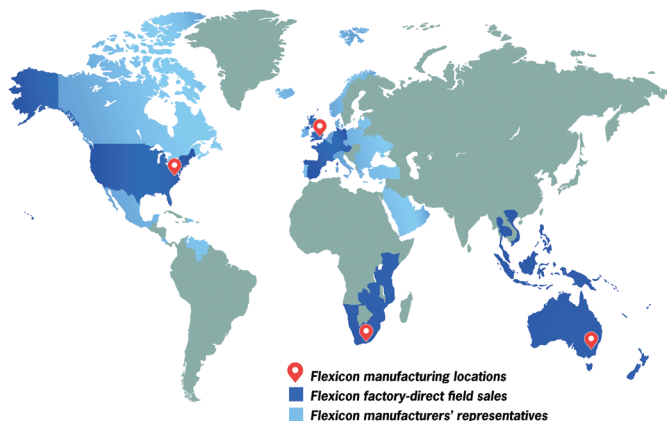




Bag Dump Conveying System Contains Titanium Dioxide Dust in PVC Blending Operation

W-0780



flexicon®

USA

FLEXICON CORPORATION
Tel: +1 610 814 2400
E-mail: sales@flexicon.com
Web: www.flexicon.com

UK

FLEXICON (EUROPE) LTD
Tel: +44 1227 374710
E-mail: sales@flexicon.co.uk
Web: www.flexicon.co.uk

AUSTRALIA

FLEXICON CORPORATION
(AUSTRALIA) PTY LTD
Tel: +61 7 3879 4180
E-mail: sales@flexicon.com.au
Web: www.flexicon.com.au

SOUTH AFRICA

FLEXICON AFRICA (PTY) LTD
Tel: +27 41 453 1871
E-mail: sales@flexicon.co.za
Web: www.flexicon.co.za

SPAIN

FLEXICON EUROPE SPAIN
Tel: +34 930 020 509
E-mail: ventas@flexicon.es
Web: www.flexicon.es

FRANCE

FLEXICON EUROPE SAS
Tel: +33 7 61 36 56 12
E-mail: ventes@flexicon.fr
Web: www.flexicon.fr

GERMANY

FLEXICON EUROPE GmbH
Tel: +49 173 900 78 76
E-mail: vertrieb@flexiconeurope.de
Web: www.flexicondeutschland.de

SINGAPORE

FLEXICON SINGAPORE PTE LTD
Tel: +65 6778 9225
E-mail: sales@flexicon.com.sg
Web: www.flexicon.com.sg

INDONESIA

FLEXICON SINGAPORE PTE LTD
Tel: +62 81 1103 2400
E-mail: sales@flexicon.co.id
Web: www.flexicon.co.id

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BREA, CA — Ameron International manufactures protective PVC lining products for large concrete sewer pipes. Titanium dioxide (TiO₂) is weighed and blended with PVC resin prior to extrusion of the compound, to impart UV resistance and a translucent white color.

With the company's previous mixing process it was difficult to contain dust. Plant personnel cut open bags of titanium dioxide (TiO₂), which has a bulk density of 45 lbs/cu ft (721 kg/cu m), and shoveled the powder into a bucket on a scale. When the net weight of TiO₂ reached 6 lbs (2.7 kg), it was dumped into a blender containing 300 lb (137 kg) of PVC (a 2% concentration).

Handling the powder in an open environment produced dust. "If you open a bag of titanium dioxide and dump it, the powder can become airborne," explains James Gross, a product engineer at the Ameron plant.

He researched enclosed systems but had trouble finding one able to handle the powder, which is cohesive and compressible, tending to pack, cake, bridge, and otherwise resist flow. "It's a powder that acts almost like a paste, so it's problematic to move," Gross says.

He ultimately decided on a system from Flexicon Corporation consisting of a bag dump station with an integral flexible screw conveyor.

Bag dump station collects dust

Pallets of 25 lb (11 kg) bags of titanium dioxide are stacked next to the bag dump station on an elevated dock. The station is equipped with a waist-high bag tray support that provides a work surface for operators to stage, clean, and open bags prior to dumping.

The bag dump station's dust collection unit is mounted directly on the 5.5 cu ft (0.16 cu m) floor hopper. The operator opens the hopper lid, activating a high velocity vacuum fan, and dumps TiO₂ through a screen that keeps foreign objects out of the system. The fan draws airborne dust onto two filter cartridges rated at 99.99% collection efficiency for materials with a particle size of 1 micron or greater. At the same time, an automatic reverse-pulse filter-cleaning system employs timer-activated solenoid valves to direct short blasts of compressed plant air at the cartridge filters, causing dust buildup on the outer filter surfaces to fall into the hopper.

