

# Manual handling forces the Pace of automation

THE MANUAL HANDLING DIRECTIVE, WHICH AIMS TO ELIMINATE ANY MANUAL HANDLING TASKS THAT POSE A RISK TO EMPLOYEES, HAS FORCED THE PACE OF AUTOMATION IN THE DESIGN OF BULK LIQUID AND POWDER FILLING EQUIPMENT. REPORT BY ANDREW SMITH.

It is now ten years since the Manual Handling Directive came into operation in Europe and forced up the pace of automation in bulk handling. Since then, equipment has become increasingly sophisticated and high speed IBC and sack lines as well as on-pallet multi-drum filling stations are now commonplace.

In fact, the directive also prompted a move away from smaller containers altogether in some sectors and stimulated the increased use of IBCs, both rigid and flexible. If manhandling was now frowned upon, ran the logic, then why be restricted to 'man-sized' containers.

On-pallet drum filling systems were introduced to eliminate a handling activity altogether – the depalletising of empty drums ready for filling on a single drum system and their repalletising for onward transport once filled. With these more recent fillers, the drums remain on their pallets throughout the operation.

Initially, most systems employed a counterbalanced filling lance, guided from one drum to the next by an operator. Now, however, semi and fully-automatic systems are available.

For example, a gravimetric on-pallet drum filler, with a simple

teaching system for bung hole co-ordinates, was demonstrated in May at the Achema Exhibition by German bulk liquid filling specialist Logdos now represented in the UK by newly appointed agent Engelmann & Buckham.

The Teach-In system can be used on its own, with the operator moving the filling lance carriage to each bung hole to identify its XY position to the controls or, when jerrycans or similar interlocking rectangular containers are being



**On-pallet drum filling:** Top: Systems from Permex are able to fill multiple layers of containers. Left: Automatic system from Feige uses a camera to locate the bung holes. Above: The Logdos Teach-In system can be used with a template so that only one or two sets of co-ordinates need be given

handled, used in conjunction with a template which clips over each layer of containers during filling. In this case, because the bung holes are kept in a consistent position, the operator need only register one or two positions for the machine to know the position of the rest.

Either way, once bung hole positions have been learnt, filling is automatic and the operator is released to carry out other tasks such as debunging the next pallet load, bunging previously

filled containers, labelling, pallet removal and so forth. The pallet load is automatically tared before each container is filled.

The machine can fill in a variety of ways – above level, below bung hole, or below level – and there is a no-penetration/no-fill interlock with an alarm as well as an optional hood for vapour extraction. A further on-pallet filling system from Logdos uses a vision system to locate the bung holes automatically.

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In fact, a machine of this type was also introduced at Achema by German manufacturer Feige, represented in the UK by Springvale Equipment. The latest version of the Feige camera-equipped gravimetric system is able to locate the bungholes, fill, and close automatically. It can identify whether containers are open or closed and is said to be unaffected by dirt, labels or water stains on the top of the containers.

The machine will handle any type of container from 20 litre cans to 1000 litre IBCs and is completely automatic in operation once the pallet load has been presented. Operator involvement is reduced to changing the pallet and pressing the start button.

Another on-pallet filler is the Panda from British manufacturer Permex which has delivered its latest system with a new easy-clean head and redesigned filling arm brakes.

