talkline

Endress+Hauser
People for Process Automation

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Tradeshow Schedule 2014

October 23 to 24	Northwestern Ontario Water & Wastewater Conference	www.nwowwc.com
November 5 to 6	SWWA Conference and Trade show	www.swwa.ca

Our valued friends, customers and business partners

Dear Reader,

Here we are, already well into the third quarter of 2014. I sincerely hope you have all enjoyed some well-deserved time off this summer. Although our Canadian summers tend to fly by, a lot has been going on in the process industries … and at Endress+Hauser Canada as well.

Endress+Hauser Canada has been accredited to ISO/IEC 17025 by A2LA in the field of calibration. We are now able to conduct field calibrations. Our mobile calibration rigs can be deployed nation-wide to better serve our customers. You can view the scope of accreditation (Certificate #3597.01) for details on the calibration parameters covered by our accreditation at http://a2la.org. We continue to invest in services and solutions, which by design, help customers to be as competitive as possible in their respective fields. If your experience with Endress+Hauser centres predominantly on flow and level products, I invite you to take a closer look at our complete offering.

From state-of-the-art pressure and temperature measurement devices, to comprehensive liquid analysis solutions, our total product offering covers the breadth of requirements found in today's process industries. We offer unmatched accuracy for your measurement point. We have a global network of factory-trained and experienced service technicians, ready to let you sleep at night while they tackle and solve your biggest headaches. All this is accomplished while keeping mindful of the best possible fit technology for your specific application. The more we can help to reduce complexity in the accomplishment of your day-to-day operations, the more we add value to your bottom line.

Maximizing up-time is an immediate benefit derived from utilizing our extremely robust and field-proven instrumentation. This can be further enhanced by working with you with a view to optimizing your processes. At Endress+Hauser, this also means ensuring a high degree of safety in everything we do. From the initial design and testing phase of our product development, right through to functional safety while in use, safety is at the core of our design and development processes. Consider us for all your safety critical applications.

I sincerely hope you enjoy a productive quarter as we head into the fall season. I also invite you to contact and consult us for all your measurement needs as you prepare for year-end and the arrival of 2015. After all, we are the *People for Process Automation*. Count on us to help you realize tangible results and achieve even greater success in 2015!

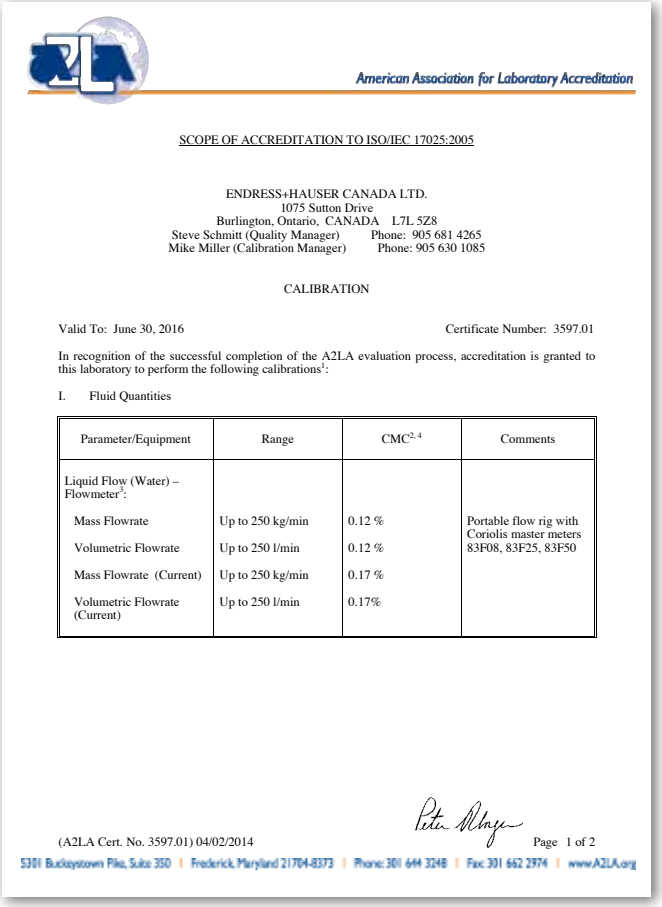
Sincerely,

Richard

Richard Lewandowski
CEO

Endress+Hauser Canada has been accredited to ISO/IEC 17025 by A2LA in the field of calibration

As an accredited calibration provider, our mobile calibration rigs are available for deployment nation-wide.



