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Table of Contents

Product Releases

ProPress System Available for Flameless Joining of Stainless Steel

System for stainless steel is suitable for industrial and commercial installations in process industries

THE VIEGA ProPress system is available for joining stainless steel piping in ½-in. to 4-in. sizes using a press technology that secures pipe connections in less than seven seconds. The system, consisting of stainless steel pipe, valves and fittings, provides a flameless way to make water-tight and gas-tight stainless steel connections. Available in two high-quality stainless steel grades, 304 and 316, and with more than 600 fitting configurations, the Viega ProPress system for stainless steel is suitable for industrial and commercial installations in applications such as food and beverage processing, chemical processing, pharmaceutical and biotech processing, oil and gas, mining and manufacturing.

For more information, visit www.ViegaProPress.us.

Ad Index

Transmitter Handles Harsh Environments

New 316L stainless steel housing is designed for hazardous areas

EMERSON PROCESS Management has expanded of range of Micro Motion Model 1700 and 2700 field and integral mount transmitters to include 316L stainless steel housing. The new housing material is suited for hazardous areas and extreme environments such as offshore applications.

The Micro Motion 1700 and 2700 transmitters are available in field or integral mounting and are compatible with a wide range Micro Motion Coriolis meters including Elite, F-Series, H-Series, and T-Series sensors.

The transmitters feature the latest generation MVD (multivariable digital) processing technology, which provides enhanced accuracy, stability and versatility in a variety of tough applications including the presence of entrained gas, high noise and high turndown.

They have been approved for CSA, ATEX, NEPSI, IECEx and INMETRO. Micro Motion 1700 and 2700 transmitters are approved for custody transfer, certified for SIL2 and SIL3, and can be installed in Class I, Division 1 or Zone 1 hazardous areas.

For more information, visit www.emersonprocess.com.

Properly Position Interlock Valves

The obvious location may not be the most cost effective

By Andrew Sloley, Contributing Editor

PLANTS CONTINUE to expand use of active safety systems. Interlocks often figure as key components of these systems. For instance, specific events may trigger interlocks to automatically close or open valves. Figure 1 shows a partial view of an overhead system in which a proposed high-level interlock (HLI) on a drum would trip a valve. The question is "where should the valve be?"

Interlocks exist to prevent some consequence. Here, the plant wants to ensure that liquid doesn't fully fill the drum because that would flood the pressure control point. The final consequence of a full drum is liquid running down the purge line to the plant vent gas system. In this case, liquid in the vent system may create safety problems.

The proposed HLI shuts a valve on the line from the overhead condenser to the drum, stopping liquid flow into the drum. The valve closing leads to liquid starting to build up in the condenser. More liquid in the condenser reduces condensation capacity. The decreased capacity causes system pressure to increase. The dual-range controller then shuts the exchanger bypass valve. At this point, the tower system starts to pressure up.

The overhead condenser is heat integrated with another system. So, the reduced cooling duty affects that system, too. Fortunately, the connected system can get heat from another source. It will suffer a small upset, but the consequences are manageable.

An alternative location for the isolation valve is directly on the vapor vent line. When the liquid level

OVERHEAD SYSTEM

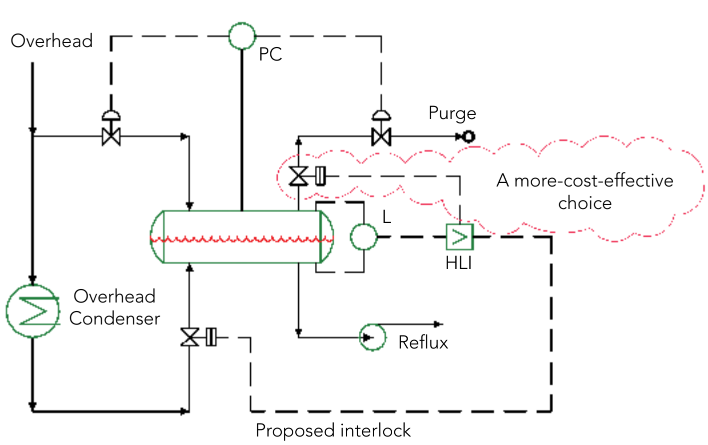

Figure 1. The proposed high level interlock will work, but so will a lower cost alternative.

gets too near the height of the outlet nozzle, the HLI closes the vapor purge line. Noncondensable gases then start to accumulate in the drum, displacing liquid. That liquid, plus vapor still being sent to the overhead condenser, causes a rise in its liquid level. This reduces the surface area for condensation, decreasing ability to condense the tower overhead. Tower pressure rises.