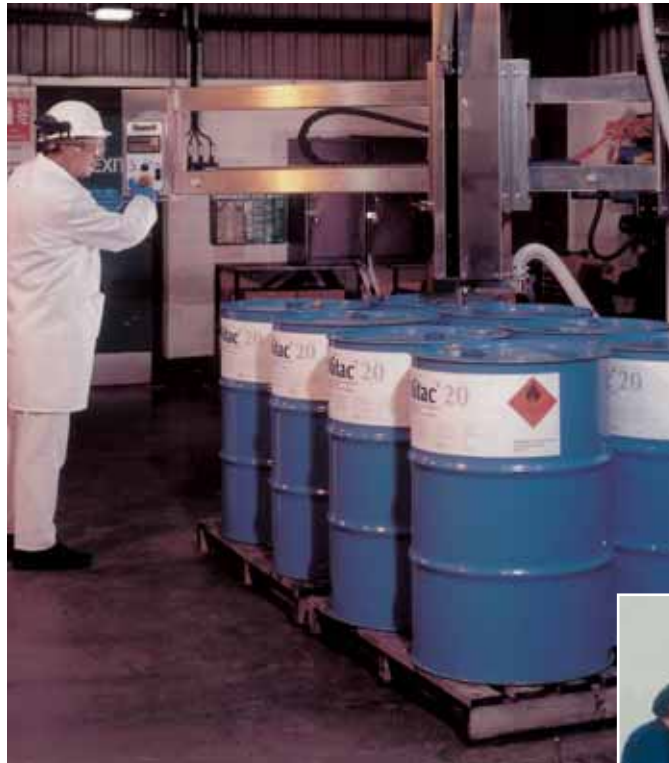
Ordered by a multi-national speciality polymer concern for use with inverse emulsions, it can fill various sizes of containers from 1.5 to over 1000 litres.

Filling multi-layer containers directly on the pallet, the Panda is said to provide high productivity, without the need for conveyors or complex multi-head machines. Changing between different size containers is simply carried out by selecting a different quantity on the batch controller before placing the filling head in the container and pressing start.

Permex says brakes are normally only fitted to the filling arms of weigh-scale machines to ensure the arm does not touch the container during weighing. However, this particular customer required brakes to hold the head in the desired position to enable high flow rates and hands-free filling, even on the lightest and smallest of its containers.

Meanwhile, BASF company, Knoll Pharmaceuticals, has installed a Masterfil single head flowmeter on-pallet liquid filler to handle various formulations of solvent in drums ranging from 20 to 210 litres.

The formulation is pumped from a bulk tank to the header tank supplying the filler and the liquid is accurately measured by passing it through a Coriolis mass flowmeter located above the filling nozzle. "The big benefit is that the Masterfil filler allows a previously filled drum to be capped



**Flowmeter filler:** Masterfil machine at Knoll Pharmaceuticals

and sealed while the next one is being filled," explains Dave Harris, project co-ordinator at Knoll. "This would not be possible with a weigh cell filling system – in fact this system does away with the need for a floor mounted weigh platform or cell completely."

Safety was also a consideration, as Masterfil director Brian Potiphar explains.

"Because of the flammable nature of the solvent being filled, an extremely important consideration for Knoll is that the filler conforms to the flameproof environment in which it is used. A fume extraction take-off point further reduces any risk of combustion and safely diverts the fumes away from the operator."

### Rising filling nozzle

The flowmeter filler features a powered drum nozzle which rises while filling to prevent foaming. Weight adjustment is programmable by keypad and the drums can be filled at speeds of more than one container a minute for 20 litre drums, while a pallet of 200 litre drums takes less than 15 minutes.

The use of flowmeters rather than weighing platforms also avoids the need for pallets and containers to be repeatedly placed within close proximity to the machine, which in some cases can prove to be awkward and time consuming. This is why, earlier this year, RCS Filling Machines introduced its APS200 for large containers.



**Drum emptying:** Kecol Powerprime



**Weigh filling:** Coca-Cola syrup is filled by two Masterfil machines at Golden West Foods

This flowmeter filler does away with the need for accurate pallet placing, by requiring the pallets to be placed only within the 1.6 x 1.6 metre working area of the machine.

RCS says another common problem with automatic filling systems is the restriction to a single operation and the ability to only fill one container size. The design of the APS200 overcomes this by providing two filling options.

In automatic mode it will automatically index the filling nozzle between the containers, filling one at a time, or in manual, the operator can fill containers in the traditional manner by manually indexing the nozzle between containers, so users are no longer restricted to one container size. The



**In-line step-across:** Feige Rapid Filler can have up to six filling valves

machine can also be designed for top or bottom filling depending on the product.