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ENDRESS+HAUSER CANADA LTD.
1075 Sutton Drive
Burlington, Ontario, CANADA L7L 5Z8
Steve Schmitt (Quality Manager) Phone: 905 681 4265
Mike Miller (Calibration Manager) Phone: 905 630 1085

CALIBRATION

Valid To: June 30, 2016 Certificate Number: 3597.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Fluid Quantities

Parameter/Equipment	Range	CMC[2, 4]	Comments
Liquid Flow (Water) – Flowmeter[3]:			
Mass Flowrate	Up to 250 kg/min	0.12 %	Portable flow rig with Coriolis master meters 83F08, 83F25, 83F50
Volumetric Flowrate	Up to 250 l/min	0.12 %	
Mass Flowrate (Current)	Up to 250 kg/min	0.17 %	
Volumetric Flowrate (Current)	Up to 250 l/min	0.17%	

(A2LA Cert. No. 3597.01) 04/02/2014 Page 1 of 2

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Endress+Hauser Canada has been awarded accredited laboratory status by the American Association for Laboratory Accreditation (A2LA).The accreditation (ISO/IEC 17025) recognizes Endress+Hauser Canada as a calibration provider. We are now accredited to conduct in-house and field calibrations. Our mobile calibration rigs can be deployed nation-wide, on-site to better serve our customers. We continue to invest in services and solutions, which by design, help customers to be as competitive as possible in their respective fields.

Endress+Hauser Canada's in-house and mobile calibration services are A2LA accredited. The company also meets additional requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and operation of a laboratory quality management system. The accreditation is part of our ongoing commitment to continuously strive to optimize our service offering to our customers. For audit compliance and all your traceable calibration needs, contact us at 1-866-887-1666.

ACCREDITED
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Ultrasonic level measurement: a modern classic!

By Moritz Rohn, Product Manager Level, Endress+Hauser Messtechnik GmbH+Co. KG

Radar technology has long had the reputation of being the best method of level measurement available – but does this also apply to the wastewater market? Based on its physical characteristics, radar technology certainly offers great flexibility and high performance. However, from an objective standpoint, non-contact level measurement using ultrasound is often the first choice and also the right choice due to its cost-effectiveness and application-specific benefits!

Level measurement in the wastewater industry

From a process engineering, water management and safety perspective, level information and limit detection data constitute important parameters in the operation of wastewater treatment plants (WWTP) and drainage systems. For example, level monitoring and control in a WWTP are key factors in ensuring optimum interaction between the subareas of influent (e.g. in a lift station), preclarification and sludge treatment. In this regard, calls from planners and operators for a universal method of level measurement are well founded. A universal method would, for example, lead to a reduction in the amount of training required and a decrease in the number of errors during commissioning. It would also result in cost savings, for example in the context of spare parts inventory. However, in terms of measurement technology, the tasks and requirements facing level measuring devices in the wastewater industry are as wide-ranging and varied as the measuring principles available on the market.

Each method of measurement has its pros and cons based on physical and/or device-related characteristics that become evident under different process and environmental conditions. The mounting location can also have an impact

Even harsh winters with icy temperatures don't affect the Prosonic S. The sensor with flood protection is equipped with a heater.

A good dosing system means good savings: Reliable dosing of precipitating agent at a biogas plant using the Prosonic T

It doesn't always have to be radar: The Prosonic S family is perfectly suited to the wastewater industry.

Exceeding limits: Even for outgassing media, the Micropilot offers high levels of accuracy and measurement reliability.

on measurement reliability or the "handling" of the measuring point.

To support users and planners in choosing the right device, the pros and cons of the different methods of measurement based on application are outlined as follows. The information presented concentrates on non-contact time-of-flight methods, namely ultrasound and radar.

