

Dec Case Study: Successful Implementation of Multiple Vessel Charging Process



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Overview

Dec has designed and delivered a safely engineered solution that allows a Mexican-based fine chemicals manufacturer to charge multiple vessels and dilution tanks.

The Multiple Vessel Charging Process solution significantly speeds up operations while maintaining much greater levels of containment.

The Need

At a customer's chemical plant in Mexico, operators were used to handling the addition of powdered, flaked and granulated ingredients manually. Each batch required up to three raw materials for formulations requiring up to 3750 kg manually added bulk solids. The 25 kg bags were lifted by fork truck to the upper level, where the bags were cut open, one after another, to pour the ingredients into the vessels. The reactors contain flammable liquids classified as Class 1 liquids by NFPA 30. The manufacturing area is a NEC Class I, Division 1, Groups C and D hazardous classified location.

Operators needed respirators and PPE coveralls to protect them from solvent vapors escaping the manways when opened and also from dusts when the bags were discharged into the vessels and manually collapsed to be returned on the floor level. The solvent and acid vapors surpassed ten times the occupational exposure limit, hence the use of protective clothing that was uncomfortable and slowed work rates.

The customer's need for a safer and more efficient solution posed a number of challenges and the need for careful product consideration in order to determine adequate process equipment.

Solid Raw Materials Assessment

The first task was to assess all 20 raw materials involved. Timellitic Anhydride and

Acrylamide fell into OEB 4 (Occupational Exposure Band 4, ie 1-10 micron/m3) materials. These ingredients are highly toxic and needed to be considered differently than all other ingredients of category OEB 2-3. Some of the solids were reactive with others and had to be kept physically separate.

Improved solids handling had to meet the following challenges:

- Eliminate PPE and respirators while handling solid raw materials
- Control ignition hazards associated with dusts/vapors
- Design separate systems to handle OEB 2/3 and OEB 4 materials
- Optimized liquid cleaning features between the batches to flush process equipment and discharge into vessels/dilution tanks
- Compatibility with high process temperatures from ambient to 260°C
- Optimized loading rates of all vessels of minimum 75 kg per minute

The Dec Solution: PTS + Isocharge

Dec's solution was based on its Powder Transfer System (PTS) technology for conveying powders under complete containment and safe dense-phase, using combined vacuum and pressure to transfer raw materials, while allowing clean in place (CIP) options.

Dec installed a PTS on each vessel/tank, connected to Dec's Isocharge system for products requiring high containment and to a bag emptying station with a dust collection system for the other raw materials.

The PTS system fully isolates each reactor on which it is installed and allows safe charging of vessels even in presence of solvents or a highly flammable atmosphere. It keeps the operation under highly contained conditions. It enables direct charging from any container or process equipment, there is no need to have a separating dispensing area.

The Isocharge station in combination with the PTS guarantees high containment (OEB4-5) when transferring substances of high concern. The system is designed to feed powder from bags or drums into reactors or other process equipment whilst managing all contamination risks for operators and the environment. It is a combination of laminar-flow cabin and a closed isolator system. The operator opens the bags inside the chamber. The product enters into the suction hopper from where it is transferred into the vessels. Optimized air flow control and filtration allows one-way air circulation when the bags are loaded into the chamber and clean air to leave the same.

Advanced remote CIP cleaning

The Dec solution includes advanced CIP cleaning features, with the PTS Cleaning Device ensuring that the PTS Powder Transfer System can be cleaned automatically, in situ, with covers in place. Furthermore, cleaning can be run remotely using operational settings from the standard PTS control panel.

Results

The Dec solution delivered a clear series of benefits. These included:

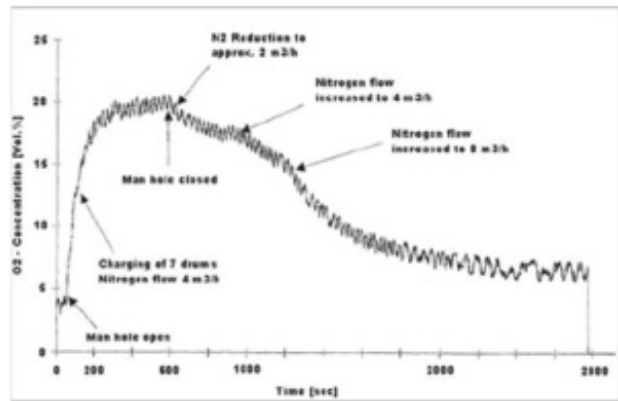
- No increase in oxygen during charging
- Keeping reactor inert and preventing vapor escape
- Low nitrogen requirement
- Unique filtration concept for strong performance and no filter clogging
- Easy to clean (CIP/SIP)
- cGMP / ATEX / FDA compliant

When compared with the former condition of manual charging through the manway, no dust collection and very poor fume collection, the Dec Solution delivers a very different environment with high containment using dense phase vacuum conveyer, PTS on receiving tank, no dust, reduced oxygen and much higher safety.

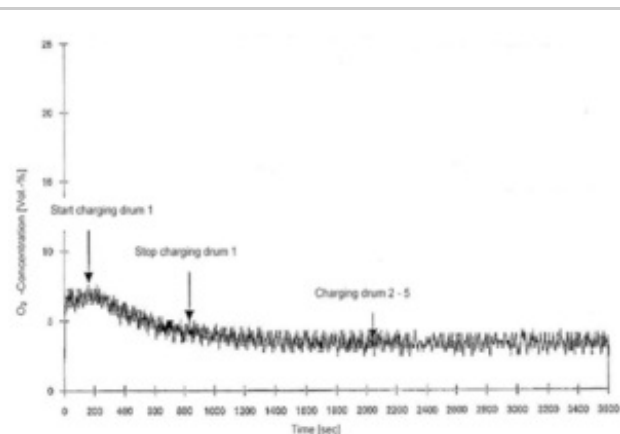


Fully sealed PTS connection to reactor





BEFORE: Oxygen concentrations in working environment when charging reactor through the manway



AFTER: Oxygen concentration in working environment when charging a reactor with PTS/Isocharge

Supplier Information

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