

Introduction

The laundry detergent industry recognizes its responsibility to introduce new, cleaner technologies and products and to encourage consumer behavior that will result in an improved environment. This is the motivation for much of the industry's new developments.

In the mid-1970's, when the additive TAED for low temperature was introduced, the wash temperature could be reduced significantly without loss of performance, thus reducing the amount of energy consumed by households.

In addition, there is now a significant trend towards tablets instead of powder. The beauty of the tablet format is the ability to offer an easy to handle product that contains the exact amount of ingredients to provide optimal results. The main environmental benefit is the substantial reduction of chemical disposal into waste water treatment while ensuring the best wash result. The exact formulation of each tablet is critical and dependent on the performance of the feeding device for each ingredient in the production line.

End Products

Since the end of the 80's detergent compositions have been rich in technical developments: for example the introduction of compact (higher density) powders with activated bleach, color enhancers, the introduction of tablets and more recently capsules. There is also a trend towards the use of concentrated liquids.

Detergent powders, tablets and capsules of different brands are generally packed in bags and boxes of different sizes.



Weigh belt feeders control the flow of detergent ingredients into the process. Other belt feeders are used as bulk flow meters.

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K2G Loss-in-weight feeders are mounted in carousel fashion. These units meter enzymes.

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Process

Laundry detergent production is typically a continuous process. There are a large number of ingredients which must be continuously, simultaneously and accurately fed into a mixer or onto a conveyor belt, which in turn supplies the continuous mixer.

Feeding of Base Powder / Additives

The base powder is produced from various solid and liquid ingredients. The actual mass flow rate of base powder being produced is metered by a Smart Weigh Belt, mounted at the discharge of either a spray tower or fluidised bed.

Next, other loss-in-weight dry feeders add additional minor powder ingredients onto the conveyor belt with the base powder. The combined ingredients then enter a continuous mixer, where liquid additives such as perfumes are dosed in exact proportion using liquid loss-in-weight feeders or liquid PID control.

After mixing, the detergent powder passes through a final sieving and metering stage.

In the final step, a Smart Weigh Belt transfers the finished product into the packing operation. There it flows directly to a packing machine, tablet press or into FIBC's for intermediate storage or bulk transport .

