Protective coating with decontamination additive
Quad Graphics manufactures offset and gravure printing inks, which are processed using Flexicon bulk bag discharging systems, as David Boger discusses

Offset, gravure ink pigments

From its humble beginnings in 1971, with a rented press and a borrowed binder in an abandoned millwork factory in Pewaukee, Wisconsin, USA, Quad Graphics has grown to become a £3.3bn global provider of print and digital communications. Today, the company has approximately 25,000 employees, working from approximately 70 locations in North America, Latin America and Europe.

A key to the company’s success is its emphasis on seamlessly integrated services from data management and creative development through electronic imaging, print production and distribution. This includes manufacturing its own printing inks – not only offset and gravure but also metallic and fluorescent inks and invisible inks, used as security markings. The company even produces glow-in-the-dark inks, based on a proprietary blend of varnish and crystals that absorb and store ultraviolet (UV) light and release a specific wavelength (colour) depending on the type of crystal used.

Quad Graphics’ Chemical Research/Technology (CR/T) division is responsible for all facets of ink production, from R&D through formulation and manufacturing. Environmentally friendly offset inks with renewable content as high as 27% are manufactured at a fully integrated facility in Hartford, Wisconsin, while solvent-based gravure inks are produced at a manufacturing facility located in Martinsburg, West Virginia. At both facilities, pigment for producing various colours is received in bulk bags weighing from 272 to 907kg apiece, which are emptied and conveyed into mixing tanks using a bulk bag unloading system from Flexicon Corporation.

OFFSET INKS FORMULATED FOR SUSTAINABILITY
Using the highest quality materials and state-of-the-art processing facilities, CR/T began formulating and manufacturing its EnviroTech offset inks in 1982. “These inks have renewable resource content, including vegetable oils and pine resin, of approximately 27% – well above the industry standard of minimum 20%,” said Charlie Bucket, Manufacturing Manager at the Hartford facility.

“Offset printing is done with four different coloured inks applied in a graphical representation of dot pattern,” Bucket explained. “The inks, known as CMYK, are Cyan (blue), Magenta (red), Yellow and Key (black), the colour to which the others are keyed. Cyan, Magenta and Yellow are produced from correspondingly coloured pigments, key from carbon black.”

Upon delivery to the Hartford facility, the bulk bags are loaded into Flexicon bulk bag dischargers, one dedicated for each of the four pigment colours. Each model BFC discharger is equipped with an electric hoist affixed to a trolley that rides on a cantilevered I-beam, allowing bags to be raised from floor level and rolled into the frame without the use of a forklift.

Pigment powders are notoriously difficult to handle, with physical properties that cause packing, caking, smearing and high amounts of dust. To deal with these conditions, design features of the material handling system must be properly engineered and carefully selected. To eliminate dust and promote flow, while discharging, a manual Spout-Lock clamp ring is raised pneumatically by a Teles-Tube telescoping tube, allowing the operator to make a high-integrity, sealed connection with the bag spout. The telescoping tube, with a 15cm OD vent port for interface with a customer-designed dust collector, maintains constant downward tension on the bag as it empties/delongs, promoting complete discharge of the non-free flowing pigment into a 0.25m³ capacity Type “T” pyramid hopper measuring 81cm square by 107cm
At the bag spout interface, a Spout-Lock clamp ring (left) and a lobe tube telescoping tube (right) eliminate dust and control flow. Also at right, Flow-Finer bag activator plates promote flow from the bag high. The dischargers are constructed of stainless steel and include a Power Cliner flow control valve for regulating flow and permitting dust-free retrying of partially emptied bags.

From the hopper, the pigment enters a separate 975cm long flexible screw conveyor, which employs a flexible stainless steel screw having specialised geometry to move non-free-flowing materials. The conveyor transports the pigment at a 45° incline, discharging it into one of four loss-of-weight feeders, each dedicated to a 640cm high pre-mix tank located approximately 716cm from the hopper, where it is blended with varnish to form an approximately 30% solids slurry.

The flexible screw conveyor discharges according to the amount of weight lost, whereby load cells on which the discharger is mounted, send signals to a PLC to activate the screw when 9.1kg of pigment have been released into the hopper and cycle five times to feed 45.4kg into the premix tank.

“Individually slurries are then fed into a holding tank with separate compartments that can hold up to four premixes,” said Buckett. “From the holding tank, the different colour slurries are fed separately into dedicated horizontal bead mills, each with a capacity of approximately 20ft³, for particle size reduction and encapsulation of the pigment to create the finished ink base for each colour. Various proprietary ingredients are then added to each base to formulate the finished inks.”

GRAVURE INKS REQUIRE SPECIAL HANDLING

The same pigments that produce heat set inks at the Hartford facility are used at the Martinsburg plant to produce solvent-based gravure inks. “Here four bulk bag dischargers, each with an auxiliary manual bag dumping station, are installed on the second floor,” said Glenn Gogin, CRF Process Specialist Manager. The operator uses the dumping station to introduce a 23kg bag of special additives, which are conveyed through a flexible screw conveyor along with the pigment to a hopper above a mixing tank dedicated to each colour. The pigment and additives gravity feed into each mixing tank, when called for, by the process.

The contents of each mixing tank are then fed into a holding tank similar to the holding tank used at the Hartford facility. Unlike Hartford, however, the Martinsburg plant uses a novel concept, painting the bulk bag dischargers, hoppers, maing tanks and other plant equipment to match the colour of the pigment each is handling.

“Because the pigments are mixed with toluene, a volatile and flammable organic solvent, the finished inks are blended in explosion-proof mixing tanks located downstream of the holding tank,” Gogin noted. “To keep Volatile Organic Compound (VOC) emissions to a minimum, a graving pressroom engineered as a permanent total enclosure is located within the Martinsburg facility. Large diameter piping allows nearly all of the solvent-laden air, within the pressroom, to be captured for reuse. The system routinely achieves efficiencies, which are considerably above the standard of 92% required by the US Environmental Protection Agency (EPA) and the 96.86% industry average.”

For both bulk bag unloading systems, Buckett says: “We sent samples of each colour pigment to Flexicon for analysis and specified the feed rates we needed. They took it from there and designed the system to meet those criteria. The system works so well that in the Hartford plant we routinely process about 72,575kg of dry pigment each week through the four bulk bag dischargers with no problems at all.”