

## Process Instrumentation

# The right tool for the job: the evolution of belt scale calibration

First put into use in the early 1900s towards the end of the Industrial Revolution, belt scales are one of the oldest process instruments in the world. Used in a wide range of industrial weighing, coal unloading is an ideal application for belt scales. One such example comes from the GDF Suez coal-fired power plant in Nijmegen, The Netherlands. First, however, the scale must be calibrated.

### **The evolution of calibration has begun**

Calibration of these scales hasn't changed that much since their introduction. What has changed is the evolution of scale designs, each requiring slightly different calibration, which we will discuss here.

When first introduced, belt scales were completely mechanical devices that provided a measurement of total material conveyed. This measurement was indicated on a dial connected to a gear on the scale. With many levers and pivots and other various connections, these older belt scales were fairly difficult to set up and maintain.

Those levers and gears that came with the first scales were a mechanical solution for an electro-mechanical problem. Once the

load cell came into the equation, it radically changed the way belt scales were designed.

An electrical signal proportional to load led to simplified and more accurate designs. The leaf springs, levers, bearings, pivots and torsion bars were left behind to rust.

These old scales needed a very high percentage of load to calibrate accurately. In most cases 80 percent was the target used by customers to achieve any kind of accuracy. Over the years this has slowly dropped to 60 percent at the higher end.

Applications have increased in capacity as well since the first scales were introduced on conveyors. Flow rates of up to 20,000 tons per hour can be found in "mega

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mines" now, which was unheard of 100 years ago. There simply isn't enough weight that operators could apply to get to that kind of calibration percentage.

## Load cells today

Even load cells have evolved. Precision machining has ensured that the electrical output of several load cells used in the same scale is equal. Belt scale designs similar to the Milltronics MSI and MMI from Siemens directly load the cells with the weigh idler, ensuring that the weight is supported by the cells, and not through levers or springs. Siemens recommends selecting calibration weights from 25 to 60 percent of the design load.

## Designing your design load

Here are a few points to consider when determining what percentage of design load to use when selecting calibration weights. Higher percentages are required when:

- Calibration mass is on top of belt, such as test chains.
- The weights are applied to a component of the scale that is not directly connected to the load cells (levers, springs, check rods, pivots, etc.). Scales with direct loading such as the Milltronics MSI has the test weight mass directly applied to the load cells.
- If the scale is a multi-idler pivoted lever style.
- Low-quality load cells are used, meaning poor linearity and poor temperature compensation.

60 to 80 percent is considered "old school thinking." With the improved load cell linearization of today and the direct loading onto the load cells, likely the market will embrace the "new school thinking" for calibration at 25 to 40 percent.

## Which type of calibration to use?

There is also the question of what to use for calibration: weights, chains, electronic/theoretical.

Generally weights are acceptable and will achieve 0.5 percent accuracy, providing that you follow manufacturer's guidelines for installation and commissioning.

Calibration chains may offer some benefit over static weights in some applications but may also require additional maintenance.

Electronic calibration (or ecal) has become more popular as the performance of the load cells has improved, but is still typically only used in non-critical processes.

As you can see, many factors need to be considered when selecting a means of calibration. The frequency of scale calibrations is a function of conveyor stability. However, a good starting point for calibration is to perform a zero calibration weekly and a span calibration monthly. Generally, the duration between calibration checks can be extended after the scale has proved reliable for a reasonable period of time.

## Unloading world-traveled ships: GDF Suez

Walking around the GDF Suez coal-fired power plant in Nijmegen, The Netherlands, the blackness of the mountains of coal stand out in stark contrast to the grey, overcast sky.

This coal has traveled thousands of kilometers from deep underground. Coal that will be fed into the power plant's furnace at a rate of 220 tons every hour. Enough to power my house, your house, and many others.

First, however, coal needs to be unloaded from ships docked in Nijmegen's Maas-Waal Canal. Which begins with a grab unloader lifting up to 50 tons of coal in each load and depositing it in a hopper.