Note: As one of the leading manufacturers of level measurement technology, the objective assessment of safety, reliability and cost is a key priority for Endress+Hauser. If a level transmitter is selected solely because it is a modern method of measurement, the planner or operator may in some cases miss out on the benefits afforded by a different measuring principle at a lower price.

Optimized control of pumps and lifting stations is a typical example of how ultrasonic technology, either compact or separate instrumentation, is used.

Overview of measurement methods

For level measurement and point level detection in the wastewater industry, Endress+Hauser offers eight different measurement methods: ultrasonic, guided radar, free-space radar, radiometric, vibronic, capacitance, conductivity, hydrostatic and float. Each of these methods of measurement is valid and facilitates the important decision of choosing the right method for the application in question.

Endress+Hauser's capacitive measurement technology is a very cost-effective solution for continuous level measurement or level detection in conductive liquids or foam. Capacitive probes are guaranteed to work reliably, particularly within small measuring ranges and where there are rapid changes in level, but also in aggressive media that forms build-up, e.g. in chemical tanks.
In level measurement applications where significant foam generation is expected, hydrostatic pressure measurement or guided radar is recommended. The hydrostatic method is particularly suited to level measurement, works independently of fixtures and offers benefits based on its tried and tested design and commissioning. However, the hydrostatic method is not suitable where there is hardened build-up such as mud or where it is necessary to measure down to the base of the tank.

Ultrasonic versus radar

Due to falling prices, free-space radar devices such as Micropilot FMR5x are being used to an increasing extent in the field of wastewater technology along with ultrasonic sensors from the Prosonic S, M and T device families.

Ultrasonic sensors make use of ultrasonic pulses that are reflected off the medium surface due to the change in density between air and the medium. The time of flight between transmission and reception of the reflected pulse (echo), as measured by the device, is a direct measure of the distance between the sensor membrane and the surface of the medium. In principle, free-space radar devices function

The Prosonic T ultrasonic sensor is perfectly suited for use in dosing and storage tanks. With its affordable price tag, easy and safe operation, the compact two-wire measuring device is an impressive choice.

in the same way. However, they have the advantages of high-frequency microwaves that are emitted via an antenna. The microwave pulses are reflected due to the change in dielectric constant between air and the medium.

The particular physical characteristics of the microwave allow the Micropilot to be used at very high temperatures (up to 450°C), in a vacuum or at pressures up to 160 bar, as well as in extreme air currents in the measurement section.

The Micropilot functions in dusty applications and the propagation speed (velocity of light) of the radar pulses is barely affected by gas composition, apart from a few exceptions such as ammonia. For measurements under specific environmental conditions, e.g. in extreme wind, rain, fog and sunlight, these 'positive' features can have a beneficial impact on the reliability/accuracy of measurements.

Ultrasonic measurement using Prosonic level devices is not affected by conductivity, humidity or dielectric constant. However, these devices cannot be used for measurement in a vacuum. Compared to radar devices, the use of ultrasonic measurement in outgassing media, varying temperature layers and strong air currents has its drawbacks. Considerable temperature differences or gas layers may affect the velocity of sound, thereby generating a time-of-flight error.

Turbulent surfaces as well as extreme build-up or condensate can be limiting factors for both technologies. Applications involving foam generation can also be problematic.

Applications

While we are aware of the physical advantages of the Micropilot, to what extent if any does the technology benefit the day-to-day running of a WWTP?

Capacitance probes are tough performers: The Liquicap guarantees high levels of measurement reliability when used in media which generate buildup.

Spotlight on the wastewater industry: Ultrasonic sensors, such as the Prosonic M, measure on a non-contact basis, are maintenance-free and offer an optimum price-performance ratio

Comprising an analysis unit and sensor, the Prosonic S as a separate instrument offers considerable advantages, particularly in environments which are difficult to access.

In practice, many typical level applications such as wet wells, rainwater basins and wastewater channels are covered or built underground. Wind and sunlight cannot interfere with ultrasonic measurement here. On the contrary, it is precisely in these applications that the Prosonic S FDU90 scores well due to a higher level of accuracy at close range, more flexible installation options as well as minimal maintenance thanks to the self-cleaning effect (oscillation of sensor membrane).