Coca Cola syrup destined for use in McDonald's restaurants all over the UK is now being filled into 300 litre containers by Golden West Foods using two Masterfil weigh fillers.

The machines are being used each week to fill some 400 of the stainless steel tanks which are then transported to the fast food chain's outlets. The tanks are then returned to Golden West where they are cleaned and used again. Prior to the introduction of this system, non-reusable containers were used to fill tanks in the restaurants.

### Digital weigh filling controls

Sunk into a pit so that they can be used like a weigh bridge, the Masterfil machines incorporate Mettler-Toledo digital weigh filling controllers to control the fill automatically. The tanks are rolled onto the weigh fillers and the machines' 1 metre stroke diving nozzles are lowered into the containers automatically.

Accuracy is high, says Angus Darwin, chief engineer for Golden West's liquid production division.

"We are able to guarantee the tight tolerances required by our customers with these 300 litre tanks. For instance, we can guarantee filling to plus or minus 0.2 litres and they are designed to cope with our rigorous cleaning procedures."

French concern, Pack 'Realisations, specialises in electronic weigh fillers for filling bulk liquids, either in individual containers or on-pallet. The company has taken the principle of in-line technology and created a compact rotary machine whereby the containers or drums are held in a set of tooling and taken through a number of stations – eight or ten – where pre-filling, filling, capping and overcapping takes place.

Pack 'Realisations says this leads to several advantages as the container is held in the same set of tooling for both filling and capping, the speed of the machine is higher than traditional in-line equipment and the footprint is "very compact", which makes fume extraction and laminar flow easier.

The tooling is said to be easy to change with no need for tools and, with the fill weight adjusted from the control panel, many customers are said to use this style of machine for several different containers with varying styles of closures. Indeed, Pura Foods in the UK has three different styles of closure on the same machine – screw cap, plug cap and pail lid – selected via a switch depending on which type of container is to be filled.

Available in the UK through Integrapak, the Pack 'Realisations range also includes a bespoke palletiser and depalletiser for difficult larger containers.

A high speed in-line gravimetric pail filler capable of 4000 x 20 litre containers an hour was among new developments announced at Achema by Feige (represented by Springvale Equipment).

### Suitable for hazardous areas

The Feige Rapid Filler is aimed at chemical products, paints and building materials and is suitable for operation in zone 1 hazardous areas. It can be equipped with up to six filling valves, each operating typically at around 11 x 20 litre containers a minute, and can be fitted with the new Feige 6in valve to handle highly viscous products. Maximum pail size is 30kg.

Control of the filling valves is via a weigh scale, with product flow automatically adjusted during the filling process to achieve the fastest fill rate consistent with avoiding spillage.

Containers are taken to and from the machine on parallel conveyors and stepped across under the filling position. All movements are under controlled acceleration and deceleration to avoid product spillage.

Also launched were transportable filling sta-

tions including the Types 14 and 19, which can be moved to the bulk storage tanks by fork lift or on rollers and simply plugged into an air and electrical supply, as well as a short product feed pipe, avoiding complex piping to a fixed filling point.

The Type 14 handles single containers up to 60kg, and the type 19 will accommodate drums up to 300kg while a further transportable fill-and-plug station, the Type 17 co-ordinate filler, handles several containers on a pallet.

### Specialised palletising robot

Feige also introduced a palletising robot equipped with a new multi-purpose gripper designed specifically to handle a number of pails or drums at a time, as well as the pallets themselves.

Emptying drums of liquid is something that almost all companies need to do from time to time and a number of companies offer solutions, generally derived from their filling equipment ranges.

Permix has based its systems on its Jumbo filling machines and offers a variety of liquid lines. The company says that generally free-flowing liquids can be handled by inserting a dip-pipe into the drum and using an in-line pump to pull the material out. For high viscosity materials it can supply pneumatically-operated drum pumps which have been mounted on the arm end, allowing the operator to move the pump to the vessel which needs emptying.

The Jumbo can be supplied with measurement systems appropriate to the application. These can be flowmeters, such as turbine meters, electromagnetic meters or mass flowmeters – which have the ability to warn if the line becomes empty of liquid – or weigh scales.

