

Manual handling is the driving force

In most areas of machine design there are various factors or "drivers" which stimulate the design of new machinery. Lower cost, higher speed, improved ease of cleaning, faster changeover, and greater accuracy are typical drivers for most new designs of packaging machinery.

However, in the area of bulk filling there has been one principal driver that has prompted new designs and changed the way in which large or bulk packs are both produced and sold.

This driver is the Manual Handling Directive which requires employers to control and preferably eliminate all manual handling tasks which pose a risk to their employees. When the legislation came into force on 1 January 1993, there was a significant problem in the UK, where 34 per cent of all lost time accidents reported to the Health and Safety Executive occurred during manual handling activities.

One significant manual handling risk which most industries have identified is handling materials in the traditional sizes of sacks and drums which can weigh up to 50kg.

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.

Half size sacks

One response to this problem is to instruct suppliers to deliver materials in smaller units, so that the weights being handled are reduced to a safe level for manual lifting. A typical example of this is cement, which is now supplied in 12.5kg half sacks, rather than the traditional 25kg full sack.

Another response to manual handling problems is to eliminate the need 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 advan-

The Manual Handling Directive, which aims to eliminate any manual handling tasks that pose a risk to employees, is the main driver in the design of bulk liquid and powder filling equipment, writes Martin Keay.



Filling hazardous chemicals: A Feige Type 84 in-line drum filler is being used by Atofina UK

tage of not only eliminating manual handling, but also reducing packaging waste because a one tonne reusable IBC replaces 40 disposable paper sacks.

Initiatives of this sort have increased the demand for both IBC filling systems and higher speed sack packing and drum filling lines.

Classic solution

In drum filling, the classic solution for low and medium throughputs is an in-line filler. For example, Atofina UK has recently taken delivery of a Feige Type 84 automatic drum filling machine to fill benzaldehyde products and other hazardous chemicals at its Widnes factory.

Supplied by Springvale Equipment, the Type

84 is an automatic in-line machine which debungs 200 litre steel drums, purges them with nitrogen, fills the product by weight and then re-inserts the bung. The machine is enclosed in a chamber which protects the operator from fumes and contact with the hazardous chemicals.

The Feige machine is fully flame-proofed and fumes from the machine are collected in either a carbon bed or a wet scrubbing system depending on the product being filled. A small dose of stabiliser is added to the drum during filling through the filling lance, which is made from nickel.

In addition to changing the way in which materials are supplied, the introduction of the



Gravimetric range: Avery Berkel supplies systems for single or multi on-pallet containers up to IBCs

For example, Avery Berkel designs, supplies and installs gravimetric filling systems for single or multi on-pallet containers from 5 litres up to IBCs. Ancillary items such as conveyors, ladders, labellers and palletisers can be integrated into the filling sequence for total automation of the packaging/production line, while simple printers or complete PC-based data logging systems can be incorporated to monitor production levels and efficiencies.

For single container filling, Avery Berkel offers different sizes of fillers to cater for 25kg, 50kg and 205 litre drums and IBCs. Multi on-pallet fillers include the articulated arm filler for stand-alone or even mobile applications and the boom arm or bi-directional XY filler for systems with conveyors.

Bottom or submerged fill options are available for foaming products, and detachable filling lines and nozzles can be fitted if cross contamination is a problem.

Hazardous areas expertise

RCS Filling Machines builds systems for a wide range of container sizes up to 1500kg IBCs, and has particular expertise in machines for hazardous areas, designed specifically to deal with volatile products. These machines use mainly pneumatic cylinders and actuators and can operate safely in Zone 1, inflammable and explosive environments, operating where necessary at low or zero voltages.

Turnkey packages from RCS can include conveyors for indexing single containers and pallets through the filling machine, fume extraction systems, drip trays that move automatically during the fill cycle and integrated lance wiping mechanisms for foaming or viscous products.

Fillers can be based on a range of systems, including fill-by-weight or flowmeters, while RCS also builds filling nozzles which, if required, allow containers to be automatically purged with nitrogen before and after each fill.