For larger measuring ranges located outdoors, for example level measurement at bridges across rivers or outgassing media (e.g. level monitoring in digestion tanks), the physical benefits of the Micropilot come to the fore. The use of ultrasonic measurement in a digester is not a viable option, as the gas layers in the digester cause a shift in the time of flight of the ultrasonic pulse, which in turn gives rise to inaccuracies.

Summary

A comparison of the pros and cons of both time-of-flight methods, ultrasonic and radar, shows that radar is not necessarily the best method for the user. Endress+Hauser has tailored its range of traditional ultrasonic measurement technology to the requirements of customers in the wastewater industry to ensure an optimum price-performance ratio by current standards.

As an all-round supplier with decades of experience, offering the full range of measuring principles and with a professional consultancy service to help with choosing the right measuring principle and the right measuring device, Endress+Hauser has many benefits to offer our customers.

Typical examples of ultrasound in use:

Dosing stations and chemical tanks

Dosing stations, in which flocculating or precipitating agents are used for the purpose of phosphate elimination, sludge dewatering or biogas desulfurization, are classic examples of where ultrasonic sensors such as the Prosonic S or T are used. The fully welded FDU9x sensors made of PVDF are resistant to aggressive media and are also particularly suited to small tanks due to the short blocking distance. The compact Prosonic T delivers a high level of reliability at a very affordable price.

Pumps and lift stations

For energy saving reasons, only the necessary number of pumps should be in operation in pump and lift stations. Using the Prosonic S transmitter, it is possible to control up to six pumps directly on an alternating basis. This ensures a uniform load across the screw pumps. An additional PLC is not required.

Flow measurement in open channels or weirs

The first measurement usually carried out in the wastewater inlet of a WWTP involves determining the inlet quantity using a Q/h curve. Endress+Hauser's ultrasonic sensors contain numerous Q/h curves for channel and weirs. Alternatively, they can be entered individually.

In practice, the typical measurement accuracy of ultrasonic measurement is completely sufficient for flow measurement in open channels or weirs. The use of a radar device that functions independently of temperature is usually not necessary. The accuracy of flow measurement is influenced primarily by the design, construction and the installation of the channel or weir.

Rainwater basin / overflow structures

Rainwater basins are used to prevent the overloading of wastewater networks and WWTPs. In the buffer basins, it is necessary to measure both the level and the volume of overflow into the drainage channel. Both measured variables can be determined at the same time using a transmitter and an ultrasonic sensor that can be mounted up to 300 m away from the transmitter. Due to the narrow measuring range, the small dimensions of the device and the option of installing it directly on the ceiling, the FDU90 is particularly suited to measurement in narrow wastewater systems such as these. The use of a flooding protection tube guarantees signal analysis even if the sensor is completely flooded. If the measuring point is located outdoors, the use of the FDU90 with heater is recommended. The heater prevents the formation of ice on the sensor and guarantees reliable measurement at any time of the year.

Bar screen control

Coarse and fine bar screens are components of every WWTP. To optimize their use, the screen should be cleaned only when a sufficient level of contamination has been reached. For this purpose, a Prosonic FDU91 is installed both upstream and downstream from the bar screen in order to measure the difference in contamination level. Analysis and control of the bar screen cleaning process is performed by the Prosonic FMU90 transmitter with two sensor inputs and integrated relays to the pulse output. Easy programming of the FMU90 keeps cost to a minimum and saves the user time.

Level interface sensing for water dump control in the oil and gas industry

By William Sholette, Level Products Business Manager, Endress+Hauser

Accurate and reliable detection of the interface between oil and water in a water dump tank improves the separation process.

In a fracking operation at oil and gas wells, water and oil both come to the surface, and must be separated. Oil and gas can be filtered from the water fairly easily, but the remaining water, called *produced water*, is contaminated and must be treated before being released into the environment.

