

# Hopper and bunker weighers as alternatives for weighbridges

**The hopper weigher has proven to be an interesting alternative for the weighbridge for the control on weight of bulk goods to be unloaded and loaded. When it comes to the loading of bulk trucks, a bunker scale (or silo weigher) can also be considered instead of a weighbridge**

In the transshipment of bulk goods, whether it concerns the incoming or outgoing raw materials, semi-finished products or finished products, the volumes will ultimately be charged based on weight. To ensure fair trade, legal requirements apply to the weighing systems used. These are in the Netherlands laid down in the Metrology Act, which in turn is in line with European regulations.

## Weighbridges

Weighbridges are reliable and accurate instruments that do their job under all-weather circumstances.



Fig. 1 A hopper weigher for fertilizers, with a capacity of 3,000 kg and an accuracy of 3,000 d or 0.03% (a read out per 1 kg). The installation can reliably dose quantities from 20 kg off

However, the weighbridge requires at least two movements of the bulk truck, which must be weighed empty and full. If there are more compartments to fill in the bulk truck, a larger number of movements is required (equal to the number of compartments used plus one). Furthermore the weighbridge also has three limitations. In the first place, the weighbridge is unsuitable for small quantities because the system is meant for full (heavy) vehicles. Secondly, there is a restriction on the maximum weight to be loaded, namely the capacity of the weighbridge minus the vehicle's own dead weight. Thirdly, it is not known how much product is loaded in the bulk truck until it is on the weighbridge. With an underload a refill is necessary. With an overload it is difficult to get product out of it. So the question arises: isn't there a simpler and more flexible way of operation? Answers to that question are the hopper weigher (fig. 1), a weighing instrument that lends itself to both incoming and outgoing materials, and the bunker weigher, or silo weigher (fig. 2), for weighing of finished products.

## Hopper weigher

The hopper weigher is an automatic, discontinuously totalizing system for controlling and adding up the weights of material flows, both for internal control and trade applications. The ability to dose relatively small amounts of different product makes the hopper weigher a flexible system (fig. 3). Any quantity of bulk material can be processed with it; from almost zero to infinite. Small quantities can easily be dosed in a truck's compartment, without additional trips to and from a weighbridge. The hopper weigher is also often used for loading railway wagons and ship holds.

A hopper weigher can be located above a battery of silos for receiving of bulk goods (fig. 4). This way it is not only possible to determine which supplier delivers which material, but also where exactly how much of it is stored. This creates a solid basis for a tracking & tracing system.

## The controller

The controller ensures the individual mass flows are accurately measured and exact totalized weighing's are taking place. In fact, this concerns the determination of the mass to be loaded or the setpoint of the weight (kg), the loaded mass (kg), the mass flow (kg/s) and the number of batches (n). All this information is available for every compartment to be filled.

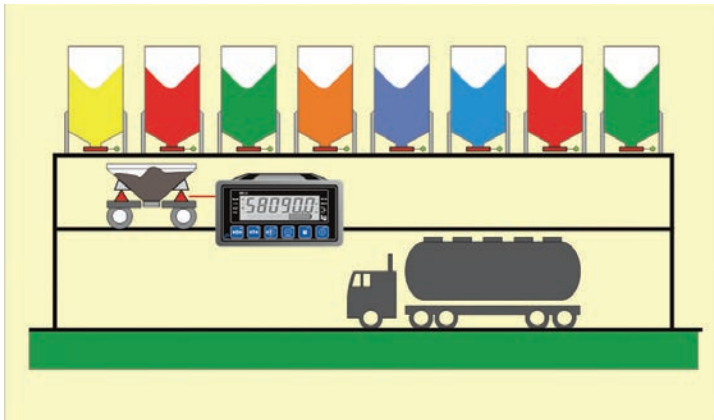
Since the control of incoming and outgoing products is essential for every process and company, the weighing systems meet high requirements. Moreover they are fully approved in accordance with the applicable laws and regulations.

## Bunkerweigher

A bunker (or silo) weigher combines the storage and delivery of products (fig 5a). Out of the silos of such a system,



Fig. 2 Weighing silos for loading the compartments of bulk trucks



A hopper weigher for filling of the compartments of a bulk truck

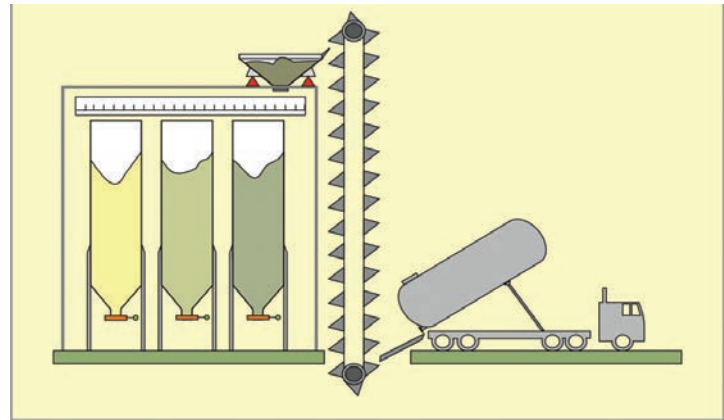


Fig. 4 A hopper weigher above a battery of silo's enables a solid tracking & tracing system