Permex has recently supplied a complete oil filling line for Shell's lubrication oil plant at Tianjin in China. The complete system, which handles containers from 205 litre pre-palletised drums up to large IBCs, was designed, manufactured, assembled and tested in the Permex factory at Hoddesdon, Herts, before being packed and shipped to China.

Pallets of four 205 litre drums are brought to the filling machine on a conveyor. The filling process is semi-automatic but containers are filled by weight at a rate of over 50 drums an hour. The system then stores the filled drums

Manual Handling Directive has encouraged machinery manufacturers and users to re-examine the design of drum filling lines.

Conventional drum filling systems take drums one at a time from a single line of drums for de-bunging, filling and re-bunging. However, the drums usually arrive on pallets and are despatched on pallets. These depalletising and re-palletising operations are typically manual on all but the very highest throughput lines.

Multi-drum filler

The response to this manual handling problem has been the development of the now familiar multi-drum filler which accepts drums on the drum supplier's pallet, eliminating the need to either depalletise or re-palletise the drums.

These multi-drum fillers can be either semi-automatic or fully automatic. On semi-automatic machines an operator removes the bungs, moves the filling nozzle from drum to drum and then replaces the bungs in the drums, while on a fully automatic machine all of these operations take place without the need for manual intervention.



Trolley mounted: Latest Permex Massfill machine with MicroBatch Plus controller

in a discharge area until they can be removed using a forklift truck. IBCs are filled on the same system at a rate of 12 an hour.

The filling lance, which is attached to a three-section articulated support arm, is raised and lowered vertically by pneumatic cylinders and is equipped with a wiper ring to clean the outside as it is raised from the container.

Air brakes are fitted to the joints of the articulated arm to ensure that, once positioned, the filling head stays in its intended position and does not come into contact with the side of the bung hole, which could cause inaccuracies in the weighing. The whole support arm can be raised and lowered pneumatically by the operator to accommodate different heights of drum and IBC.

The filling nozzle is a Permex Autofill Mark 12, made in stainless steel with a pneumatically operated PTFE poppet valve and Viton seals. It incorporates an overflow protection port and Permex LevelGuard control system, which ensures that filling stops once a predetermined level has been reached, even if the operator inadvertently chooses the wrong batch weight for the size of container.

Quickly drained

The system can fill at rates of up to 280 litres a minute and the filling accuracy is within $\pm 0.5\text{kg}$. The pipework to the filler is designed so that it can be quickly drained and purged before a new grade of oil is filled.

However, while multi-drum filling systems have solved the manual handling problems associated with single lane drum filling lines, they have their disadvantages.

The most accurate method of filling large drums is to fill them by weight. Typically this will be a gross weight gravimetric filler, where the drum or bulk container is placed on a weighing platform, weighed and filled to the required total weight, the filling nozzle being controlled by the weighing device to cut off at a predetermined point.

This method provides accurate filling for single drums, but for multi-drum filling the accuracy and speed is inevitably lower, because several drums are on the same weighing platform. The alternative is to meter the liquid into the drum using either volumetric piston or flowmeter devices.

This technique avoids the need for tare weighing the drums and increases speed. However, for liquids like lubricating oil which is often filled hot, volumetric filling is not an accu-

rate method of filling because the specific gravity of lubricating oil varies significantly with temperature.

Mass flowmeter head

Permex's solution to this problem has been to develop multi-drum filler equipment with a mass flowmeter head which enables liquids to be dispensed into drums by the kilo, rather than by the litre.

The latest mass flowmeter-based filling system from Permex is a trolley mounted unit that incorporates the company's Panda articulated arm and its MicroBatch Plus batch controller. The arm is adjustable in height to allow top filling into drums on pallets and small IBCs positioned around the machine.

Adding the MicroBatch to the filling system provides a wider range of options, including bottom-fill using a stepping lance linked to the batch controller. Nine pre-set batch quantities can be programmed in and, says Permex, calibration of the system becomes simpler.