Fracking is becoming widely used in the oil and gas industry. As it grows in popularity, treating produced water coming from wells is becoming a major challenge, especially because the cost of cleaning produced water is about 300 times that of cleaning municipal waste water.

A similar problem exists at oil refineries, where incoming crude oil contains water that must be removed prior to refining. At refineries, crude may contain anywhere from 3% to 5% water.

The volume of water produced is dependent on a number of factors including source of the oil, age of the well, type of separator, and location in the refining process. Volumes ranging from several hundred to millions of gallons a day are possible.

Whether the separation is done at the well site or at the refinery, one of the most critical parts of the process is measuring the level of the interface between oil and water in the separation vessel. A correct measurement ensures that the maximum amount of oil is drawn off for refining

In a separation vessel, oil and water separate, with oil moving to the top and water to the bottom. Capacitance level switches are used to detect the oil/water interface.

purposes, and a minimum amount of oil and hydrocarbons are sent to the water treatment process.

Separation Processes Oil in production fields contains varying amounts of water depending on the specific oil reservoir, the age of the well, and the methods used in extracting the oil from the ground. Some separation of water from the oil is done in the field to reduce the amount of water that is transported to the refinery.

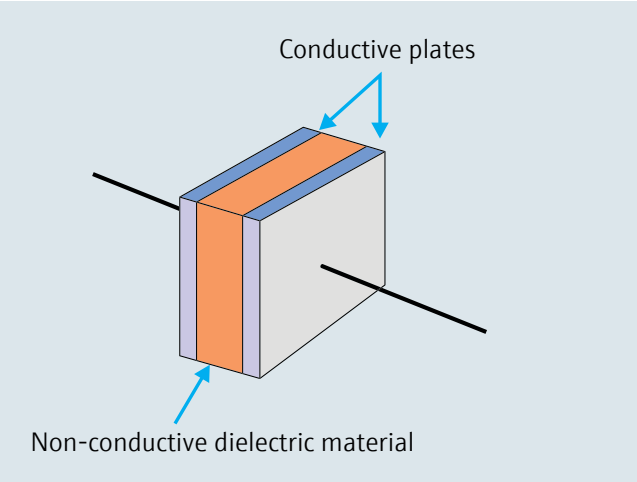
At a well site, especially one that uses fracking, the separated water must be treated on site or at a nearby water treatment facility before the water can be returned to the environment.

Refineries take in crude oil from production fields with varying levels of Basic Sediment & Water (BS&W) measurements. The higher the BS&W measurement, the more water is in the crude. The refineries separate the water and other impurities through various separation processes including, but not limited to: gravity separation, desalter vessels, and skim tanks.

In all these processes, water separates from the oil and must be evacuated from the bottom of the vessel, while the hydrocarbons typically are removed on a continuous basis by flowing over a baffle at one end of the separation vessel.

Essentially, all the various separation processes involve a tank where oil and water co-exist, with oil on top and water on the bottom. As the separation process continues, the water must be removed.

Water Dumping The process of removing water from the separation vessel is referred to as a "Water Dump." The water is "dumped" to a treatment plant for processing, while the oil is removed from the top for further refining. Because of the high cost of treating the water, it is critical to know when the interface between the water and oil reaches a low point, to prevent dumping oil to the water treatment facility.



A capacitance sensor can be used to detect the presence of conductive fluids.

The main purpose of water dump control is to prevent excess hydrocarbons from being sent to the water treatment facility. There are two reasons for this: first, in some cases there are fines for dumping hydrocarbons to the water treatment plant; second, the idea is to maximize the hydrocarbon throughput to the refining process, not dump it down the sewer.

A number of methods can be used to measure the interface between water and oil. These include everything from manual sampling to sophisticated continuous level measurement instruments, such as: guided wave radar and gamma radiation transmitters.

But for water dump control, an on/off capacitance level switch inserted near the water outlet is almost always the preferred alternative, for reasons delineated below.

Inside Capacitive Switches A capacitor is made up of two conductive plates separated by a non-conductive "dielectric" material.

