WEIGHING APPLICATIONS FOR HAZARDOUS LOCATIONS

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PEPPERL+FUCHS
PROTECTING YOUR PROCESS

Weighing Applications for Hazardous Locations

Protecting Your Process

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There is a broad range of hazardous weighing applications in the process industry. Many of the applications require weighing equipment to be located in hazardous locations. Batches of powders and solvents need to be mixed for an accurate step in a recipe. This is true in products where you might think that the end product is not hazardous at all.

In many cases, minor spilling of chemical agents can't be avoided. Scales in an industrial environment must withstand harsh conditions due to corrosion and explosive or flammable materials. The industries where you can find these applications are the following:

- Pharmaceutical
- Fine chemicals
- Specialty chemicals
- Flavors & fragrances
- Agrochemicals
- Dyes & inks
- Soaps & detergents
- Polymers
- Inorganic chemicals
- Petrochemicals

The processes where weighing equipment is used include the following:

- Vessel weighing
- Filling & dispensing
- Formulation
- Batching & blending

Weighing systems and strain-gage load cells

The function of any weighing system is to obtain information on gross, net, or bulk weight, or some combination of these. Obtaining the net weight of a vessel's contents requires two measurements: the total weight and the weight of the unloaded container. Net weight is obtained by subtracting one from the other.

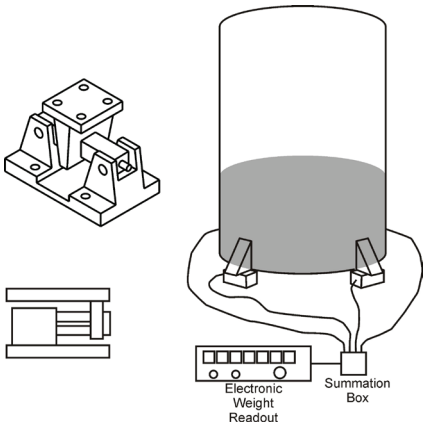

Figure 1
Electronic load cells measure tank weight

In today's processing plants, electronic load cells are preferred in almost all applications for final batching recipes. The selected load cell should always be suitable for the operating environment in terms of its corrosion resistance, intrinsically safe design, hose-down requirements, etc. Strain-gage load cells convert the load acting on them into electrical signals. The gages themselves are bonded onto a beam or a structural member that deforms when weight is applied. In most cases, four strain gages are used to obtain maximum sensitivity and temperature compensation. Two of the gages are usually in tension, and two are in compression. They are wired with compensation adjustments as shown in Figure 2, on page 3. When weight is applied, the strain changes the electrical resistance of the gages in proportion to the load. As strain-gage load cells continue to increase in accuracy and become more economical, other types of load cells are fading into obscurity.

Bulk weighing with load cells

Bulk weighing with load cells involves weighing large quantities. Each product increment is weighed and added to the weights of the remaining increments to obtain the total weight. Because the entire weight is never measured at one weighing, it allows a reduced weighing system, reducing cost and sometimes increasing accuracy.

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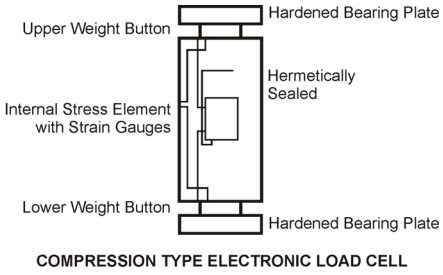

Figure 2:
Tank staying arrangement

Although they are less accurate, conveyor belts can also be used for bulk weighing. Utilizing this method, the total bulk weight is obtained by integrating the product of the belt speed and the belt loading over a specified time period.
Batch weighing systems satisfy the requirements of industrial recipes by accurately dispensing a number of materials into a common receiving vessel for blending or reaction.

Pepperl+Fuchs has the system for your application

There are typically three (3) or four (4) strain gages on a vessel plus a summing box. Pepperl+Fuchs' galvanically isolated strain gage transmitter barrier **KFD2-WAC2-Ex1.D** is the solution.

With its 3-way isolation between power supply, input, and output, this barrier provides a highly accurate means of supporting strain gage applications within a hazardous location. The strain gage can be connected in either a 4-or 6-wire configuration depending on the required accuracy. The strain gage excitation voltage, mV signal range, tare value, and current output range are all field selectable on the barrier. In addition, there is always an RS-232 signal back to a computer system. Two P+F **KFD2-FF-Ex2.P.RS-232** barriers protect this signal. The signal can be passed through a hazardous location at a maximum data transfer of 20 kb/s. Since the barrier is galvanically isolated, an intrinsic safety ground is not necessary.