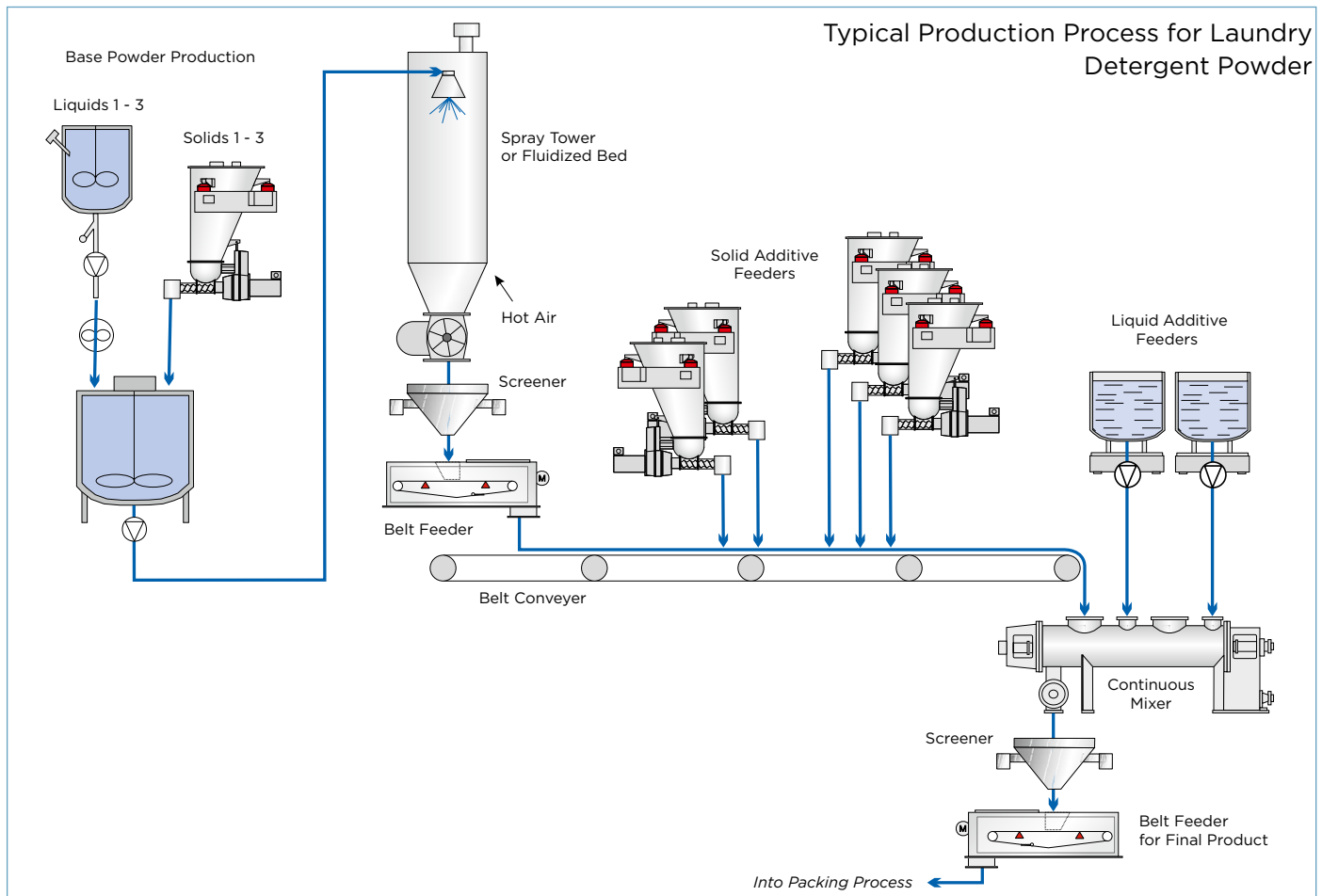
Typical Ingredients

The powder feeder must handle a wide range of ingredients such as:

- > Sodium carbonate
- > Sodium bicarbonate
- > Sodium perborate
- > Sodium sulphate
- > Tetrahydrates
- > Sodium tripolyphosphate
- > Sodium silicates
- > Sodium percarbonate
- > Anionics
- > Encapsulated enzymes
- > Coloured beads
- > Anti-foaming powder
- > Polymers that release stains
- > Polymers that prevent new stains

The liquid feeders supply:

- > Sodium silicates
- > Anionics
- > Non-ionics
- > Perfumes



Smart Weigh Belt Feeder for Base Powder and other Bulk Additives

The Coperion K-Tron Smart Weigh Belt (SWB) feeder is the perfect solution for a compact gravimetric feeder which can handle large volumes of bulk material with different flow characteristics. The SWB feeder offers continuous online taring by using two weigh modules.

Automatic and continuous online taring of the weigh belt reduces costly maintenance, line shutdowns and laborious manual calibration while at the same time substantially improving long term accuracy and stability.

The conveyor is removable from the stainless steel housing via a telescopic support structure. This facilitates thorough cleaning of the feeder.

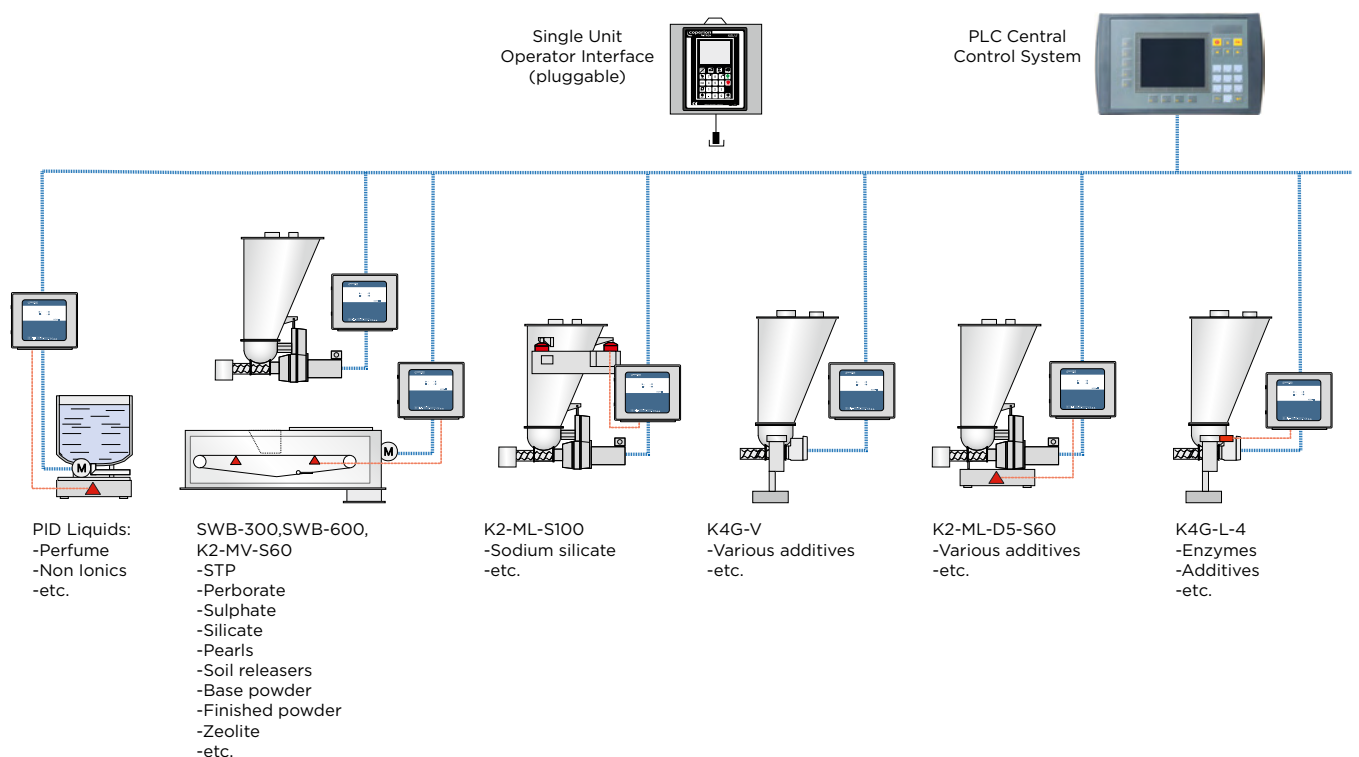


Smart weigh belt feeder with conveyor removed from the housing on the telescopic support for easy cleaning or belt change.