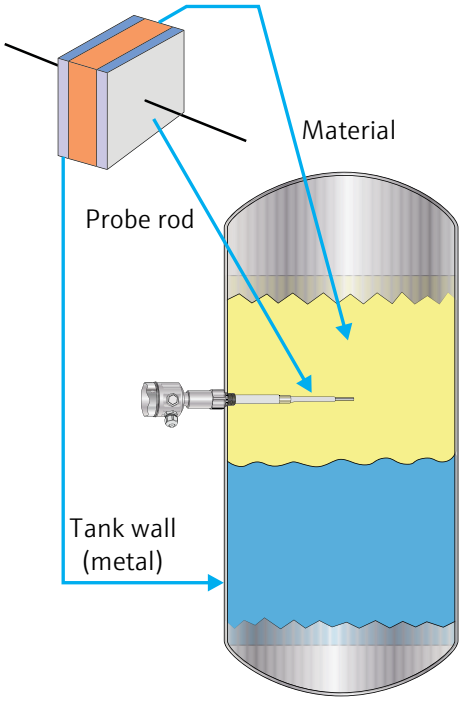
Dielectric materials are categorized by their "Dielectric Constant" or "DK" which is a number that is related to the material's ability to store a capacitive charge. The higher the dielectric number, the more capacitance it can store.

Capacitance is equal to the DK (Dielectric Constant), times the Area of the conductive plates, divided by the Distance between the two plates, or: $C = (DK * A) / D$

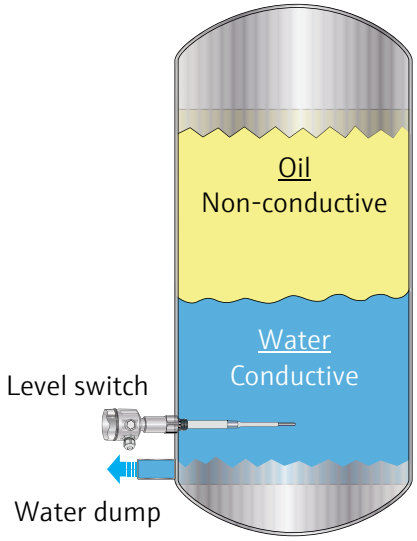
Capacitance sensors for level measurement use these basic capacitance concepts, with the vessel becoming one plate of the capacitor in point level applications. That is, the probe becomes one conductive plate, the vessel or a ground reference becomes the second conductive plate, and the material being measured is the dielectric material. In the case of conductive materials such as ground water, the plates are essentially shorted out, providing a large change in capacitance.

A bridge circuit in the sensor's electronic unit is balanced to null out the capacitance generated by an uncovered sensing element. As material covers the probe, an increase in capacitance is generated on the probe side of the bridge, which causes the bridge to become unbalanced. This change is converted to a switch command to allow a relay or other output to indicate the status of the switch, either covered or uncovered.

In the case of materials that leave a coating on the probe, active buildup compensation in the electronic unit provides a means to compensate for the coating and continue to provide reliable measurement.



In a capacitive level sensor, the vessel itself becomes one plate of the capacitor, and the oil/water mixture is the dielectric material.



A capacitance level switch mounted just above the water dump outlet line can detect the presence of oil and send a signal to shut off the pump, thus preventing oil from reaching the water treatment process.

Water Dump Applications Knowing where the interface between the water and oil occurs is important to prevent dumping oil to the water treatment plant, **resulting in loss of product, extra cost for treatment, and potential environmental fines**.

Using a capacitance switch to identify the interface between the oil and water is very effective because of the dramatically different electrical properties of the two fluids. Ground water is very conductive and acts to short the two plates of the capacitor, causing an almost infinite change in the measured capacitance. The oil phase is not conductive, and the low dielectric constant of oil (around 2DK) causes a small change in the measured capacitance. This results in a very clear electrical definition between the two phases.

In a water dump tank, the sensor is covered with a mixture of oil and water until the separation process proceeds, when oil moves to the top and relatively clean water moves to the bottom. The separated water will still contain some oil, grease, iron, polymer additives, paraffin wax and other contaminants that will be removed in the ensuing water treatment process. The sensor will probably never see pure water. However, even with the contaminants, the water phase will be conductive making it electrically different than the oil phase.

