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David Fazzini, Global Director for the Pharmaceuticals Industry at Turck: "Coordination and communication on a global basis is a must to successfully execute a pharmaceutical project."

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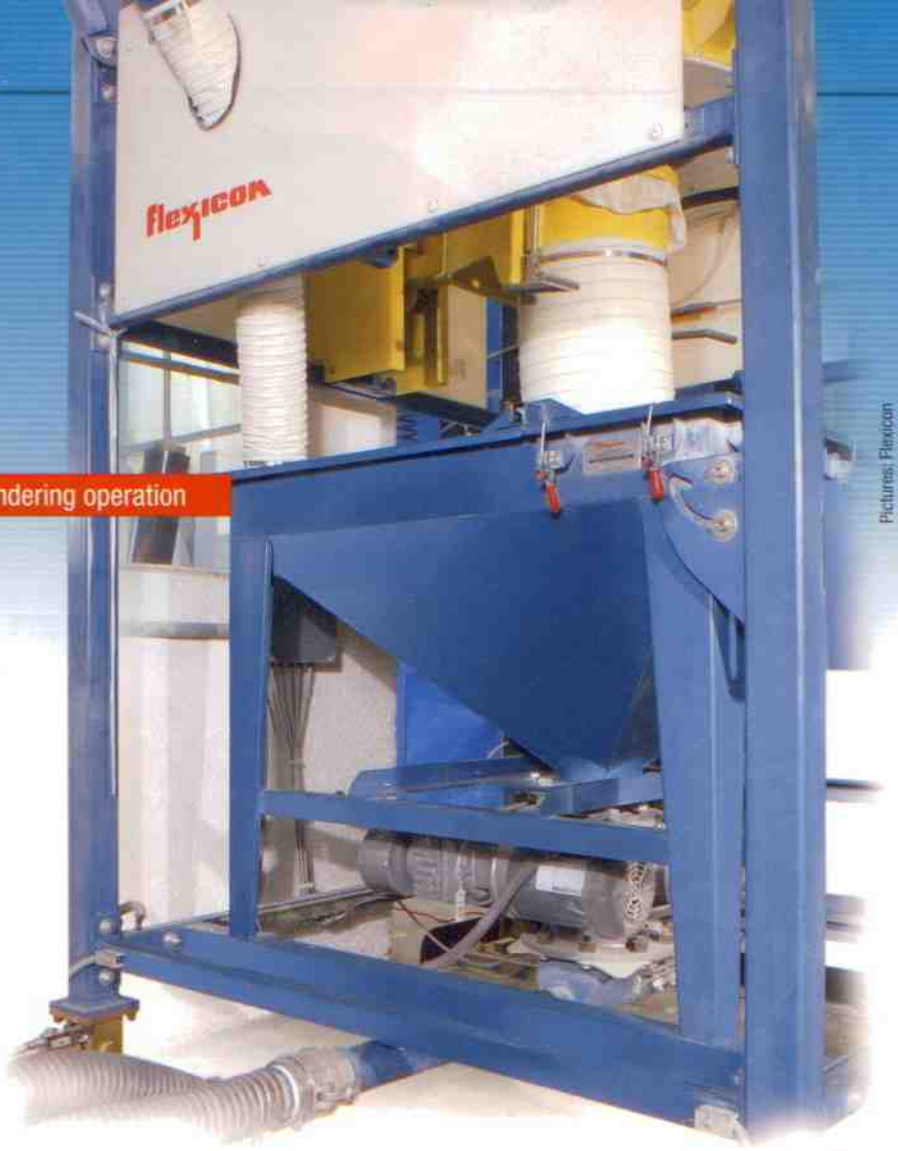
Vinyl frontier

Bulk-solids handling system upgrades calendering operation

One of the largest plastics processors in Mexico City has streamlined its materials handling, improved process quality, created a safer work environment and made more efficient use of its workers by installing a bulk-bag unloading system with pneumatic and flexible screw conveying.



Pictures: Flexicon

Below the hopper on the bulk bag discharger frame, a drop-through rotary valve meters PVC resin into two pneumatic conveying lines.

Oplex S.A. de C.V. calenders polyvinyl chloride (PVC) sheet for applications like advertising banners, automotive seat covers and door-panel liners, truck canopies, awnings, shower curtains and synthetic leather. The company produces sheet on two calendering lines that receive PVC compounds from a central batch-mixing system. Previously, workers had started each 200 kg batch by manually loading 25 kg paper sacks of PVC resin and calcium carbonate ($CaCO_3$) into a mixer. They then used a special conveyor system of the company's own design to add liquid components such as plasticizers, stabilizers and lubricants.

This manual loading created problems, notably in quality control. Oplex was mixing up to 144 batches per day. With one batch mixed and discharged every ten minutes, workers were rushed, which led to mistakes. It was not unusual for them to forget how many bags had been added to a batch, and since the bags were opened with knives, particles of paper sometimes fell in the mix. The work was repetitious, and had the potential to create injuries from carrying bags to the mixing station. The empty bags also had to be collected and disposed of, increasing production costs.

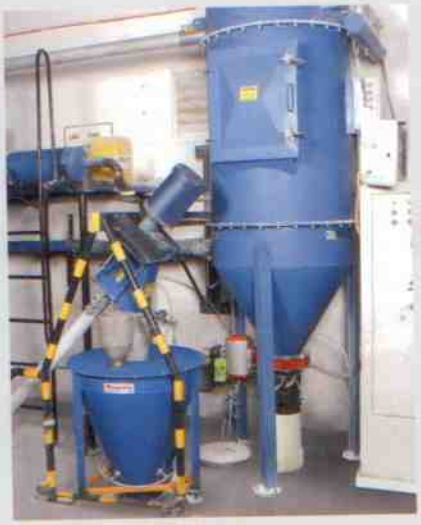
Oplex decided to automate the mixing of PVC resin with a bulk-bag unloading system, reasoning that this would not only improve batch quality but permit the use of several dozen 700 kg or 1,000 kg bulk bags in place of hundreds of 25 kg sacks. An automated system would also create a safer work environment by reducing the amount of manual labor required for batch loading and mixing. The company developed a specification for a PVC materials handling system that demanded equipment compatibility with an existing programmable logic controller (PLC) and in-house software. $CaCO_3$ would still be loaded by hand from 50 kg sacks because it is not available in bulk bags, but Oplex still planned to install a more efficient hopper and additive mixing station for $CaCO_3$.

