

Bigger packs - smaller packs: Cutting heavy lifts

THE MANUAL HANDLING DIRECTIVE, WHICH AIMS TO ELIMINATE ANY MANUAL HANDLING TASKS THAT POSE A RISK TO EMPLOYEES, HAS TENDED TO POLARISE BULK PACKAGING INTO BOTH SMALLER AND LARGER CONTAINERS.

One principal driver has been responsible for changing the way in which large or bulk packs are produced and sold – the Manual Handling Directive, which requires employers to control and preferably eliminate all manual handling tasks that pose a risk to their employees.

Research into strain injuries in general and back injuries in particular indicates that there are significant risks of injury when people handle loads weighing over 25kg and that injuries can occur with loads as light as 15kg if someone is handling them repeatedly.

So one response to this problem has been to instruct suppliers to deliver materials in smaller sizes, so that the weights being handled are reduced to a safe level for manual lifting. A typical example of this is cement.

Another response to manual handling problems is to eliminate manual handling altogether and have materials delivered in bulk packs, such as IBCs, which can only be moved with pallet trolleys or fork trucks. This solution has the advantage of not only eliminating manual handling, but also reducing packaging waste because a 1 tonne reusable IBC can replace 40 disposable paper sacks.

Indeed, 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.

There are three basic options in terms of dosing: piston, flowmeter or filling by weight, each with their merits depending on the application. However, as UK manufacturer Masterfil points out, the weigh filling option is often chosen since it requires no priming and delivers a full pack on the first shot following a changeover.

Masterfil makes all types and is currently



One machine – several applications: Masterfil on-pallet flowmeter filling machine handles jerrycans, drums and IBCs

building a typical on-pallet drum filler for a French agrochemicals company based, in this case, on a weighcell. The filling lance is manually positioned, with powered vertical movement for the boom and lance and two sets of controls at either end of the boom.

Duplicate controls

These duplicate controls are standard on Masterfil on-pallet fillers and allow the operator to work from all sides of the pallet and manoeuvre the lance accurately into the bung holes without stretching, particularly important when 5 x 4 layers of 25 litre drums are being handled. Alternatively Masterfil is able to provide fully automatic operation.

For cleaning, Masterfil offers a simple system in which the filling lance is clamped into a scabbard and cleaning fluid pumped through the entire system, cleansing the internal dosing parts and also the outside of the lance in a single operation.

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

For example, an on-pallet drum weigh filler, with a simple teaching system for bung hole coordinates is now available from German bulk liquid filling specialist Feige, represented in the UK by Springvale Equipment.

When bung hole position is usually random, such as with four 200 litre drums on a pallet, the operator uses a joystick to identify the X-Y co-ordinates of each bung hole to the controls and allow the drums to be filled automatically. Alternatively a template is used, and the bung holes aligned with it manually. The filling valve then moves automatically to these pre-programmed points.

When jerrycans or similar interlocking rectangular containers are being handled, and bung hole position is pre-ordained by the palletising pattern, a height adjustable template, carried on pneumatic cylinders, is clipped over each layer of containers during filling, ensuring that containers with offset bungs have been palletised in the correct orientation.

Since bungholes 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

semi-viscous liquids such as lube oil, or to fill from outside when high viscosity products such as grease are involved.

A vapour extraction system that operates through a jacket around the filling lance – so reducing the amount of vapour-laden air that requires scrubbing – is also available along with the more traditional gas hood systems.

One of the latest Feige machines to be delivered in the UK by Springvale is a type 37 automatic drum-on-pallet machine which is being used by International Flavours and Fragrances (GB), Haverhill, to fill a range of ingredients into 4 x 200 litre drums placed on a pallet.

The machine fills by net weight and so incorporates a weigh scale on which the pallet stands while the drums are filled automatically in turn, using a template.

For higher throughputs, and handling hazardous chemicals, Feige also builds completely automatic in-line drum fillers which can be enclosed in a chamber, flameproofed and equipped for nitrogen purging.

French manufacturer Pack Realisations, represented in the UK by Integrapak, has recently

Bespoke line handles food ingredients in drums and IBCs

Weightron Bilanciai has installed and commissioned a bespoke caramel filling line and mechanical handling system to handle a variety of containers, drums and IBCs for the food ingredients division of the Healy Group, at Bardon Hill, Leicestershire. Based on a weigh-fill StrongArm filling machine, the line handles a wide range of viscosities from free-flowing liquids to heavy treacle.