Measuring 30 in. (762 mm) square x 44 in. (1118 mm) high, the hopper is a "high-flow" configuration that causes titanium dioxide to topple and flow toward and down the unit's steep back wall, preventing the powder from bridging between the unit's sidewalls. Additionally, it is equipped with a pneumatic vibrator and an agitator to promote flow toward the conveyor's



25 lb (11 kg) bags of titanium dioxide, a dusty powder, are manually emptied into the bag dump station, which includes dust collection, and a support tray for opening bags.



The bag dump station's support tray provides a work surface to open bags prior to dumping. A vacuum fan pulls dust onto the filter cartridges, while a pneumatic vibrator and an agitator promote flow of the difficult-to-move powder toward the flexible screw conveyor's inlet at bottom.

inlet. "For most materials, neither of these devices is required, but they are needed to move titanium dioxide," Gross notes.

Flexible screw conveyor moves difficult material

The hopper directs powder into the intake adapter of a 25 ft (7.6 m) long, 2.625 in. (67 mm) diameter flexible screw conveyor inclined at 45 degrees. The conveyor employs a flexible, stainless steel screw with a specialized geometry that has been engineered by Flexicon to handle materials with difficult properties such as TiO₂.

A 2 hp (1.5 kw) electric motor at the discharge end of the conveyor rotates the screw, propelling titanium dioxide through the plastic tube and through a discharge spout connected to a 4 ft (1.2 m) long, 6 in. (152 mm) diameter wire-reinforced PVC downspout. The powder falls into a bucket enclosed in a dust-containment box, which sits on an electronic scale above the blender.

When the blender calls for titanium dioxide, an operator activates the conveyor, as well as the vibrator and agitator in the hopper. The controller automatically stops the conveyor when the weight of the material in the bucket reaches 5.5 lbs (2.5 kg). At this point, the remaining powder in the down spouting trickles into the bucket, bringing the final weight close to the required 6 lbs (2.7 kg). "We're achieving batch weight accuracy of approximately ± 0.02 lb (± 0.01 kg), which is many times more accurate than the old system," Gross reports.

Gross's initial estimates allowed up to three minutes to deposit the required 6 lb (2.7 kg), given the variable flow characteristics of titanium dioxide, but the task is now accomplished in 30 to 45 seconds.

Conveying process ends in dust-containment box

Since an operator can empty the filled bucket into the blender without removing it from the dust-containment box, titanium dioxide is contained throughout the system.

"The system has effectively contained dust," Gross reports. In addition to protecting workers and keeping the surrounding plant area clean, the system reduces material waste and eliminates the need to clean a remote dust-collection site.

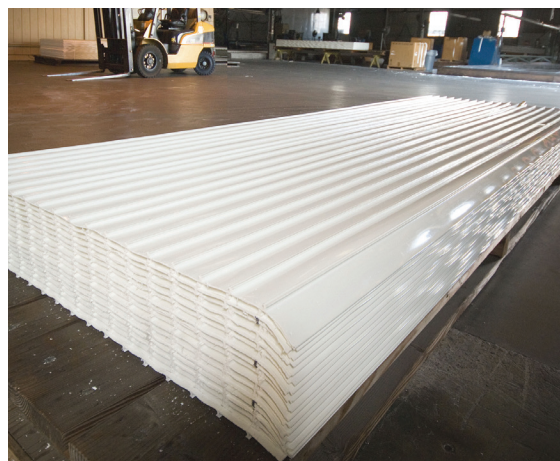
As for maintenance, Gross cleans the equipment every three or four months, noting, "It's basically a no-maintenance item."



A 25 ft (7.6 m) long flexible screw conveyor transports titanium dioxide to the mixer on the mezzanine. The conveyor employs a flexible screw with specialized geometry for moving the non-free-flowing material.



Titanium dioxide travels from the conveyor's discharge spout through a 4 ft (1.2 m) long downspout before entering the blender. A controller achieves batch weight accuracy of ± 0.02 lb (± 0.01 kg).



Ameron International's protective PVC lining product contains titanium dioxide to impart UV resistance and translucent white color.

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USA

FLEXICON CORPORATION
 Tel: +1 610 814 2400
 E-mail: sales@flexicon.com
 Web: www.flexicon.com