French manufacturer Stoppil Industrie, represented in the UK by Sussex & Berkshire Machinery, also builds a mobile filling trolley which is able to dispense into bulk containers up to 200 litres. It is equipped with a choice of electromagnetic or mass flowmeter depending on the product range to be handled and, so far, has found applications in the cosmetics, detergents and chemicals industries.

In addition, Stoppil builds in-line flowmeter fillers, with two to eight heads and a Siemens PLC with touchscreen control, able to handle fills up to 30 litres. One eight-head machine has recently been supplied to fill lubricating oil.

In sack filling there has also been a trend to smaller packs which can be handled safely by hand and larger IBCs which will only be carried by pallet truck or fork lift.

Tubular film for form-fill-seal

One method of filling polyethylene sacks at high speed is to use a tubular bag form-fill-seal machine, such as the Weitek WFM supplied by Aetna UK. These machines form sacks from a reel of pre-printed lay-flat tubular polyethylene film to produce either a pillow shaped or gusseted sack.

Sacks produced on a tubular bag form and filling system have two seals only, unlike sacks produced on a vertical form-fill-seal machine, which have a vertical back seal as well as a top and bottom seal.

When gusseted sacks are required the lay-flat

Wet, dry and mixed go together

Baby milk food manufacturer Farley Health Products has simplified the automation of a dry and liquid ingredients handling and processing system at its Kendal factory with a system from Neu International.

Replacing the manual materials handling methods of the dairy reconstitution plant could have presented a serious logistical problem because it involved handling dry and liquid ingredients as well as process control needs. However, Neu provided the answer by managing the total project as a fully integrated solution that included specialised 'liquids' equipment from Swedish company, Food Tech.

The integrated solution includes dry materials discharge by recipe, weighing, vacuum conveying and buffer storage, before mixing with a downstream liquids system.

A Ystral mixer can be used to reconstitute in two modes: production to a silo or silo recirculation, so reconstituted product is passed through various stages to any one of five 120,000 litre capacity liquid silos.

A CIP system is also installed. The reconstitution plant can be cleaned separately from the silos, which themselves can be cleaned independently, allowing one silo to be in production while another is being cleaned.

In addition, Neu provided a SCADA system for the plant and the links into the overall factory control system.

More information - enter 131

tubular film is supplied with the gusset pre-formed and this ensures that the gussets are precise and regular, which in turn makes the finished sacks regular and much easier to handle, palletise and stretchwrap.

Once the base of the sack has been sealed it is passed to the filling position where the required weight of product is loaded.

In applications where customers need to fill woven polypropylene or paper sacks as well as polyethylene sacks, the Weitek machine can be supplied with a pre-made sack magazine. This allows one machine to cater for two separate requirements, yet retain the materials economy of form-fill-seal over pre-made bags for a proportion of the operation.



Wet and dry ingredients: Above: Dry materials discharge area. Below: Handling the liquid ingredients



Once filled, the sacks are released from the filling position, gusseted and top sealed, before being laid down and flattened ready for palletising.

Products need compaction

Most bag and sack filling machines depend on the product being flowing and settling quickly into the sack. However some products, such as straw and sawdust, need to be compacted as they are filled. The Esse Gi range of form-fill-seal machines, available from Aetna UK, has been specifically designed to handle products of this nature and incorporate a range of compression devices. They produce bag sizes from 5kg up to 50kg and are available with feeding

and weighing systems to suit the products being handled.

A novel feature of the larger machines, such as the CTS-50 for bagging peat, topsoil, bark and similar materials, is a carousel for the forming tubes, which is of particular benefit for users who regularly need to make size changes.

Large format forming tubes are frequently too heavy to be lifted by a single operator, but the Esse Gi machines can be equipped with a carousel magazine holding four tubes, which are exchanged simply by removing a pin and turning the magazine until the new tube is brought into place.

Meanwhile, to meet escalating quality requirements, attention has now turned to sack

BULK LIQUIDS AND POWDERS

mouth closing machines, since conventional systems leave threads or tape on the sack when it is opened, which could easily fall into the product.