The capacitance switch is mounted at a point where the low interface between the oil and the water needs to be detected. This could be a horizontal installation just above the water dump outlet line. The capacitance switch could also be mounted directly into the water outlet piping.

In some cases, the vessel has no openings to mount the sensor horizontally at the required point of control. In these cases, a capacitance sensor can be mounted from the top of the vessel extended down to the control point. Since the capacitance sensor will see a large change between the water and the hydrocarbon, vertical mounting is often feasible, but a horizontal installation at the control point is preferred.

The capacitance switch is set with a large preload on the bridge circuit to make it less sensitive. This allows the switch to detect the water because of the large change in capacitance due to water's conductive electrical properties. The low dielectric constant and non-conductive properties of the oil phase will not generate a large enough change in capacitance to exceed the large preload on the bridge circuit.

The result is that the switch will change states as soon as the water drops below the tip of the probe. This provides an extremely reliable indication of the water/oil interface that can be used to stop dumping.

Other Point Level Methods for Detecting Interface

Several other methods are available to detect the water/oil interface, but all have significant disadvantage as compared to capacitive level sensors:

Manual sampling

The manual sampling method is somewhat archaic, but is still used in many facilities. A number of valves are spaced vertically on the side of the vessel. An operator opens the valve briefly and pulls a sample. By observing the sample visually, it can be determined which valve yields water and the next closest valve where oil is present, thereby identifying the interface is between the two valves.

Manual sampling has a number of flaws. First, it only gives an idea of where the interface is located—that is, somewhere between two valves. Since the samples are taken manually, the location of the interface is only as accurate as the last sample. It also relies on a manual visual interpretation of what is water and what is oil. This interpretation is arbitrary and inconsistent with different operators. Last, it is an operator's judgment to decide when to stop dumping, which adds to the human error factor.

Sight glass

A sight glass located in the water dump outlet line can be used to visually discern the change from the water phase to the oil phase. As in the manual sampling method, it relies on a visual interpretation of what is water and what is oil. Also, because the sight glass is in the outlet line, some oil will inadvertently be dumped. As this is a manual function, human error is introduced.

Conductivity switch

Conductivity switches operate by passing an electrical current from one electrode to a second electrode through a conductive liquid. In an oil/water interface application, the current passes through when water is present. When the liquid changes to non-conductive oil, the current no longer passes between the electrodes and the switch indicates a change of state.

Conductivity switches can and do provide reliable interface detection in many installations. However, if the electrodes become coated with a non-conductive material such as heavy crude oil or paraffin wax, the electrode will no longer be able to pass current. This will indicate a false reading until the electrodes have been cleaned. For this reason, conductivity switches should only be used in separation processes where the phases are free of heavy material or contaminants.

Float switch

Float switches can be used for measuring the interface between water and oil. The float is calibrated for the specific gravity of water, which is 1.0 or slightly higher. The oil has a lower specific gravity, generally between 0.7 and 0.9. As the water level drops the float arm moves down, providing an indication of the low water control point.

Floats can be problematic in water dumping applications for several reasons. The moving parts of the float switch are susceptible to wear and damage. The float can be compromised causing it to sink. Heavy crude and wax can build up on the float and float arm, causing hang-up and failures. Finally, the specific gravities of both the ground water and the oil are variable, requiring calibration "tweaks" on a regular basis.

Conclusion There are a number of point level approaches to measure the interface between water and oil for water dump control. Manual methods, such as sampling valves and sight glasses are still widely used in these applications. Using level instrumentation to determine the interface removes both the manual aspect and human error from the procedure.

When comparing point level instruments that can detect the water/oil interface, the capacitance sensor stands out as the best choice. Capacitance level switches are simple to calibrate and can be installed horizontally or vertically. There are no moving parts to wear out or hang up. Because capacitance has the advantage of active buildup compensation, materials that coat such as heavy crude or paraffin are not a problem.

Capacitance level switches provide reliable water oil interface detection, and help to automate the water dump control process.

Products Spotlight

Cleanfit CPA875

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