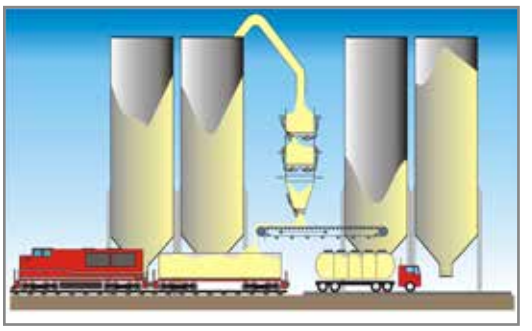
Engineering White Paper

WHITE PAPER FOR HOPPER WEIGHING SYSTEMS
PENKO ENGINEERING B.V.

INTRODUCTION

This White Paper discusses the challenges, options and solutions for process manufacturers when measuring and totalizing the discontinuous mass flow of bulk materials by means of one, or more than one, hopper(s).



Truck and/or wagon loading

PURPOSE OF WHITE PAPER

… is to explain why it is important to dose the correct amount of bulk material – be it in or out railway wagons, ships, trucks and so on. Challenges regarding control apply which have a direct effect on cost and profit margins for the process manufacturer. Where overfilling results in profit loss and product spillage, under filling results in unhappy customers and may even be a legislative fallacy.

In addition to such losses, there is the added argumentation of operating with a quality management system inside international standards and legislations on trade such as for the European Economic Region that warrants a scrutinizing view on accurate, fair and proper mass control on bulk solids.

The advantages of high speed measurement (PENKO instruments weigh at 1600 samples per second) is faster throughput and less spillage of product– leading to fast ROI

BACKGROUND ON HOPPER WEIGHING

Hopper-weighers are automated systems designed for checking and totalizing the weight of charged or discharged bulk material for the purposes of internal control and/or external trade applications. The totalizing process is usually found at the start or the end of production processes in any given industrial process flow. The application of a small, discontinuously totalizing the transported mass, hopper weigher offers a flexible system for charging or discharging any amount of bulk material, from almost zero to infinite. It is suitable for trucks, railway wagons, seagoing and inland ships. Controllers for hopper weighing processes are designed to ensure the mass flow is measured discontinuously and the conveyed amount is totalized exactly. For external trade applications, legal requirement is obligatory. The worldwide OIML (International Organization for Legal Metrology) recommendation R107 from 2007 outlines these rules, while the MID (Measurements Instruments Directive) 2014/32/EC “on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments” is Europe specific and the NIST Handbook 44, edition 2014, automatic bulk weighing instruments in chapter 2.22 is relevant to the United States.

PENKO
an ETC Company

THE ACCURACY CLASSES ACCORDING TO THE MID, APPENDIX VIII, CHAPTER VI, TABLE 6, ARE AS FOLLOWS:

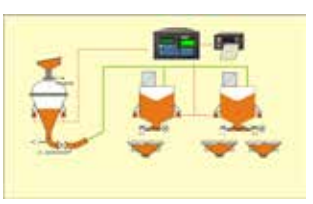
Accuracy classes	Maximum permissible error of the totalized load
0,2	± 0,10 %
0,5	± 0,25 %
1	± 0,5 %
2	± 1 %

THE REQUIRED TOTALIZING ACCURACIES ACCORDING TO THE MID, APPENDIX VIII, CHAPTER VI, TABLE 7, ARE:

Load (m) in totalization calibration units (dt)	Maximum permissible error
0 < m ≤ 500	± 0,5 dt
500 < m ≤ 2 000	± 1,0 dt
2 000 < m ≤ 10 000	± 1,5 dt

Because these systems are standard used for bulk loading, in other words, trade applications, these products are fully certified in accordance with the current European Directive MID and OIML-recommendation R107.
During operation our instruments offer a wealth of information:

- Transported mass (m)
- Mass flow (m/s)
- Number of discharges



Discontinuous charging by means of pneumatic conveying

Discontinuously totalizing hopper

Shipment from a seagoing vessel to an inland vessel

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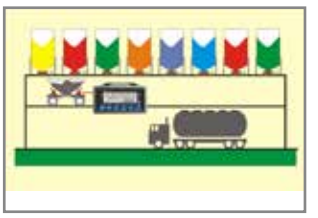
Applications:

