

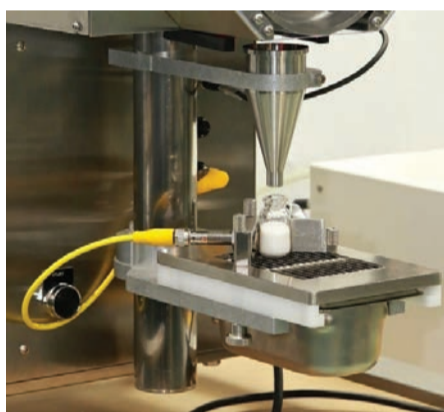
# Laboratory Products

## Introduction to volumetric powder filling technology

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Volumetric powder filling technology has proven to be an excellent solution for not only accurate and repeatable dosage requirements, but also a cost-efficient answer for various product applications.

Comparably, net-weight fillers may reduce the need for a check-weight measurement, but they can significantly increase the filling time; nor do they cope well with fine powders due to their design. The product is firstly transported via vibratory plate/belt onto a load cell to satisfy the initial dosing procedure (near the samples target weight). This is then followed by a slowing of the feed stream, to complete the desired fill size; a feature which may impact dispensing time, efficiency, and dusting. In answer to this issue, auger filling machines have a closed off design, more suitable for use with fine or consistent particle distribution powders. However, their downfall lies in the additional attention required for a steady and even feeding process. Failure to do so could result in unreliable accuracy levels as well as possible product damage due to the compression inside of the cylinder and auger.



Kinematics and Controls Corporation (KCC), on the other hand, utilise volumetric powder filling technology in their equipment design for a fast, accurate and economical powder filling solution; suitable for not only a free flowing, but also fine, powders. Furthermore, KCC's engineers have introduced a modular design of their systems in order to overcome any possible concerns of volumetric fill limits being too low. This enables operators to upgrade from a base model system (4400VC), to a fully automated production machine (4400TX or 5500TX).

### The Process

Desirable results are achieved by using an uniform vacuum force to pick up the product and compact it in a cylindrical chamber. The homogeneously compressed powder assures consistency in the powder density, as well as repeatable dosage weight with accuracy levels often achieving a  $\pm 1\%$  variation. Then, the product can be dispensed into the user specified container by applying a gentle positive pressure, minimising the risk of dusting.

### Semi-Automatic 4400/VC system

In the case of the 4400/VC powder dispenser, the maximum dosing speed is often determined by the time taken to manually handle the containers between the dosages. For example, the upper dosage output per minute will be 20 fills whereby 1 second picks up the container, 2 seconds to dose the powder inside and finally rest the container onto the surface. Of course, some factors will influence the upper dosage number, described below.

### Automatic

Where a greater level of automation is needed, similar restrictions can be applied and further consideration taken place in relation to the way the container will be introduced to the system.

The PLC (Programmable Logic Controller) based program can then be configured to the desired mode/program selection, which will initiate the start of the fill step. This can be determined with use of the sensor or timer, depending on user preference. Additional accessories, like the funnel or large product hopper with the sensor can further improve the efficiency of your filling process and decrease the down time between batches. Furthermore, for fully automated production lines, the KCC powder fillers can also be integrated into a conveyed belt line with container washing and capping capabilities.



#### SIMPLE OPERATION

1



**THROW THE SWITCH** on the console. Vacuum surges through the filling gun, ready to pick up powdered product.

2



**DIP THE GUN** into the product trough. Powder is instantly picked up into the barrel at a controlled, even density.

3



**DOCTOR-OFF** the excess product left at the tip of the filling gun.

4



**INSERT THE GUN** into the mouth of the container to be filled. Depress the foot switch. Vacuum changes to gentle pressure, discharging another perfect, dust-free dose.



When choosing your desired system, the factors to consider are:

- Required speed / number of doses per hour
- Batch size & dose size
- Desired accuracy levels
- Container design
- Available budget

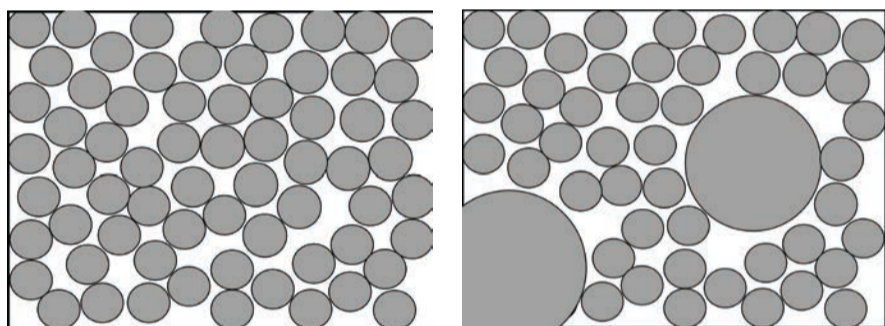
Although, ultimately, the suitability of your filling solution will be determined by the product sample itself. Therefore, a product test is highly recommended to maximise your output and streamline operation; Biopharma offers a free product sample test to assess the best filling solution and accessories.

