



PNEUMATIC CONVEYING SYSTEMS

## CASE STUDY: Parker Hannifin

### **Parker Hannifin Streamlines Carbon Black Unload and Transfer with Cyclonaire Pneumatic Conveying**

#### **Background**

Parker Hannifin Corporation is an international company that operates in 45 countries and manufactures a broad array of industrial equipment. Its plant in McCook, NE, receives and processes large quantities of carbon black, a key ingredient in making rubber compounds. For commercial use, carbon black is formed into very small pellets that are relatively friable and come in several grades. The McCook plant works with three grades of carbon black pellets and uses this material to manufacture a wide range of hoses for hydraulic, air, water, and other applications.

At the McCook plant, some bearings and other components of the bucket elevator system installed to transfer carbon black to storage silos showed significant wear and needed to be repaired. While bucket elevators are widely used in many industries, they are not always the ideal conveying choice. In this application, carbon black could stick to the buckets and create cross contamination between grades.

Mechanical systems can be hard on conveyed materials and break up pellets of carbon black so that their flow and mixing characteristics



*To prevent mixing grades, Parker uses seven dedicated Cyclonaire Bin Vent Dust Collectors to capture and redirect carbon black dust. Exterior view of McCook plant shows carbon black storage silos topped by four blue Bin Vents plus three more Bin Vents over the day bins on the roof.*

are adversely affected. In addition, mechanical bucket systems cannot avoid exposing material to atmospheric humidity, and moist carbon black does not mix easily with clay and whiting, which are other rubber compound constituents. Bucket elevators also require frequent maintenance and adjustment, which translates into downtime. On top of all this, Parker was pushing plant output to a level that the existing bucket system could not reliably support;

consequently, managers decided to replace the entire aging bucket elevator with a pneumatic system.

#### **Evaluation**

Management called Cyclonaire Corporation in York, NE, for recommendations. Cyclonaire engineers requested application information such as required convey rates and distances as well as carbon black samples for testing. At Cyclonaire's CycloTech™ System Proving Facility,



pneumatic conveying equipment is evaluated to measure conveying rates in setups designed to provide full-scale simulations of the actual system that clients will have installed in their plants – right down to line dimensions and elbows. The simulations are used to verify that systems and components under consideration will meet design parameters.

### The Advantages

Cyclonaire engineers were confident that pneumatic conveying would offer the McCook plant several significant advantages. Pneumatic systems easily adapt to automation and completely contain the product, controlling humidity and environmental issues, as well as many of the cleanup problems carbon black can create. Pneumatic lines can easily be blown clean with convey air to avoid cross contamination. When retrofitting an existing plant, pneumatic lines can readily be routed to multiple destinations around obstacles, other equipment, and through walls.

Cyclonaire DPV-B Conveyors are specifically designed for moving large quantities of friable pelletized materials like carbon black, as well as powdered, granular, and abrasive materials. Cyclonaire vacuum-loaded Dense Phase Conveyors use only positive air pressure for both vacuum loading and pressurized conveying. The heart of these systems is a high-pressure venturi of proprietary design. The venturi generates a vacuum that draws carbon black in dense phase mode

from railcars or trucks into the DPV Conveyor's transfer vessel. A high-level control senses when the transfer vessel is full. The system controller then automatically switches to discharge mode and pressurizes the vessel for conveying material to the storage silos. Cycling between vacuum loading and pressure discharge is completely automatic. Cyclonaire's proprietary venturi eliminates the extra filtration, the vacuum pump, and other equipment that would be required by a conventional vacuum/pressure pneumatic system. This results in

substantial savings and a simpler, more compact design. For Parker Hannifin, the DPV controls were integrated with existing plant controls so that the system requires minimal supervision and can be remotely operated and monitored.

Working with a single-source manufacturer for all the major conversion components offered Parker Hannifin a significant advantage over sourcing from multiple suppliers. Cyclonaire accepted complete system responsibility and was able to take the conversion project from concept engineering and project



***Cyclonaire DPV Dense Phase Conveyor with proprietary venturi uses positive air pressure for both vacuum loading and pressure conveying. With the QuadLift™ Dolly in position below the delivery truck hopper, the Cyclonaire DPV cycles between vacuum and pressure modes as it alternately draws carbon black from the truck into its transfer vessel and then conveys the material under pressure to storage silos outside the enclosed truck bay.***





**Programmable Controller**  
*graphically shows system status, diverter valve position, and selected destination in the plant diagram and on the color display next to the keypad.*

management through installation supervision. In addition, Cyclonaire provided factory-trained service technicians to assist with equipment start-up and offer formal classroom and in-plant operator training.