The dip tubes or drum pumps can also be provided with level sensing systems to detect when the drum has reached a low level point to prevent air being drawn into the line. Foot-operated valves and pneumatically operated valves to prevent the line draining, and wiper rings and drip cups can also be provided.

A drum emptying system for viscous liquids and pastes which enables up to four drums on a pallet to be emptied, without manual handling, has been introduced by Kecol Pumps. The Model 540 Powerprime system has an articulated arm with two pivot points enabling the drum pump to be positioned over each drum in turn. The pump is raised or lowered into the drum by operating a control valve on the pneumatically operated unit.

For high viscosity, semi-flowable and sticky products, such as fruit pastes or tomato paste, a

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follower plate is attached to the suction inlet which the company says enables these products to be pumped cold with a minimal amount of waste. The system can be used on straight-sided or tapered drums and is also suitable for drums with aseptic liners.

For filling and emptying liquids from IBCs, Maso Process Pumpen claims its sine pump cannot be bettered.

The company says that with the combination of high suction, high viscosity handling, low shear, pulse-free flow and easy maintenance, the pump empties IBCs "very efficiently, leaving an absolute minimum of material inside the plastic liner".

For road tanker emptying, the pump is also said to be superior, saving both time and

energy, and ultimately money by releasing the tanker earlier to carry on work elsewhere. For example, the company claims its pump can empty a 25,000 litre tanker of fruit juice concentrate in an hour and 45 minutes using only a 5.5kW drive, compared to a standard lobe pump which would take 4-5 hours using a 15kW drive.

Other suitable applications include suction lifting of heavy viscosity products from 200kg drums and other containers without damaging any suspended solids. The low shear also enables it to handle products such as detergents without foaming.

### Solids handling

Whereas a common problem with liquid handling is moving the material, particularly when it has a high viscosity, with solids handling, especially of powders, the major concern is often exactly the opposite – containment. In non-hazardous products, lack of containment can lead to product loss and cross contamination from ambient influences, and with toxic powders there is the additional problem of operator safety.

In both cases the presence of static electricity can cause poor powder flow, surface contamination, shocks to personnel and even risk of combustion and explosion.

Well aware of these potential problems, the

industry has spent much time and effort creating safe, reliable systems for handling bulk powders and a number of solutions for applications across all industry sectors are available.

A simple solution for powder transfer is Mueller's dust free handling system which is typically employed in tablet manufacture. The



**Above:** Latest version of the Flowmat Carousel bag filler has automatic final weight adjustment.

**Right:** Zanchetta Shuttle employs PE liners to ensure containment during gravity transfer

press is fed by a drum and hopper assembly lifted over the press by a mobile lifting unit into the support nest mounted on a column.

The male hopper discharge tube is lowered into the female charging tube on the press through a diaphragm that temporarily seals the connection. Charging of the press can then begin by simply actuating the valve on the base of the hopper. Dust escape is prevented because of the fit of the diaphragm around the discharge tube. If hazardous product is being handled, Mueller says any risk of dust contamination can be entirely removed by using a variant of the system that includes a dust removal vacuum.

Available in the UK from Ultrapac, the system can be produced in a number of variations to charge reactors, blenders, mills or other stations.

Healthcare specialist Romaco Zanchetta says it offers a complete range of handling equipment for use in the production of solid dose pharma-

ceuticals. From standalone manual installations to fully-automated factory systems, the company's Integrated System (IS) plants are claimed to "improve productivity with a number of novel solutions".

Handling equipment in the range incorporates bins for powders, granules and tablets, bag dumping and bin emptying stations, semi and fully-automatic bin washing stations, connection and transfer systems, calibrators and column hoists. The company has recently invested in an in-house bin manufacturing plant, which it says can supply virtually any size or shape of bin, either from stock or with rapid delivery.

The range of Zanchetta hardware is complemented by a number of connection and transfer systems – the ISOClean range – which are claimed to address the technical and validation issues posed when products are transferred from

process machines to intermediate storage, or from storage to packaging machines.