"The design of the line gives us the best of both worlds and allows us to accommodate the different filling requirements for the wide range of end customers," explains Healy Group operations manager Mervyn Penson. "Although the majority of caramel is shipped in bulk to food and beverage manufacturers, there is a growing requirement for smaller quantities in more versatile formats."

For longer runs of the same product, the filling system can be set to fill 25kg screw top containers automatically. To fulfil smaller orders, which may be made up of different

extended its range of rigid container filling machinery with a rotary indexing filler-capper for drums, the PR6/2000 series E.

Containers are accepted onto a starwheel and indexed to the operating stations for orientation, taring, pre-filling, net weight filling, cap-



In-line: Feige automatic drum filler with enclosure

been learnt, filling is carried out automatically and the operator is released to carry out other tasks such as de-bunging the next pallet load, bunging previously filled containers, labelling, pallet removal and so on. The pallet load is automatically tared before each container is filled.

A further on-pallet filling system from Feige is equipped with a vision system to locate the bung holes of drums or jerrycans automatically and then de-bung, fill and bung – all without operator intervention once the pallet has been positioned.

Like other systems in the company's range the filling lance can be programmed to operate below surface for flammable or foaming liquids, to fill from just inside the bung hole for



Rotary: Complete rotary drum filling-capping station and palletising system from Pack Realisations



Filling a variety of containers: Weightron Bilanciai weigh-fill line handles caramel for the Healy Group

size containers including 25kg pails, 250kg drums and 1000kg IBCs, the line can be switched over to semi-automatic mode.

The filling head is carried on an articulated arm supported by a compact central pillar, and can be moved easily to give a full 360deg working radius with a reach of over 2 metres, so

ping the bunghole and crimping the cap. The PR6/2000 can be equipped with one to three filling stations, giving an output up to 120 x 200 litre drums an hour.

Pack Realisations points out that the indexing mechanism makes the machine particularly flexible and able to handle a range of containers from 20 to 250 litres. Format changeovers are said to be simple and quick – less than 15 minutes – as a result of its 'Click & Play' tooling method. Height adjustment for all stations is centralised with these and other format settings held in memory.

Optional equipment, aimed largely at flammable or aggressive products, includes cabinet enclosures for fume extraction, nitrogen injection before and after filling, capping under pressure, and a CIP system.

Complete turnkey lines are also available, such as a recent installation by Pack Realisations at a petrochemical site in France. This is designed to operate in an explosive area in accordance with ATEX regulations and includes an automatic infeed table carrying up to 40 x 200-litre drums, a PR6/2000 series filler-capper, labelling equipment and a palletiser, all built by the company itself.

The first rule of powder filling is that appar-

offering optimum filling versatility around the centre of the machine.

In automatic mode, the arm is locked in position with the filling lance positioned above the conveyor. In semi-automatic mode, when filling different size containers, the lance is moved manually.

ently similar powders can behave quite differently within a filling machine.

In theory, the bulk density and angle of repose of a powder are the equivalent of the specific gravity and viscosity of a liquid and should therefore define the powder. However, unlike most liquids, the bulk density and angle of repose of a powder will in practice vary from batch to batch and even from dose to dose. Moreover, what is frequently not recognised is that powders have two states, a dynamic state in which they are fluidised and can be moved and a static state when they are settled.

Dynamic bulk density

The static bulk density can be measured, but the dynamic bulk density can often only be guessed at. The bulk densities of these two states can be quite different and the energy needed to fluidise and the time taken to settle a powder can vary widely. Large particle sized powders such as dry sand will fluidise and move very easily and settle very quickly, while small particle sized powders such as icing sugar take a lot of shifting when compacted but, when fluidised, behave like water and are slow to settle and compact.

Inevitably, most products lie somewhere between these two extremes, but the success of

In the automatic mode, rectangular 25kg containers are automatically indexed along the powered conveyor before stopping underneath the filling lance on a section of conveyor supported by a stainless steel 60kg capacity weigh platform.

At this point the weight of the empty container is automatically tared out and the filling lance descends just inside the neck of the container, with two speed filling employed to ensure optimum accuracy – fast to 95 per cent and then a trickle feed.

Following capping, containers are removed from the conveyor and stacked on a pallet using a pneumatically powered lifting arm. Containers are filled in under 20 seconds – depending on viscosity – to a tolerance of $\pm 10g$, says Weightron Bilanciai.

In semi-automatic mode, the system employs a stainless steel floor scale with three 3000 division ranges – 0-300kg x 100g, 0-600 kg x 200g and 0-1500 kg x 500g – to allow different size containers to be filled on the same machine at the same relative accuracy, saving time and cost.

In this way 25 kg drums can be weighed to $\pm 100g$, the 250kg size to within $\pm 200g$ and the IBCs to within $\pm 500g$.