Conveyor with belt removed shows the two weigh modules which allow continuous online taring.

Diagram of Coperion K-Tron SmartConnex System in a Laundry Detergent Process



Case History

A leading European maker of laundry, household-cleaning, and personal care products began planning a new detergent plant in October 1998. It also planned to streamline an existing packaging operation to handle more production and resolve material flow issues.

A Team Approach

The expansion project began with the formation of an in-house team to plan, design, engineer, and monitor construction of the plant. The team included three engineers, a CAD operator, an accountant, a secretary, and a construction site supervisor. An engineering manager led the team and controlled the basic design of Plant 2, with input from all operations and engineering staff at Site 1.

As with the original plant, the detergentmaking process in the new facility begins at the silos, which deliver powdered raw ingredients onto weighbelt feeders. The weighbelts meter the powders into a fluidized-bed processor. (The company was the first to manufacture dry detergents using a fluidized-bed technique.) Atomizing nozzles within the process spray liquids onto the fluidized layer, agglomerating the contents into a mixed powder. The agglomerates then pass through a sieving and metering stage. Oversize particles and particles suspended in the air-stream are recycled back into the process.

Next, other dry feeders add additional minor powder ingredients. The combined ingredients, along with a perfume, then enter a final mixer. After mixing, the detergent passes through the final sieving and metering stages. In the final step, bucket conveyors transfer the finished

product to the packing operation, where it flows either directly to packing machines or into FIBCs for intermediate storage.

The process is continuous and allows for minor formulation changes without stopping the process. For major formulation changes, workers stop production, clean all product from the equipment, and restart it for the next formulation. Final formulations may contain as many as 40 separate ingredients. Therefore, selecting the right powder-metering devices and integrating the controls were crucial steps.

Relying on Experience

Equipment selection for the new plant was by competitive tender against the company's specifications, followed by on-site evaluations. Some elements of the plant were awarded as large contracts to single suppliers. The powder and liquid-metering equipment was one of these elements.

The powder feeders must handle a range of ingredients: sodium carbonate, sodium bicarbonate, sodium perborate tetrahydrate, sodium sulphate, sodium triphosphate, sodium silicates, sodium percarbonate, anionics, encapsulated enzymes, colored beads, antifoaming powders, and polymers that release soils from the fabric and prevent new stains. The liquid feeders meter sodium silicates, anionics, nonionics, and perfumes.

Feeder Selection

The original plant used feeders and weighbelts from a single manufacturer, Coperion K-Tron



International, which operates sales, engineering, and manufacturing sites worldwide. "We had 17 K-Tron feeders in our existing UK plant," the engineering manager said. "Our operational experience with both their loss-in-weight feeders and weighbelt feeders was very good."

Important parts of the technical specification were feeder accuracy for each raw ingredient, control system simplicity, and operational efficiency. "There is not much complementary industry nearby, so we have to be self-sufficient with all equipment," the engineering manager said. "Training was also important, and fully integrating the feeder controls into the main process control system (PCS) was of the utmost importance." The equipment also had to be easy to clean and maintain and should prevent accidental changes to feeder settings.

Easy Integration of Controls

After the evaluations, the team selected Coperion K-Tron to supply the feeding and metering equipment, as well as the

controls. "The aesthetics of the overall feeders were impressive, particularly the weighbelts, with controls completely contained within the stainless steel casing," the engineering manager said.

The control system, called Coperion K-Tron Control Module (KCM), enabled workers to connect a local keyboard and display at the feeder when necessary, while the plant's PCS still retained central control. The ability to integrate all operator-required functions into the plant's PCS was another attractive feature.

"The integration of the process controls was our greatest concern," the engineering manager said. "Our history of installing the equipment meant we had a good deal of knowledge about refill systems, isolation from plant vibration, access for maintenance, and calibration requirements." The load cell system on the metering equipment, called SFT II, also played a role in damping the effects of "electronic noise" within the plant. "The load cell system contains an 'intelligent filter' to greatly reduce the issues associated with plant vibration," the engineering manager said.

The new plant's metering system includes three weighbelts used as bulk flow meters, six loss-in-weight feeders, 13 weighbelt feeders, two volumetric screw feeders, and 12 gravimetric liquid feeders. All of these are controlled via the supplier's KCM controls, which communicate with the PCS on three Modbus loops. All the KCMs are linked electronically with the supplier's SmartConnex system, which enabled the company to minimize the installation of field cable.



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