

Flow Measurement in Water Service Using Honeywell Smart Transmitters

Flow measurement applications in the chemical industry



Problem: A Chemical Plant Experienced Short Transmitter Life in Water Service

A chemical plant in New Jersey has a variety of flow applications in water and gas service. The plant engineers specified differential pressure transmitters as the most cost effective method for monitoring water flows. Immediately after a major plant upgrade, there were many failures in which the transmitter diaphragm was shown to be bulging outward. The transmitter typically displayed a gradually increasing differential pressure that did not return to zero after pressure was released.

Plant engineers conducted a study of the materials of construction along with studies of the transmitter applications to in an attempt to identify and solve the problem.

Pressure and differential pressure transmitters using stainless steel diaphragms with zinc plated flanges or process piping in close proximity in water service are susceptible to a phenomenon called “**hydrogen migration**”. The potential difference in the metals leads to the formation of monatomic hydrogen in the immediate vicinity of the diaphragm. This hydrogen gradually passes through the thin metal diaphragm primarily due to its nickel constant as shown in Figure 1. The hydrogen atoms combine in the fill fluid to form hydrogen gas.

The **symptoms of hydrogen migration** are evident in both the output of the transmitter and in a physical examination of the diaphragms. When process pressure is released, the gas bubbles form in the fill fluid pressing out on the diaphragm from within. This causes measurement inaccuracies. Over time, the gas bubbles increase in size causing permanent damage to the diaphragm. This evident in a prominent bulging outward of the diaphragm.

A second application in the same plant utilized high pressure (1000 psig) hydrogen gas. In this application a gauge pressure transmitter with stainless steel diaphragms and stainless steel flanges was used in the pressure measurement.

Even with the all stainless steel construction, the hydrogen migration problem was experienced. Research into this problem revealed that monatomic hydrogen exists in small amounts in gaseous hydrogen. This leads to the same phenomenon of hydrogen migration as in water service.

Solution: The Honeywell Smart Pressure Transmitter (ST3000) with Gold Plated Diaphragms

In consultation with the local Honeywell representative, the plant engineers determined that gold plating of the transmitter diaphragms greatly reduced the magnitude of the hydrogen migration. The coating of gold is thin enough to avoid noticeable decrease in sensitivity in the transmitter but thick enough to retard the flow of hydrogen through the diaphragms. For most processes in which hydrogen migration was considered minimal, a gold plating of 50 micro-inches was specified. For the high pressure hydrogen process in which the gauge pressure transmitter had a life measured in weeks, due to hydrogen migration, an extra thick gold plating of 150 micro-inches was used.

The plant engineers were reminded that the thin gold coating is designed to control the hydrogen migration, not for corrosion protection.

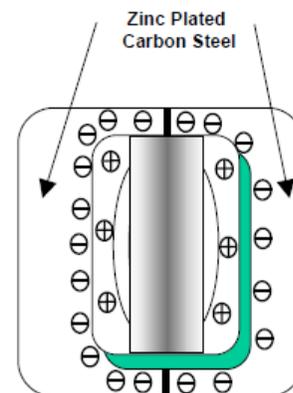


Figure 1 Potential Difference Leading to Hydrogen Migration

The field-proven reliability of Smartline transmitters reduces the need for frequent calibration checks. Based on experience with the performance of the ST3000 smart pressure transmitters in use, calibration checks can be made at one-year intervals, versus the one to three month intervals for conventional transmitters and “smart upgrades.”

Benefits

Using Honeywell Smartline transmitters for water flows and level increases profitability in the following ways:

- Fewer transmitter models needed for applications due to the wide rangeability of Honeywell pressure transmitters.
- Honeywell Smartline transmitters have the highest accuracy of any transmitter on the market today.
- Maintenance cost decreased with higher reliability and stability with self-diagnostics.
- Installation cost lowered as the Honeywell transmitters are designed to be installed “out of the box” with no preliminary zeroing or calibration needed.
- Re-ranging eliminated in Honeywell Smartline transmitters. Time and inventory savings result.
- Increased reliability result in fewer leaks and faults.
- Digital integration to Honeywell TPS provides database security plus a wide range of diagnostic and configuration capabilities.

More Information

For more information on Flow Measurement, visit www.honeywellprocess.com, or contact your Honeywell account manager.

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