Coal then moves onto a conveyor and is carried on a belt to the stockyard, where a stacker-reclaimer creates mountainous stockpiles of the black rock. Conveyor belts equipped with belt scales then carry the material into storage bunkers, where coal awaits the furnace.



Test chain calibration is widely accepted method of belt scale calibration that may offer advantages in some applications.

Static test weights are the most popular and cost-effective means of belt scale calibration.

Electronic calibration has become a friendly alternative to processes that are not able to stop the conveyor and perform a normal span calibration.

## The importance of being accurate

GDF Suez pays for each delivery of coal, so belt scale accuracy and reliability are essential. If scales are not performing correctly, the power plant may end up paying for more coal than was delivered.

As well, the company wants to optimize its consumption of coal – reducing costs and ensuring that inventory amounts remain adequate for continual feeding into the furnace. GDF Suez chose Siemens Milltronics MMI trade-approved belt scales for this application. Combined with a Milltronics BW500 integrator and SITRANS WS300 speed sensor, this weighing system provides accuracy of 0.25%.

The special triple beam parallelogram style load cell design allows for direct load transmission from the idler, unaffected by shearing forces generated for example by start-stop operation or belt mistracking. The shearing forces do not require any additional mechanical compensation. This is suitable for the very compact design of the MMI, allowing for short idler spacing typical on compact conveyor belts.

Based on the load cells' fast response time, Siemens Milltronics MMI belt scales provide high accuracy even with significant variations in flow rates. In fact, the belt scales are available for use on systems with flow rates of up to 12,000 tons per hour.

GDF Suez technicians monitor the entire power generation process – from unloading to storage to feeding the furnace and beyond – from the control room using Siemens SIMATIC PCS-7 control system. If an instrument needs servicing or a process requires adjustment, technicians know immediately.

## Getting it right

Proper calibration is like picking the right tool for the right

job. The type, percent and frequency all need to be properly aligned to ensure the scale's performance.

Siemens offers several means to calibrate belt scales: weights, flat bar weights, high tolerance weights, manual and motorized weight lifter/storage devices, test chains, and chain storage devices. The Milltronics BW500/L, Milltronics BW500, SIWAREX FTC, and SIWAREX WP241 can also perform electronic calibration, making coal unloading faster and easier.

As Peter at GDF Suez says, "Siemens is the best supplier of field-proven instrumentation. Not just under ideal lab conditions, but for real-world industrial applications."

Siemens Industry, Inc.  
Process Industries and Drives  
100 Technology Drive  
Alpharetta, GA 30005  
1-800-365-8766  
info.us@siemens.com

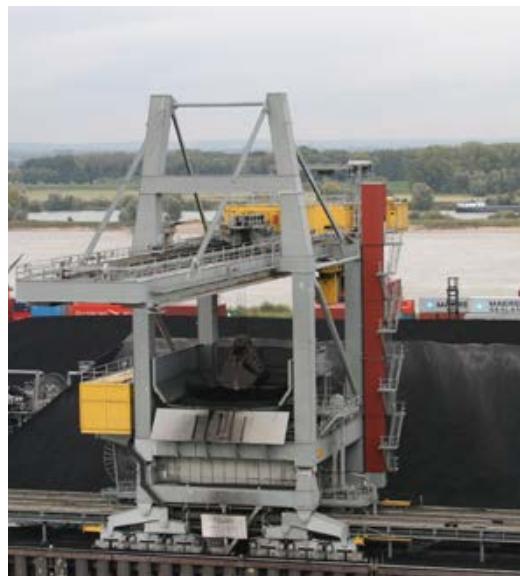
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GDF Suez's stacker-reclaimer creates stockpiles of coal after it is unloaded from ships in Nijmegen's Maas-Waal Canal.

Siemens Milltronics MMI trade-approved belt scale measures incoming coal with an accuracy of 0.25%.

With Siemens SIMATIC S-7 control system, technicians monitor the entire power generation process from the comfort of the control room.