Liquid-Level Sensors

with Temposonics® Magnetostrictive Technology

MTS® SENSORS

Accurate measurement of spirits

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Case Study

Stainless steel tanks that hold Seagram's™ Coolers prior to packaging utilize a Modbus based MTS liquid-level sensor to communicate to an existing Simatic 505 PLC used in the tank room.

Introduction

Seeking a new method of liquid level measurement, the Seagram's US distillery is retrofitting its facility to utilize magnetostrictive liquid level sensors to measure its spirit and carbonated beverage production throughout the distillation process. This measurement information is necessary for internal productivity tracking as well as government required record keeping.

Situation

The Lawrenceburg, Indiana Seagrams distillery, run by Pernod Ricard USA is the only US distillery producing Seagrams Gin and Vodka for worldwide distribution. The facility also produces and ships various other beverage alcohols and carbonated products worldwide. The 150-acre plant employs nearly 600 people and processes beverage alcohol end-to-end, from fermentation to bottling.

Excise Taxes Calculated by Volume

Throughout each step of the distilling process, Pernod Ricard must keep accurate measurements of its product during processing, storage and shipment. Because the government requires that all spirits be subject to excise taxes, meticulously kept paperwork must be generated during all custody transfers during the distilling process. Pernod

Ricard generates approximately $1 million per day in tax liability. Therefore, accurate liquid level measurement is crucial to accurate excise tax reporting, record keeping and overall cost savings.

Previously, Seagram's had been using a float/counterweight system to measure liquid level. The problem with this method was the occurrence of air agitation causing wear on the gauge. This produced a less accurate and less repeatable measurement process. Any drift in measurement could cost thousands of dollars in tax overpayment, or the risk of underpayment. Seagrams was searching for a measurement technology that could be easily installed into new and old tanks, be compatible with existing control systems, provide quick monitoring and troubleshooting data, and produce accurate, reliable level reports. Seagrams turned to magnetostrictive technology to fulfill these requirements and also found added benefits over and above its basic necessities.

Close-up of a tank top in the wine room.

Magnetostrictive Technology for Level Measurement

When searching for an alternative technology to the float/counterweight system, Seagrams focused on reliability, accuracy, repeatability and installation ease. Magnetostrictive technology was invented more than 30 years ago and has had great success in industrial automation and processing applications. The MTS magnetostrictive gauge consists of an outer pipe which is installed into the tank though an opening at the top. For processing applications the pipe is manufactured of welded stainless steel and meets clean-in-place (CIP) and sterilize-in-place (SIP) processes. Inside the outer pipe is a waveguide composed of a magnetostrictive material. The waveguide conducts an electrical "interrogation" pulse from the electronics head of the gauge along the length of the pipe. A float inside the tank contains a magnet, which (based on the specific gravity of the liquid being processed —water is 1.0, alcohol is 0.8), rests atop the surface of the liquid as it rises or lowers. When the interrogation pulse intersects with the magnet, the electronics head calculates the time it takes the pulse to return, enabling it to calculate the liquid level inside the tank.

Magnetostrictive sensors offer an inherently high degree of accuracy (non-linearity 1/32" or 0.794 mm) and repeatability (0.01% full scale) without drift. The sensors operate on standard voltage inputs and offer Modbus RTU for quick monitoring in the field or closed loop control functions for PC or PLC based monitoring. The gauges are ideal for the processing industry because they have NEMA-rated sealed electronics, corrosion resistant materials and never require scheduled maintenance or recalibration. Each sensor provides a 100 point strapping table in order to automatically calculate the volume of each tank.

Seagrams began using MTS liquid-level sensors about 10 years ago, beginning with LDF flex gauges. Today they are installing more than 30 M-Series digital rigid and flex gauges throughout the distilling plant for a total of 36 MTS gauges. Most of the production facility is automated, especially at the bottling phase.

Seagrams chose MTS sensors for several reasons — the most important was performance. The first requirement was repeatable measurement with no drift. MTS gauges have a repeatability (hysterisis) of 0.002% full scale (0.0015" in any direction.)

Another determining factor for choosing magnetostrictive technology was accuracy. Because spirits are costly and Seagrams pays excise taxes based on volume, accurate measurements were crucial. The tanks used in processing and storage are very large — up to 1000 gallons per inch, meaning the slightest inaccuracy could cost thousands of dollars in product. MTS sensors provided level accuracy to 1/32" or 0.794 mm, and do not need to be recalibrated or adjusted even in the event of a power outage.

Because of continuous processing, Seagrams needed installation to occur quickly and smoothly, so as not to disturb distillation processing. Most tanks had existing holes at the top of each tank. Because MTS gauges calculate temperature, interface and liquid level using the same instrumentation, no new holes were required at the tank. In some instances, indoor tanks were enclosed in low-roofed structures that offered little headroom. In some of these cases, flexible M-Series gauges were used to "snake" in the sensors. The flexible metal rope-like pipe enables a means of transporting and installing the pipe even in large tanks (up to 75 feet) without the extreme headroom needed to accommodate rigid pipes. In other cases, Seagrams was able to request rigid pipe magnetostrictive gauges be directly installed in the tanks during manufacturing so that they are immediately functional at tank installation. In addition, the sensor's digital output was compatible with

Seagram's Modbus based PLC control system making set-up and plant integration simple.

MTS gauges never need to be removed from a tank. If the electronics need to be replaced or repaired, a technician simply opens the sensor's electronics housing at the top of the tank and removes the waveguide and electronics only. The outer pipe stays intact and never requires draining or disrupting a tank's contents.

A major benefit of magnetostrictive sensors is the ability to use more than one float. The sensors not only measure liquid level, but temperature and interface values as well. With two floats, Seagrams was able to measure the total volume of a tank and the interface of two liquids within the tank (such as oil & water or oil & alcohol). This was of great importance to Seagrams because of the production of fusel oil, a by-product of the distillation process that is also sold and used in perfume manufacturing. Using the specific gravity of fusel oil, the interface float easily rests atop the oil, while the main float rests atop the alcohol.

Seagram's Lawrenceburg distillery.

Conclusion

Overall, Seagrams was able to rapidly outfit its distillery with magnetostrictive sensors for more accurate and reliable liquid level monitoring, all while maintaining production throughput. Added benefits of magnetostrictive gauges allowed for closed loop control with existing systems, temperature and interface gauging and reduced set-up and maintenance. As it expands, Seagrams anticipates outfitting new processing tanks with magnetostrictive sensors.

MTS® SENSORS

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