T: 01246 260062

E: sales@weightroncb.co.uk

a particular powder filling system depends not only on the accuracy of measuring out the product and its ability to cope with changes in bulk density, but also on how quickly it can take the product from the dynamic to the static state.

Powders that are difficult to settle can be dealt with in a number of ways. These include filling the fluidised product into an oversized bag and letting it settle off line before sealing, filling the fluidised product and extracting excess air by vacuum on line (a process sometimes called vacuum densifying), or filling the product in a compacted state. Settling by vibration is probably the most widely employed.

Last year Arodo announced a new pack de-aeration system – based on the vacuum densifying principle – that enables all air to be removed from the product and the bag or sack sealed without perforations. Originally aimed at the cement industry, this process has now been found suitable for any powdered material that packs with entrained air, such as milk powder. In fact, Arodo reckons that bag volumes can also be reduced, in many cases up to 50 per cent, and has a self-contained pilot plant that can be shipped to a potential customer's site to test the process under real conditions.

"Our experience tells us that factors such as

BULK LIQUIDS AND POWDERS

temperature, moisture and the type of transfer system to the packing line can dramatically affect a material's characteristics, which cannot sometimes be re-created in tests within our factory," says Arodo.

Indeed, the vacuum densifying approach has a number of advantages in bulk packaging, not least that the density of the product can be adjusted to give sacks the optimum rigidity for secure palletising. Cleanliness and lack of dust is another.

Bottom up filling is also a way of countering dust and helping the powder settle quickly.

For example, All-Fill has just supplied a dual head automatic system to a German company, for dosing drums with 75kg of micro-cellulose powder, replacing a large weighpan type system which required violent vibration and was extremely dusty.

The solution provided by All-Fill features tare weighing of the empty drum, full height container lift to provide a bottom-up fill of the powder without aeration and consequent dust generation at the first bulk fill head, and gravimetric weigh-filling to an accuracy of 20g at the second top-up head.



Bottom up filling: All-Fill system handles 75kg drums of micro-cellulose powder

New from Chronos Richardson Systems Europe is the Chrono-Fill PBS 500 open-mouth sack filler which can handle 5-50kg bags of powders or granules at speeds up to 700 an hour. The complete system includes weighing/dosing unit, bag placing, bag filling, bag closing and bag transportation modules in a compact layout that requires minimum floor space. A fully integrated PLC control system is also said

Bulk bag discharger transforms output

Electrical transformer manufacturer Carroll & Meynell has increased output significantly following the installation of a Spiroflow bulk bag discharging and conveying system to handle the silica sand used to 'pot' the transformers.

Previously sand was received in 25kg bags, emptied into a hopper and the hopper raised over the transformers by fork truck, a time-consuming process.

Now sand is delivered in 1 tonne FIBCs and carried by Spiroflow flexible screw conveyors up to small holding hoppers above two production lines for discharge into the transformers.

to reduce installation time.

At the heart of the PBS 500 is a light and fast bag transfer system, which Chronos Richardson says helps ensure that product contamination is eliminated from bag placing through to closing, while a bottom-up filling system is available to meet the hygiene requirements of the food industry.

Options include bulk material feeding systems, air evacuation devices, vibration systems, densification modules, bag closing, labelling and marking devices as well as palletising and load protection systems.

Fills up to 25kg

German built Behn + Bates bulk powder filling machinery was shown in the UK for the first time at last year's PPMA Show by agent Springvale Equipment which highlighted a new valve sack filler developed to handle free-flowing powders for fills up to 25kg, gross or net weight.

For hygiene in the food industry, the machine incorporates a purpose designed filling spout with integrated bag de-aeration, an easy clean surface, and power cabling located in the upper areas of the housing, outside the dust area. Bags are sealed at the filling spout by ultrasonics.

Indeed, complete containment to avoid spread of dust and noise is often required, which is one reason, says Springvale, that Behn + Bates has been particularly successful in the food ingredients market with the Integra Plug 'n Pack system.

Springvale points out that the Plug 'n Pack system combines the bag placement, filling and sealing stations in one compact cabinet so



Unloading sand: Spiroflow bulk bag discharger and conveyor system at Carroll & Meynell

T: 01200 422525

E: sales@spiroflow.com

forming a dust-tight and low-noise fully automatic filling plant that can be housed in tight spaces. As a result, commissioning times are also said to be particularly short, hence the Plug 'n Pack name.

