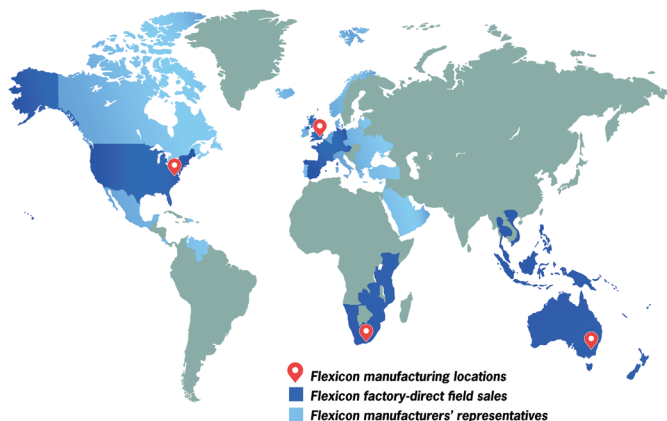




Sealed Bulk Bag Discharge System Contains a Chemical Dust Hazard

U-0205



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COLLEGE STATION, TX — The Texas A&M University System is famous for its agricultural and engineering programs, but less well known is the fact that one of its agencies has the country's largest training facility for firefighters. The 120 acre (48,560 m²) Brayton Fire Training Field, operated by the Texas Engineering Extension Service (TEEX), includes full-scale buildings, a chemical complex, a petroleum refinery unit, a loading terminal, a ship, and an aircraft fuselage that are used for realistic firefighting drills.

Each year, TEEX trains more than 80,000 firefighters and emergency response personnel, who come from all parts of the U.S. and more than 45 other countries. In the course of their training the students have to fight a variety of fires, using various types of equipment, such as hand lines (hoses) and hand-held fire extinguishers that contain sodium-bicarbonate-based (NaHCO₃) chemical powder.

Brayton Fire Training Field (BTF) is currently in the midst of a \$30 million infrastructure upgrade and one of the first projects to be completed was the installation of an improved refilling operation for portable fire extinguishers. NaHCO₃ is a fine powder of 5-20 microns, similar to talcum. It is easily airborne when handled or transferred from one container to another, creating a potential dust hazard.

The key feature of the redesigned operation was the installation of a sealed system for unloading bulk bags of the chemical powder and filling the canisters. The new system, from Flexicon Corp., Bethlehem, PA, has eliminated the potential for dusting associated with the previous unloading method and is much more efficient, says Ron Peddy, TEEX's program manager for environmental safety and field services.

Prior to installing the new system, the powder was received in 400 lb (180 kg) drums. When a drum was needed for the refilling operation, it was hand-rolled to a 9,600 lb (4,350 kg) hopper that fed the refilling line. A drum dumper was used to empty the drum into a 600 lb (270 kg) capacity hopper, from which the powder was augured up into the large hopper. From the hopper, hoses were used to refill the canisters as they moved along a roller conveyor. Powder was transferred to the hoppers in the open air and the refilling process was performed outside, under an awning, to prevent dust inhalation, says Peddy.

In the new configuration, the whole operation has been consolidated indoors in a single building. Chemical powder is received in 2,200 lb (1,000 kg) bulk bags, which are stored in the building. A bulk bag discharge frame is located above a floor hopper, at the head of the U-shaped roller conveyor. The powder is transferred from the bag to the hopper and into the canisters without being exposed to the environment.

Both the bulk-bag discharge frame and the floor hopper were supplied by Flexicon. The Model BFC bulk-bag discharger incorporates a cantilevered



Texas A&M's Brayton Fire Training Field trains more than 80,000 firefighters per year from the U.S. and about 50 other countries.



Sodium-bicarbonate powder is transferred from a Flexicon bulk bag unloader, into a hopper and through a hose to refill canisters on conveyor line. TELE-TUBE® telescoping tube, between bag outlet and hopper, elongates the partially empty bag to prevent dead spots and flow restrictions. FLOW-FLEXER® bag activators (yellow plates) raise and lower bottom edges of the bag to promote total evacuation.

I-beam, electric hoist and trolley. Bags are brought to the discharge frame by a forklift and lifted by the hoist, which has a spreader bar that attaches to the bag's four corner straps. The bag is positioned above the hopper.

Powder is discharged from the bulk bag through a patented SPOUT-LOCK® clamp ring that creates a dust-tight seal between the spout and the equipment, and a TELE-TUBE® telescoping tube that promotes product flow and complete discharge by exerting continual downward tension on the bag as it empties and elongates.