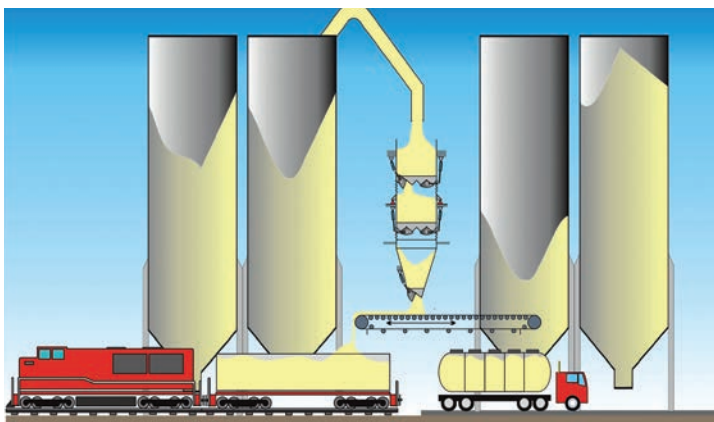


Fig. 5a A bunker weigher for filling bulk trucks and train wagons

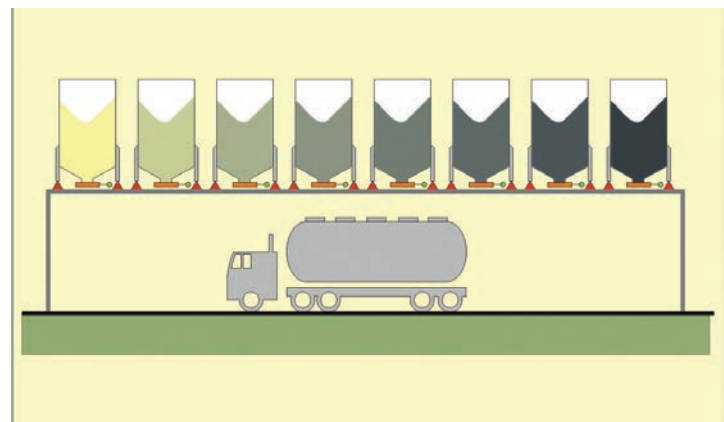


Fig. 5b A bunker weigher for filling bulk trucks

**Advantages and disadvantages of weighers**

A hopper weigher has the following advantages:

- suitable for all quantities
- can process multiple products
- both for receipt and delivery (not in combination)

and as disadvantages:

- requires more building height
- more time per transaction (loading, unloading, driving)

A bunker scale has the following advantages:

- no extra building volume (the waiting bunker is also the scale)
- fast delivery (out of the finished product stock)
- simultaneous loading of several trucks

and as disadvantages:

- more weighers needed (one per type of product)
- limited weighing capacity

the compartments of a bulk truck can be filled one by one (fig. 5b). There are two options for this. The first is exactly the required amount is already in the silo which it is completely unloaded in the relevant compartment. The second possibility is the silos contain a much larger stock and out of the silos the requested amount is dosed into the truck compartments. In that case, product can be stored in the silos (waiting bunkers) for several customers. The silo valve in fact is the dosing element of a loss-in-weight system (fig. 6).

**Accuracy**

It must be clear the weighing capacity of the silo determines the maximum quantity to be delivered. The smallest amount is determined by the accuracy of the weighing system. So, assuming the usual 3,000 d (or 0.03%) is present, a silo with a weighing capacity of 15 tons has a weighing accuracy

and display unit of 5 kg (d). Ergo, not more than 15 tons can be loaded at a time. When it is a non-automatic weighing system, the smallest permitted amount is 20 d or 100 kg.

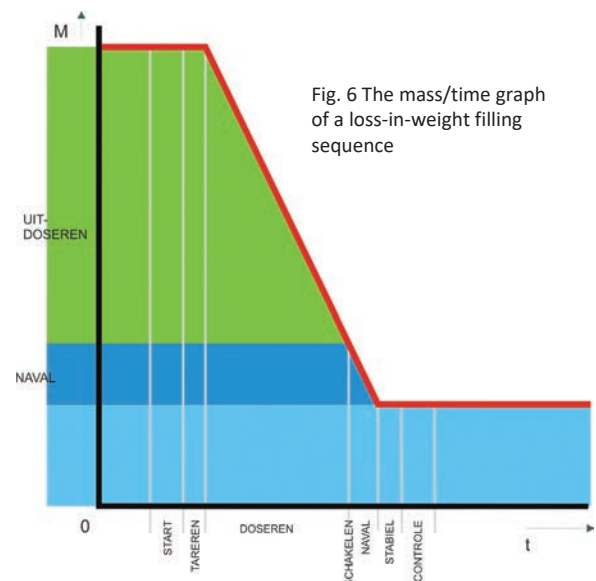


Fig. 6 The mass/time graph of a loss-in-weight filling sequence