One recent installation outside the food industry is at a German animal feed producer for filling grass seed and animal feed into 10 and 25kg polyethylene and paper valve sacks at the rate of 180 an hour. ■

For further information:

All-Fill International
T: 01767 691100
E: info@allfill.co.uk

Arodo
T: 01634 672253
E: sales@arodo.co.uk

Chronos Richardson
T: 0115 935 1351
E: info@chronosrichardson.com

Integrapak
T: 01420 593680
E: integrapak@integrapak.co.uk

Masterfil
T: 01296 425001
E: sales@masterfil.com

Springvale Equipment
T: 01420 542505
E: springvale@springequip.co.uk

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Agrochemicals filling line offers Versatility and accuracy

A NEW FLOWMETER BASED FILLING LINE – INSTALLED IN LIMITED SPACE – DEMONSTRATES HOW A BROAD RANGE OF SMALL AND BULK PACKS OF LIQUID AGROCHEMICALS CAN BE HANDLED EFFICIENTLY AND WITH HIGH ACCURACY ON THE SAME EQUIPMENT.

Agricultural chemicals manufacturer Nufarm UK, at Belvedere, Kent, has brought its packaging in-house with a substantial investment in a new automatic filling line capable of handling some 20 million litres of herbicide a year. The line was designed and commissioned in under six months and only requires three operators to run it.

The line at the moment operates on a single shift and is scheduled to pack some 6 million litres in its first year of operation, from an area of just 25 metres x 25 metres.

Central to the line is a purpose-built Masterfil eight head mass flowmeter filler, chosen for the intrinsic accuracy of flowmeter machines, ease and security of cleaning, and the capacity to handle a broad range of container sizes, from 1 to 20 litres.

“Bringing all filling and packaging in house gives us better control of quality and logistics,” explains Phil Dickinson, formulation manager at Nufarm’s Belvedere plant. “Mass flow meters are used elsewhere on the site and we find them to be one of the most reliable forms of measuring available. Cleaning is also very secure, since they are based on a straight through tube.”

An Australian company, Nufarm acquired the Belvedere site in 1994 – its first outside Australasia – and at the same time set about expansion, now manufacturing in 14 countries and with marketing operations in 20. Belvedere packs for both UK and parts of the European market, currently filling some 20 different formulations of herbicide.

Previously the site carried out only a small proportion of its filling and packaging, using a low-speed line equipped with a single head filling machine, with the remainder handled by contract packers.

The new line was designed and supplied by Masterfil. It runs down three and a half sides of a refurbished 25 x 25 metre building, extending



Flowmeter filling: The heart of the Nufarm line is an eight head Masterfil machine

from a pallet lift and infeed table for containers, stretch sleeving, filling, capping, labelling, checkweighing and induction sealing through to end-of line. Speed is 14 containers a minute for 20 litre jerrycans through to 40 a minute for round 1 litre bottles. Other sizes handled are 5, 10 and 15 litres.

Container flow crucial

With minimum space available, and little or no room for accumulation between the various items of machinery, start and stop queuing and control of container flow has been crucial, as Phil Dickinson explains.

“There is less than a metre between some machines, yet when the line is working on 20 or 15 litre containers – which have the same foot-

print – we’re looking at controlling a block of eight containers 2.4 metres long. In spite of the space restrictions, Masterfil has provided an excellent means of controlling the line, which we can set up to optimise production on the different size containers.”

From the infeed table, which has an adjacent pallet lift to allow containers to be swept manually across, a layer at a time, the empty packs pass to a stretch-sleever. Servo driven, the machine is able to decorate containers of 5-20 litres with a conventional stretch sleeve and also apply a ‘sleeve booklet’. This consists of a sleeve with the material extended beyond the seam to form two additional flaps held in place by peelable adhesive, so providing user information on four pages of virtually the same area

as the front panel of the container.

However, as Phil Dickinson points out, the sleeve booklet is in effect three layers on one side and a single layer on the other, so the sleever chosen had to be capable of fine control over tension to avoid risk of tearing during application.

Filling then takes place on the eight head Masterfil mass flowmeter machine. Apart from high accuracy, which is better than ± 0.2 per cent, or $\pm 40g$ on a 20 litre fill, the flowmeter dosing system allows Nufarm to change over quickly and securely using a new sequential CIP approach developed in conjunction with Masterfil.

Cross contamination eliminated

As filling plant team leader Martin Childs points out, with both selective and total water-based herbicides in the product portfolio, the slightest risk of cross-contamination had to be completely eliminated.

"Since the flowmeters have no moving parts they can be flushed through by hot water as easily as a plain pipe," he explains. "However since eight heads are involved, and there could be a pressure drop that would reduce cleaning efficiency, we called on Masterfil to give us a system in which each head is cleaned in sequence by full pressure."