To make the connection, the clamp ring is raised pneumatically toward the bag spout, with the clamp ring in the open position. The spout is pulled over the rim of the tube and the ring is locked in place over it. The bottom end of the telescoping tube is connected to a collar in the lid of the sealed hopper.

Once the clamp ring is connected, the pneumatic pressure that raised the tube is released, causing the assembly to exert downward tension on the spout. The drawstring on the bag spout is then untied to allow the powder to discharge through the spout. Continuous downward tension keeps the spout taut at all times and helps maintain a steady flow of powder by preventing excess material in the spout from bulging outward and creating dead pockets, or falling inward and restricting the flow.

Powder transfer is further enhanced by means of Flexicon's FLOW-FLEXER® bag activators. These are two pneumatically driven plates that rhythmically raise and lower opposite bottom edges of the bag to direct material into the outlet spout. As the bag empties, the stroke of the plates increases to form the bag into a steep V shape and promote total evacuation. An adjustable timer controls the frequency of the strokes.

Canisters are refilled from the floor hopper via hoses, using an air-driven venturi system. This is the same method as was used before, says field-support foreman Donnie Calhoun, who is in charge of the refilling operation. However, a key difference is that the floor hopper has a capacity of only 200 lb (90 kg), versus 9,600 lb (4,350 kg) for the hopper that was previously used. In the new arrangement, the bulk bag essentially fills the role of the supply hopper and the floor hopper is a sealed transfer unit that continually feeds the refill line.

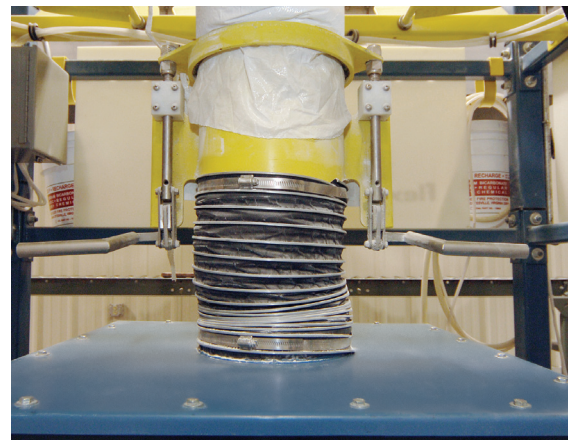
Besides being dust-free, the new unloading system is more efficient than the previous one, says Calhoun. "It used to take about four hours to fill a hopper from the drums, using the auger," he says. "Now, it takes only about five minutes to set up a bag on the discharge frame and start feeding powder."

BFTF uses about 13,000 hand-held fire extinguishers per year, each of 20 lb or 30 lb (9.2 or 13.6 kg), so the refill line's weekly volume averages a modest 250 canisters. Most of the extinguishers use pressurized carbon dioxide (CO₂) as a carrier gas for the NaHCO₃, but some use nitrogen. The latter include wheel-mounted extinguishers, of which about 100 are used annually.

Canisters are moved manually along the roller conveyor from station to station. First, residual gas and powder are exhausted from each extinguisher; next, the CO₂ cartridge is removed and replaced by a fresh one, then the canister cap is unscrewed and the hose nozzle is purged with compressed air.



Canister, ready for refill, is fitted with two hoses: one for carbon dioxide or nitrogen, and one for sodium bicarbonate powder.



The TELE-TUBE® telescoping tube promotes product flow and complete discharge by exerting continual downward tension on the bag as it empties and elongates.

At this point a canister is ready for refill. The container is fitted with a specially designed fill head that creates a vacuum for powder transfer. This is attached to a venturi-driven fill hose from the hopper. Three 8 ft (2.4 m) fill hoses are attached to the hopper — one for extinguishers equipped with CO2 cartridges, one for those that use stored-pressure nitrogen, and one for wheel-mounted units. Extinguishers that use nitrogen are first filled, and then N2 is injected into the canister through an adapter.

The major innovation on the conveyor line is the installation of a dust-collection system. Dust generated by the cleaning operations is removed via overhead hoods and collected on wide-pleated, spun-bond polyester cartridge filters, which are periodically cleaned by back-flushing.

Peddy says, "The bulk-bag unloading equipment is efficient and reliable and has made our job easier by allowing us to move the whole operation into one building." Under the former arrangement, drums of chemical powder were stored in one building, CO2 in another, and the powder-transfer and refill operations were partially outside.

Moving the refill line indoors had another benefit in that it liberated the work from the vagaries of the weather. Peddy explains that refilling must conform to standards set by the National Fire Protection Association and at times it was difficult to meet the standards with the outdoor operation. "For example, we couldn't fill on days when it was raining," he says, "but now we do everything in a building that has a humidity-control system."



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