The system in detail

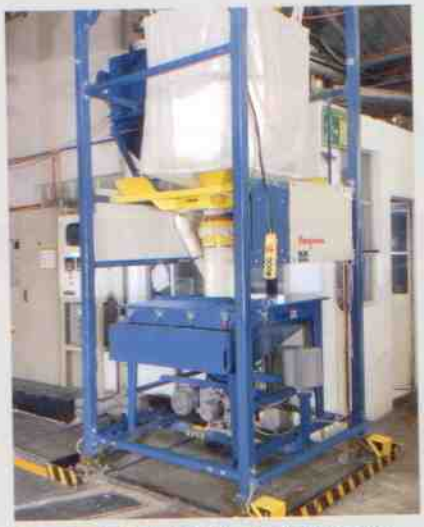
The first part of the system is a BFC Series Bulk Bag Unloader from Flexicon Corporation, Bethlehem/USA. The unloader features an electric trolley hoist on a cantilevered beam that lifts bags weighing up to 1,450 kg into place above a carbon steel frame about 6 m tall.

PVC resin flows from the bag through a Tele-Tube telescoping tube; this attaches manually to the bag spout with a Spout-Lock clamp ring to create a dust-tight connection. The tube is raised and lowered pneumatically, applying continuous downward tension to elongate the bag and keep the spout taut. This facilitates complete emptying by preventing the spout from bulging outward (creating dead pockets) or falling inward (creating flow restrictions). A bin vent dust collector mounted on the discharger frame also keeps dust from escaping into the plant. This not only helps to safeguard worker health by reducing airborne particles, but also improves plant cleanliness and reduces the risk of product cross-contamination. A pneumatically actuated Power-Cincher flow-control valve allows an operator to close partially full bulk bags should the need arise.

The Oplex plant is in an old building with little horizontal space, so operations are spread over several floors. Flexicon's vacuum pneumatic system conveys PVC resin from bulk bags to a filter receiver on the third floor. A hopper integral to the bulk bag discharger directs PVC resin to a drop-through rotary valve, which meters the material into one of two 75 mm diameter pneumatic conveying lines. These transport the resin 60 m to the 1,000 mm diameter filter-receiver above the mixer. The bulk bag discharger is equipped with load cells to allow the PLC to receive loss-in-weight data as material is conveyed from the discharger. This enables the PLC to control



PVC from the bulk bag unloader is pneumatically transported to a 914 mm diameter filter-receiver and hopper on the third floor of the Oplex plant. The flexible-screw conveyor empties $CaCO_3$ into the smaller weigh hopper. Both ingredients are then gravity fed to the mixer on the floor below.



Oplex installed a BFC Series bulk bag unloader from Flexicon to improve the quality and productivity of its PVC compounding operation. Features include a cantilevered I-beam and hoist, Bag-Vac dust collector, Flow-Flexer bag activators beneath the bag for positive material flow, Tele-Tube telescoping tube and Spout-Lock clamp ring at the bag spout interface, hopper, and PLC-controlled rotary valve.

the feed of the pneumatic conveyor so that the required weight of PVC resin is delivered to the filter receiver, then dropped through a chute to the mixer. The two separate pneumatic conveying lines prevent cross-contamination when running different products. On the second floor, Flexicon installed a bag dump station with dust collector for loading $CaCO_3$. Material from the dump station is transported to a small weigh hopper on the third floor by Flexicon's Bev-Con flexible screw conveyor. A flexible stainless steel screw, designed to move difficult-to-handle materials, rotates in a 90 mm diameter, 9 m long plastic tube set at a 45 degree incline. The screw self-centers as it rotates, providing clearance between it and the tube wall to prevent grinding of the material. The conveyor is powered by a 4 kW motor at the discharge end where the $CaCO_3$ enters the weigh hopper through a transition adapter. Load cells under the weigh hopper permit precise weighing of $CaCO_3$. From the hopper, the weighed batch passes through a slide gate valve to the mixer.

Improved performance

The accuracy of the automated system has improved overall product quality and repeatability. Moreover, by permitting the use of bulk bags in place of 25 kg sacks, the new system reduces the amount of valuable floor space needed for materials storage. From the third floor, the PVC resin and $CaCO_3$ are gravity-fed from the filter receiver and the weigh hopper, respectively, to the mixer on the main floor where the liquids are added. After the batch is processed it is metered into two compounding machines. One compounder, a Buss Kneader, processes up to 1,200 kg/hour. The compound is discharged to a two-roll mill for aeration and then into a calender where it produces sheet 1.8 m wide. The other line uses a Banbury mixer that processes compound at the same rate, discharging into a two-roll mill and an extruder-strainer, followed by a second calender which produces sheet 1.6 m wide. An important factor when designing the pneumatic system was Mexico City's altitude; at 2,240 m above sea level, the air is thin. Flexicon successfully addressed this issue to maintain proper performance and make certain that the fans that cool the motors generated enough air flow to be effective. Carlos Barra, Director of Operations at Oplex, acknowledges that Flexicon's efforts in these areas, as with the installation overall, were on target. *kem*