### Adapting to Change

Less than a year after the Cyclonaire equipment was placed in service, Parker changed suppliers of McCook's carbon black. Shipments by rail required 16 days of lead-time. Parker identified a supplier that could deliver carbon black at competitive rates by truck with only an 8-hour lead-time. A Parker spokesperson notes, "Thanks to the versatility of the pneumatic equipment, all that was required to change from a rail unload to a truck unload system was relocating the DPV to an enclosure we built for truck receiving."

Cyclonaire provided a QuadLift™ Receiver Dolly on castors fitted with vacuum hose and a boot to mate with the truck gates. This design simplified the connection and reduced the time required for hookups. An operator would simply guide the low-height dolly into position under a truck and align its pickup pan with each of the truck's hopper gates in turn. Pneumatically actuated lifters at the corners of the QuadLift Dolly elevate the pan to press it firmly against the hopper gate to form a complete seal; then the gate is opened. As the truck empties, it rises, so during unloading, the pneumatic lifters expand to maintain a tight seal that eliminates material leakage.

### A Second Project

Later, based on the success of the earlier work, Cyclonaire was called on to solve a second set of problems at McCook. The plant's original pull-push pneumatic conveyors, built by another pneumatic conveyor manufacturer, were still being used to move carbon black from the four exterior storage silos to the compound mixing area. However, this sub-system was plugging on a weekly basis, causing unacceptable downtime and major housekeeping issues. Sometimes the main problem appeared to be erratic airflow control in the pneumatic lines. At other times, the plugging occurred in an aging rotary diverter.

"The manufacturer of the original conveyors had installed pneumatic boosters at regular intervals in the

lines to augment the line pressure – but the results were not adequate," the Parker spokesperson explained. Cyclonaire changed out the existing boosters and replaced them with its patented Convey Line Injectors. The injectors connect to the control air supply by flexible hoses and are designed to improve the airflow distribution and the size of material slugs in dense phase



**Cyclonaire patented Convey Line Injectors**  
*use a controlled air supply to improve airflow and further reduce material degradation.*

applications. The injectors Cyclonaire used for the McCook retrofit were 304 stainless steel units for the ultimate in durability.

Distribution of the carbon black for compounding within the plant created another problem. The three grades of carbon black were

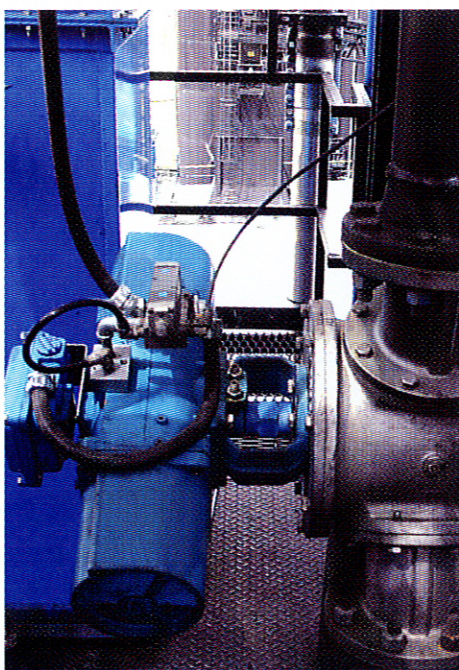


separately conveyed from the main exterior silos to a single receiving hopper fitted with a rotary diverter. The rotary diverter was pneumatically positioned to flow the material from the hopper into one of four day

bins above four receiving mixer lines. This arrangement created the potential for cross contamination of the material grades.

Parker and Cyclonaire engineers worked out a series of modifications to simplify handling by eliminating the receiving hopper, its dust collector, and the rotary diverter so that the three grades of carbon black could be delivered directly to day bins above the mixers. This was accomplished by installing diverter valves to supply the grade-specific day bins. The Parker spokesperson reports, "The diverter valves operate reliably and completely eliminate the risk of mixing grades."

Now, instead of a single shared dust collector, each of the three grade-specific day bins has its own Cyclonaire Bin Vent. The new setup simplifies the material routing and eliminates the downtime problem and the sources of potential contamination. In addition to offering more direct routing and cutting costs, this arrangement is also more robust and provides improved material grade segregation and dust collection.



***Cyclonaire Diverter Valves segregate the different grades of material without cross contamination. They handle high-pressures and offer unobstructed flow plus multiple-destination flexibility.***



***Three roof-mounted Cyclonaire Bin Vents recycle carbon black dust by grade before it is introduced into the compounding process inside the plant.***

## **For More Information**

Cyclonaire makes a broad array of bulk material handling systems, components, and controls. Industries served besides rubber compounding include cement, chemical, battery, food, foundry, milling, mineral, power, and railroad. To learn more about Cyclonaire products and services, visit the Cyclonaire website at [www.cyclonaire.com](http://www.cyclonaire.com) or call 1-800-445-0730.