## Factors Affecting Powder Filling Applications

Powder filling or dispensing is a term used in many industries and not limited to a specific application. While decisions should be made on the most suitable fill solution, the product itself needs to be examined to determine its characteristics:

- Compressibility
- Free flowing or non-free flowing
- Stickiness/dusting
- Size and shape of the particles
- Desired dose size
- Product cost

## Product characteristics



No matter what particle size your sample is, the uniform/similar shape and dimensions of the particle will be distributed in more harmonised manner, while also improving the constant bulk density and accuracy levels between the dosage.

Looking at the right-hand side picture above, the particle size elements differ significantly, which will likely compromise the repeatability between the doses. This is because the amount of small and very large particle sized drawn by vacuum in each fill will affect the overall bulk density and weight of the fill. By assuring that the particular sample has consistent size particles, we can achieve very high accuracy and repeatability of dosage.

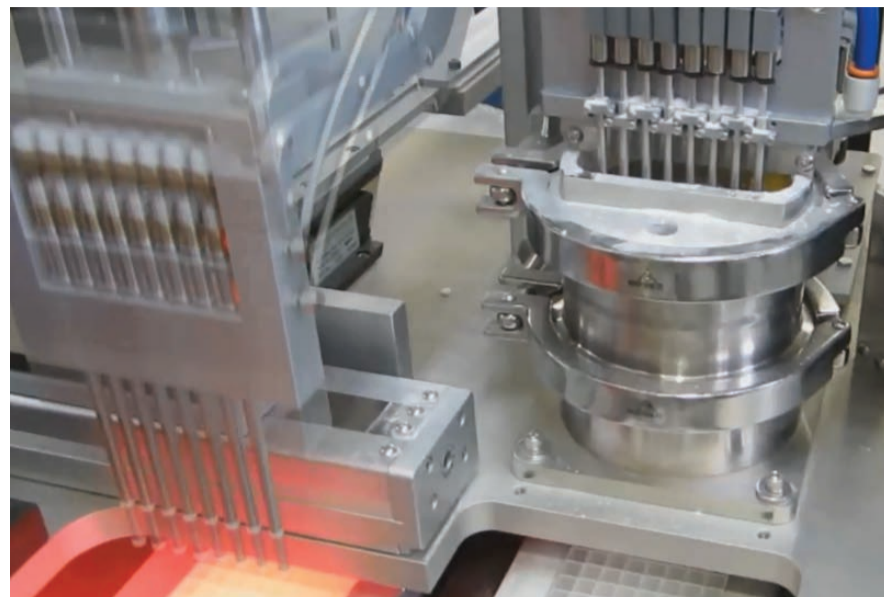
Where the auger systems have the tendency to damage the product, this results in uneven distribution and low dosage weight repeatability; moreover, auger fillers require slow operation to have the capability to improve the accuracy levels, extending the pick-up rate significantly. In comparison, the volumetric system by KCC allows the product to be picked up by negative vacuum and condense it in the filling chamber without a loss of integrity of given product.

Undoubtedly, the pick-up rate will depend on the powder behaviour under the vacuum. Lighter powders may pick up faster, but they may have higher dusting properties and could also compact under the vacuum with higher overall bulk density.

## Dusting v Accuracy

Product dusting during the dispense contributes to unnecessary wastage, increased cleaning and H&S protocols, whilst also influencing the discrepancy between the weight of the fills. This circumstance has been taken into consideration during the design stage of the Kinematics powder filler systems and flexible solutions are in place to assist various product characteristics. Larger and heavier samples may need significantly higher force to dispense the product, whereas a small light one will require light positive pressure to aid this process. The KCC systems therefore have an adjustable positive pressure vacuum gauge to aid specific dosage requirements, improving overall instrument flexibility.

Custom made solutions are also available if an 'off-the-shelf' item may not provide the best suited result.



## Container type

The container design is often determined at the early stage of the new powdered product development process, meaning the filling could potentially be an afterthought. However, container parameters will play a crucial role on the selection of the filling equipment, and so should certainly not be overlooked.

With the aforementioned in mind, versatility of equipment is clearly an essential quality when considering powder filling apparatus. KCC volumetric systems have around 20 various standard filling guns to choose from, each differing from the other, ensuring a customer specific dosage application can be achieved within tolerance. Filling gun barrels have a different chamber diameter and overall volumetric capacity to assure precise dosage.

Being KCC's European distributor, Biopharma Group encourages clients to carry out free sample trials at our UK facility to allow the opportunity to experiment with actual samples; this allows the best advice to be offered in relation to the following:

- Appropriate filling gun size – allowing for accurate dosing (within the customers specified tolerance range) for your product sample size.
- Dosing pressure – to ensure dispensing is an efficient procedure, minimising the risk of some product retention in the filling gun (if too low a pressure being used). In addition, to reduce the prospect of material being expelled from the filling barrel at too great a force, facilitating 'dusting', and ultimately loss of product/inaccurate dosing; an occurrence we always seek to avoid.
- Container height – needs to be enough to accommodate the length of draw in the volumetric filling gun chamber.

Some sachets or bags may cause user handling difficulties, which would also require further investigation prior moving to production stage. For instance; the pouch will require opening prior the filling stage, and closing following the dose.

## Implementing a solution

With the vast manufacturer experience and Biopharma's free product evaluation offer, we can confidently provide tailored advice and support for any powder filling application; including a weekly hire option on a 4400VC system.

For further assistance contact [bps@biopharma.co.uk](mailto:bps@biopharma.co.uk)



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