Hybrid circuit protection

In industrial organizations, the ever-increasing use of extremely sensitive, computer-controlled equipment makes inadequate attention to the destructive potential of lightning extremely expensive. The main purpose of the surge protection barrier is to limit induced transient voltages across sensitive electrical equipment and to safely divert the surge current to ground. The surge protection barrier incorporates the line to line (differential mode) and line to earth (common mode) protection. This is achieved by integrating suitable switching elements into the surge protection device and guaranteeing a proper connection to ground. This protection device must be able to respond extremely fast on high impulse voltages and currents. Since a single switching element is unable to fulfill this requirement, several stages are included in the device. This network is called "hybrid circuit" protection. Gas discharge tubes represent the first stage. They are able to clamp high voltages and divert high currents, but their slow response time still allows dangerously high energy levels to pass through (see Figure 3, Gas discharge tube).

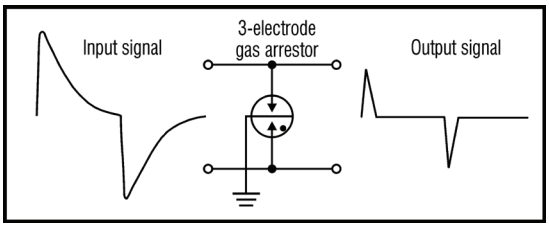

Figure 3:
Gas discharge tube

Therefore, a second “switching” element must be implemented to control the remaining energy. The silicon transient voltage suppressor (TVS) diode type responds very quickly to lower voltage and current levels, clamps the voltages to non-damaging levels, and diverts the surge currents to ground. Both protection stages are decoupled via inductance (see Figure 4, Hybrid circuit protection).

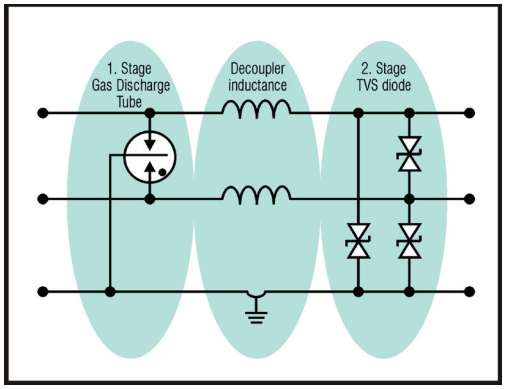

Figure 4:
Hybrid circuit protection

Level control

Most weighing and feeding equipment manufactures also have level control requirements. Pepperl+Fuchs has a full line of level probes and transmitters for continuous control, ranging from the very basic to the most multifaceted. Our wide selection of level sensing instruments is unmatched.

EXTEC Termex terminals

In addition, Pepperl+Fuchs new **EXTEC Termex terminals** have a direct interface to weigh scales. Termex has three (3) inputs for improved accuracy over the entire range of the load cell for fine, medium, and heavy weighing in one unit. More importantly, Termex uses a simplified calibration setup.

Using Termex linked to a PLC/PC/DCS, the user can forward the results to a host for tracking. This eliminates the need for separate displays and data entry points. This is a huge concern in the food and pharmaceutical industries where P+F’s barcode input and keyboard solution is 21CFR part 11 compliant.

All weighing systems have some sort of HMI (Human Machine Interface). Pepperl+Fuchs EXTEC now has an industrially hardened, intrinsically safe product line to monitor the process and perform final quality control with its unique barcode readers to ensure validation of the process (see Figure 5).
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Systems & Solutions from Pepperl+Fuchs

Pepperl+ Fuchs products are used throughout the world in applications involving industrial, hazardous, and corrosive environments. Now we are able to take our products a step further. Pepperl+Fuchs is able to integrate our full line of products into a cabinet that reduces your commissioning time, and most importantly, reduces your upfront costs with a single purchase order. By offering the customer a complete variety of enclosures and panels that are designed according to each unique specification, we can now provide a turnkey solution. These are custom designed and manufactured at our own facility in Twinsburg, Ohio.

For more information on the wide range of products that P+F has to offer the process automation industry, visit our website at ***www.pepperl-fuchs.com.***

Figure 5:
Fine, medium, and heavy weighing
Three circuits in one unit

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