto a 24 in. weigh belt feeder. Accuracy of the Heavy Duty Feeders is achieved by controlled vibration which densifies material, assures uniform filling and emptying of the screw flights, and controls the tendency of the coal to fluidize. From the weigh belt feeder, the coal goes to a rotary gas lock, then into a tank where it is mixed with recycle oil.

The slurry is pumped up to a pressure of 3000 psig, heated to 700°F, and sent to the reactor. There it reacts with hydrogen in the presence of a catalyst (the ebullated catalyst bed). The liquid product derived from the process is depressurized upon leaving the reactor and separated into gases, liquids and solids. Gases and oils produced in the reaction emerge from the top of the separating vessel, leaving a clear oil product. The concentrate remaining is solidified by cooling on a flaker belt. In the Pilot Plant Project, this material is saved for further testing; in a commercial sized-plant it can be used as a fuel or to make hydrogen by gasification.

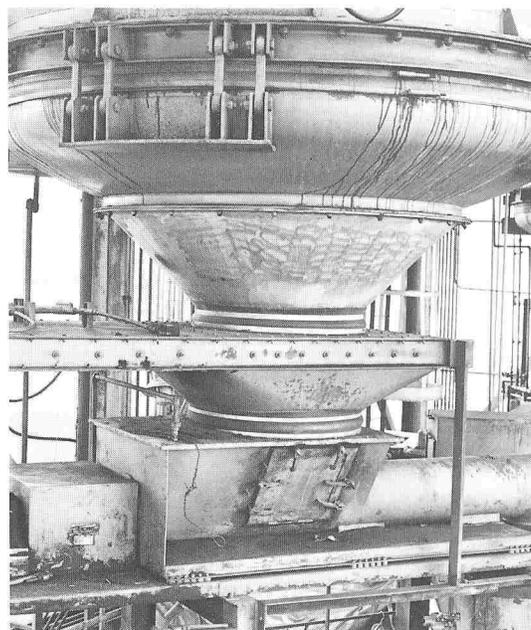
Since May 29, 1980, several successful test runs have been completed. 94-95% of the coal is converted to oils and gases in the process. The Illinois coal feed rate is 220 tons a day, with each ton of coal yielding about 3 barrels of synthetic crude oil.

Results

Two factors of critical importance to the success of the operation have been: 1) uniform flow of coal into the process, and 2) accuracy of the feed system. The performance of the Bin Activators and the Heavy Duty Feeders in these two areas helped make possible achievement of the project's objective.



The H-Coal Pilot Plant converts coal into hydrocarbon liquids with the help of Bin Activators and Heavy Duty Feeders.



The Bin Activator and Heavy Duty Feeder provide the H-Coal Pilot Plant with a uniform flow of coal and an accurate feed system.