1. Mining products, such as charcoal and sulphur.
2. Wheat and flower.
3. Plastic granulates.
4. Fertilizers.



Loading of a road truck

HOPPER WEIGHER SOLUTIONS EXAMPLES, FREE PROGRAMMABLE VERSION

FLEX-2100

- User friendly touch screen panel offers ease of operation
- Simultaneous display of mass flow, transported mass and hopper weight
- Checks level indicator of storage silo
- Controls charge and discharge valves, including position transmitters
- Menu with pre-sets for mass per hopper and total amount
- Separate indelible memory for the grand total of the installation
- Checks presence of, to be loaded, vehicle
- Suitable for charge and discharge of vehicles

Product inlet

FLEX EXTRAS INCLUDE:

- Create master/slave controls with instruments for two hoppers
- Analog speed control for load and/or discharge conveyors

Hopper weighing system

FLEX MULTICHANNEL EXTRAS INCLUDE:

- Multiple hopper weighers, enabling a continuous, uninterrupted, flow in or out.

Two hopper system for a continuous flow

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COMPETITIVE ADVANTAGE

A high resolution filtering system combined with high speed – high accuracy measuring, offers smart weighing results for any operation environment.
All instruments are certified with an accuracy of 10.000d. The combination of measuring at high speed (1600 conversions/s) with a high internal resolution (16.777.216), smart filters and sufficient computing capacity, make the FLEX range suitable for any hopper weighing application. The combination of the high resolution and conversion speed guarantees the best achievable accuracy for discontinuous mass flow control, even when conveying at high speed, and thus prevents for inconsistent process conditions and over- or under-filling. This is essential for trade applications.

PRODUCT SOLUTION

Model FLEX 2100

This three-in-one device combines a stunningly-simple touchscreen interface, a core of sophisticated hardware and a clever calibration system. It offers 8 inputs/8 outputs, communication via portal Ethernet (TCP) with protocols Modbus, FINS, Ethernet-IP, ASCII, portals RS232 and RS422/485 with protocol Modbus and ASCII. Protocols for printers, web browsers and configuration software between PENKO devices are available on Ethernet (TCP), CAN, RS232/422 and USB portals.
Additional options are analogue output and portal Profibus with Profibus-DP communication.

Model FLEX

This most versatile apparatus is an all-in-one compact, reliable and user friendly indicator/controller, suitable for automatic and non-automatic weighing.
The FLEX has an integrated PLC, offers an expandable number of inputs/outputs including remote I/O's; its communication includes portal Ethernet (TCP) with protocols Modbus, FINS, Ethernet-IP and ASCII, portals RS232 and RS422/485 with protocol Modbus and ASCII as well as optional portal Profibus with protocol Profibus-DP. Protocols for printers, web browsers and configuration software between PENKO devices are available on Ethernet (TCP), CAN, RS232/422 and USB portals making it highly suitable for complex weighing applications. Digital and analogue inputs/outputs are optional.
The FLEX range has all the features of models FLEX-2100.

Model FLEX Multichannel

This most versatile apparatus possesses all the features of the models FLEX and FLEX-2100 with additionally the capacity to control up to four weighing systems in one instrument simultaneously and, where necessary, cross linked.

CONCLUSION

PENKO instruments control the hopper weighing system as well as the checking and totalizing application all in one. All PENKO systems are “Slave” systems.

Controlling mass flows by means of hopper weighers to correct and specific weights while adhering to regulations in the shortest time possible and the most effective way, remains a challenge throughout the processing industry and will vary from one manufacturer to another. Consideration not only needs to be given to under- or overload challenges, but each product – particularly natural products - has its own intrinsic weight and volume that influences the mass flow. To engineer the most efficient way per industry, per product, per manufacturer, there is no “one-size-fits-all” solution. Engineers at PENKO work out the best and most effective way this can be done.

Following White Papers will discuss Non Automatic Weighing Systems, Check Weighing Systems, Filling Systems, continuous totalizing with Loss-in-Weight and Belt Weighing, Grading Systems by means of Weighing and Batch Control on Weight for Mixing Plants.

For more information: www.penko.com