Where low Operator Exposure Levels (OELs) are essential when moving bulk powders and granules, the performance of the ISOValve is said to be exceptional, with the standard version limiting exposure to less than 10 microgram/m<sup>3</sup>. The valve features a simple design, with an ultra-low profile doing away with the need for inflatable seals.

The passive part of the system consists of a magnetic stopper that couples automatically to the active valve the instant the two are brought together. The physical properties of the stopper are said to allow the system to be greatly simplified, with full split-valve

isolation assured from an assembly with only six parts in total.

The Air Chamber and Shuttle are transfer systems designed for gravity feeding product from storage in the technical area to the hoppers of packaging machines on the floor below. Both feature disposable polyethylene liners located in the transfer pipe and when used in conjunction with the ISOValve, Zanchetta says they guarantee



complete segregation of product and environment and eliminate the need to clean the transfer pipes at every product change. An added benefit of these systems is gentle handling, with the rate at which products descend controlled at all times.

T-Mail takes the established concept of pneumatic transfer (used widely in mail sorting) and applies it to handling solid dose pharmaceuticals. At the point of origin – a processing machine, IBC discharge station or tablet press, for example – product is loaded automatically into sealed containers and then dispatched pneumatically along transfer pipework. At the destination, the containers are opened and unloaded, again automatically, before being returned to the point of origin to collect another load.

The advantages of the system include the ability to transfer product through any area of the plant and over almost any distance with total containment, full automation of transfer, disposable cartridges and again, no cleaning of pipework.

### Handling fine particles

Fumed silica – used in the manufacture of silicon rubber, inks, paints pharmaceuticals, cosmetics and as an emulsifying agent for oil-water systems – is notoriously difficult to handle as it has an extremely light bulk density, fluctuating from 32 to 160kg/m<sup>3</sup> and a very fine particle size which can be sub micron.

These characteristics alone make gravimetric feeding problematical enough, but this is also compounded by the product's variable flow properties. When flow is induced – by injecting air – the silica becomes extremely fluid and in many cases can cause flooding through a metering mechanism. When allowed to de-aerate and settle, the material becomes quite sluggish.

Faced with these problems, Acrison has developed a bin discharger feeder and bin discharger with a large cross-section inlet and specially designed conditioning augers to allow for mass flow without fluidising the product. The company says its non-load cell, high resolution counterbalanced scale system can detect the discharge of small amounts of silica, even on a large weight loss feeder.

Flomat Bagfilla International says it has made a major improvement to its high capacity Carousel FIBC filling machine by fully automating final weight adjustment. It claims this improvement will improve efficiency, reduce operator fatigue and, typically, achieve an accuracy of ± 200g per 1000kg bag. Throughput is 80 to 100 x 1000kg bags an hour.

The Carousel machines have three stations, but only two operators. At the first station an operator rigs the IBC onto support arms and connects it and its liner to the filling head, which has an inflatable seal for dust-free operation. A blower inflates the liner to shape the bag ready to receive its contents.

The FIBCs are then automatically indexed around from one station to the next after each operation and at the second station filling from the pre-charged weigh hopper commences once the FIBC is in position. The loadcell mounted hopper is charged with product while the FIBC is rigged.

A pneumatically operated, cone-shaped vibrating table alternately lifts to compact the product and lowers to allow the bag to stretch, producing stable, easier to handle and aesthetically pleasing FIBCs. Air displaced during filling is vented to a high capacity filtration system.

While previously the weigh hopper was always charged with the total weight at station two, the latest model now marginally under-fills the FIBC, and at station three each one is check-weighed and automatically topped up via a metering feeder, avoiding the need for manual adjustment.

The second operator ties off the top of the liner and then the neck of the IBC itself before placing the weight confirmation ticket into the pocket of the filled FIBC while moving it onto a conveyor for collection by fork lift. Flomat says the high filling rate – it usually takes three fork lifts to keep up with the output of the Carousel – eliminates the need for storage and consequent double handling of filled IBCs. ■

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