Meypack, represented in the UK by Dobby, supplies a range of machines to overcome this problem called the FTS (fold tape seal) Series, which avoid the problem of leaving extraneous thread or tape when the sack is opened, and yet are suitable for use by both sack packers and sack manufacturers. The FTS closure is suitable for any size of single or multiwall paper sack and is equally effective on pillow and gusseted styles.

Precise clean edge

The first format within the series, the FTS-HD can be applied to any kind of open mouth sack. The machine grips the sack between carrier chains, which keep the flattened sack top aligned, while the base of the sack is supported on a conveyor.

The sack top is then trimmed to give a precise clean edge and, if required, the inside walls in the seal area are cleaned. Next, the plastic inner liner or coating is sealed, with the top then folded over twice. Finally, a heat sealable paper tape is applied to the folded sack top, so providing a totally hermetic closure with a well protected seal.

One of the benefits of the FTS-HD is its ability to produce 'strippable' sacks for use in clean-room environments. The strippable sack is designed so that the inner polyethylene sack can be removed from its paper outer without being opened and exposing its contents. This feature, together with the sack mouth cleaning mechanism, makes the sealer particularly suitable for the food and pharmaceutical industries.

The system can also add a polypropylene tear strip to the sealing tape which, says Meypack, is ideal for rapid opening of the bag without risk of particles contaminating the contents. A further machine in the series is the FTS 600 RC, for closing paper bags and allowing them to be reclosed after initial opening.

The increasing demand for both liquid and powder filling systems to fill pallet sized bulk packs is now evident in both the food and chemical industries and has prompted machine manufacturers to develop new filling systems.

Indeed, machinery supplier Webster Griffin confirms that bulk packs or semi-bulk containers such as jumbo bags and Octabins are being used more and more by the food and chemical industries because they dramatically reduce



Mobile discharger: *Prodima big bag emptying station eliminates need for fixed lifting equipment*

manual handling. But machines to fill these containers have generally been quite slow.

However, the new Webster Griffin H3C-PF4 machine can fill bulk containers at a rate of 30-40 tonnes an hour. The machine adjusts itself to different sizes of container and can be programmed to fill a variety of boxes, bins and bags with fill weights between 500kg and 1500kg.

Rigid containers such as bins, boxes and drums are conveyed through the machine to achieve the maximum throughput and when filling jumbo bags, the machine can be fitted with automatic bag hooks.

Filled containers are checked weighed and this information is then fed back to the powder dosing system to ensure consistent weight accuracy. The weighing system can also provide the user with real time production management reports.

Moved from silo to silo

The filler is mounted on wheels so that it can be towed into position by a fork truck, which makes it suitable for situations where both road tankers and big bags need to be filled from the same silos. In fact, the mobility of the filler means that it can be moved from one silo to

another if necessary in preference to conveying powders to a central packing station.

Suitable for handling powdery and pelleted products – such as PVC, plastic resin chips, sugar, salt and powdered chemicals – the system is said to be easy to clean out between different products while changing from one size of container to another takes minutes.

Emptying big bags

However, as more material is supplied in bulk, so the emptying process needs to be considered. For example, a mobile big bag emptying system that allows any number of process plants or packaging machines to be fed with powders or granules, with no need for fixed lifting equipment at each point, has been developed by Swiss process specialist Prodima.

The BB-BS FIBC emptying station can be moved with a fork lift or pallet truck and incorporates its own discharge hopper and electrically-driven 3.5 metre flexible mechanical conveyor, used to elevate product into process vessels or the charge hoppers of packaging machines.

"The attraction of the BB-BS station is that no preparatory work is involved in the factory," points out Simon Nicholls, project manager at UK agent S & B Process. "New plant, new factory layouts or a change of bulk supply container to big bags can be accommodated immediately."

Finally, sealing large diameter closures on bulk containers has always been a problem. Whether the need is to eliminate spillage, provide tamper evidence or to provide an oxygen barrier, induction sealing provides the answer, according to Relco which now offers a portable induction sealer, the 1.2H, that can seal closures up to 130mm diameter, although larger sizes can also be accommodated. ■

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| Springvale Equipment | enter I27 |
| S & B Process | enter I28 |
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