This has proved successful and Masterfil has adopted the system as standard on other flowmeter machines.

Manual mechanical changeover on the filler involves adjusting the side guides and the pitch of the nozzles to suit different size containers, while nozzle height is motorised and forms part of the product program selected from the control panel, along with fill volume, flow rate and the speed with which the bottom-up filling nozzles rise to avoid foaming.

To adjust nozzle pitch, eight containers are run into the machine against the gate and the nozzles simply lined up with the necks. This, explains Martin Childs, has proved much simpler than marking the support beam since container width can vary and nozzle position may even need to be adjusted during a run in compensation.

Password protection for the main program on each product also allows operators to adjust speed and fill volume to counter any variations in the product batch, but without changing the base settings permanently.

From start to finish, a full container and product changeover can be accomplished well

within the two hours that it takes for the final wash water to be analysed within Nufarm's laboratory and the machine declared clean for handling another product.

Nufarm employs closures with two types of tamper evidence: ratchet style circumferential tear-off skirts or induction sealing. Both are applied by a Mastercap single spindle machine, fed by an elevator-unscreamer. Six different cap sizes are handled.

The Mastercap machine is one of the latest from the company and has been engineered for higher speed than its predecessors. This includes a new design of gearbox, which provides smoother indexing of the capper's starwheel, so allowing faster transfer between infeed and capping station without risk of slopping.

Other improvements include a wider cabinet to improve access for changeover and a larger diameter starwheel to cater for containers with a long footprint, such as Nufarm's 15 and 20 litre jerrycans. Motor-driven spindles are now used to change the height of the capping head for a different container, giving smoother and more accurate adjustment.

Nufarm stretch-sleeves some of its products but others are labelled. So following the capper is a front-and-back labelling machine with an additional side belt on the outfeed to allow 1 litre bottles to be given a full wraparound label. The machine also includes a top hold-down belt to ensure containers cannot topple.

Checkweighing is carried out on two machines, one for the 1 litre bottles and a heavy duty machine for the remaining sizes up to 20 litres.

Nufarm also uses a standalone scale to make regular additional weight and other QC checks as part of its E-marking procedure now granted approval by NWML. The machine calls for samples to be placed on its weigh platform and interrogates the operator with a series of questions including the condition of the container, closure label, coding and label position. Data is fed back to create records on a production office PC.

Tighter tolerances than required

However, as Phil Dickinson explains, "Flowmeter filling means we have been able to set ourselves tighter tolerances than legislation requires." For example, although average weights legislation demands no more than a $\pm 150g$ tolerance on a 10-litre container, Nufarm is able consistently to obtain considerably higher accuracy.

A counter-balanced bottle lifter has also been installed, to avoid heavy manual lifting by operators when transferring bottles to the stand-alone checkweigher.

Induction sealing, where required, comes next with containers passing below a machine capable of operating at a range of up to 25mm to cater in particular for caps that sit in the recess below the shoulders of jerrycans.

Nufarm has also installed a vision system a metre or so upstream to monitor caps automatically and confirm the security of each closure. A further vision system checks the date and batch codes printed on the containers at this stage by an ink jet.

Case-packing is carried out on a heavy duty bottom load machine which creates collations of 2 x 1 for the 10 litre size, 2 x 2 for the 5 litre size and 2 x 4 for the 1 litre bottles. Larger containers go through the machine on a bypass direct to the palletiser.

The machine is equipped with an extended horizontal magazine, allowing up to 150 blanks to be held and give unattended running time of about 15 minutes on 10 litre containers and 45 minutes on the 1 litre size.

Cases identified on top

A large character ink jet printer is then used to place a product description on the top of the case – for improved visibility to delivery drivers – while a case labeller adds a generic label to the face. A case checkweigher then ensures that no packs are missing from a case.

A robotic palletiser is equipped with interchangeable gripper and suction cup heads to handle cases or jerrycans and also picks and places empty pallets ready for loading. Layer pattern programming on the machine also includes facing cases so that all labels are to the outside of the pallet load.

Finally there is spiral stretch-wrapping. This is carried out on a fully automatic machine, which is able to include a top sheet within the wrap for enhanced load protection.

"We now have all the benefits of the product consistency and accuracy that come from fully automatic packaging, along with a considerable rate of output," says Phil Dickinson.

"Twelve months ago we were novices in terms of running filling lines, but with the help of Masterfil and the other machinery manufacturers and an excellent skilled workforce we have been able to develop our own expertise." ■

T: 01296 425001

E: sales@masterfil.com