Both locations lead to very similar direct consequences. So, other factors should drive the decision about where to install the valve. Two major questions are how easy are the valves to access and how much do they cost?

The isolation valve on the exchanger outlet would be located very close to the ground. Installation and access would be easy. However, the valve installation might force the exchanger up and increase pressure drop in the overhead system. While not insurmountable, elevation changes required to make the system hydraulics work would increase costs.

The isolation valve on the drum outlet would be located above the drum. An access platform already exists to service the pressure control valves. So, installing the isolation valve would involve only a modest expense.

The exchanger outlet would require a 6-inch valve. In comparison, the drum outlet would call for a 2-inch valve. In alloy 2205, this translates into a significant cost difference.

Overall, the best choice is to put the isolation valve on the vapor outlet line. While both options pose essentially the same process consequences, the vapor line valve offers lower installation costs and the valve itself is cheaper. ●

ANDREW SLOLEY, Contributing Editor
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THE BT-KUB can be used under almost any gas, vapor or liquid media conditions due to its standard operating ratio of 98%, the tightest operating ratio in the rupture disc industry.

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Pick the Proper Centrifugal Pump

Consider the impact of startup conditions and prospective operating points

CENTRIFUGAL PUMPS impart velocity to a fluid and then recover the velocity as pressure head. Performance curves depict the total dynamic head generated at a given flow rate for a specific impeller and rotational speed (Figure 1). They typically show total dynamic head in feet, not psi, unless the curves are for a defined liquid.

You can convert pressure rise from feet to psi via:

$$\Delta P = \rho \Delta H/144 \quad (1)$$

where ΔP is pressure rise in psi, ρ is density in lb/ft^3, and ΔH is dynamic head in feet.

Pump work applied to the fluid is:

$$W = Q\Delta P/1{,}714\eta \quad (2)$$

where W is work in hp, Q is flow in gpm, and η is pump efficiency, as a fraction of one.

Both ΔP and W vary with liquid density. So, you must know the density to convert from a dynamic pump performance curve to the physical pressure rise or power required.

Pump efficiency varies with flow rate. In addition, the efficiencies of the drive system (belts, gears, couplings, etc.) and driver come into play. For an electrically driven pump, the driver efficiency is the motor efficiency. This can vary as a function of total load. Motor efficiencies drop at low loads.

Dynamic head in feet doesn't change as density changes. Imposed pressure in psi and power demand will vary as liquid density varies. For many processes and conditions, the density is well understood and known in advance.

However, densities can vary dramatically in some common situations. For instance, at startup many units are cold, so densities are higher, increasing power demands. Let's look at a situation where startup density differences created motor problems.

Figure 2 shows the bottoms of a high temperature distillation tower. The startup procedure required circulating cold tower bottoms to the fired heater reboiler. Limits on both the pump (suction specific speed) and the fired heater (minimum safe firing with air control) restricted flow rate to 1,500 gpm for starting conditions. The design operation was 2,250 gpm. Obviously, the pump can handle the lower flow rate.

However, startup usually was a hit-or-miss affair because the pump motor's thermal protection system was near its trip point, a power draw equivalent to 300 hp. Table 1 illustrates the normal and startup conditions; efficiency takes into account the pump,

Pump Curve

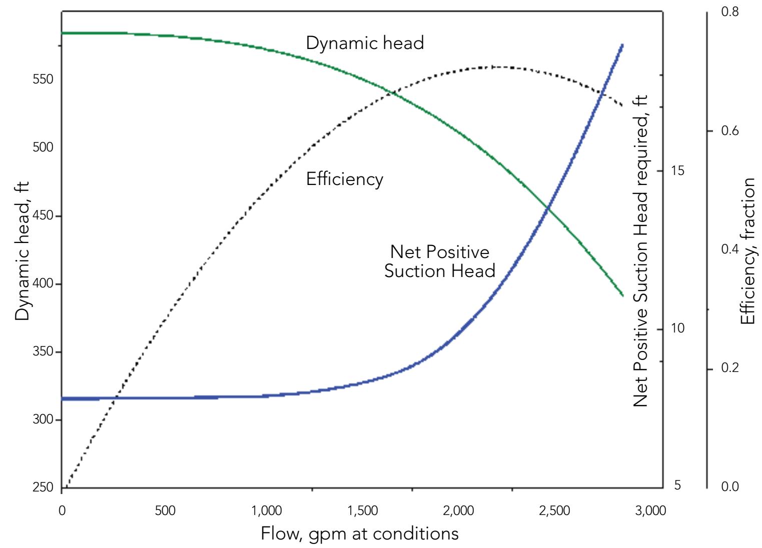

Figure 1. Dynamic head in feet doesn't directly give pump power required.

Startup Versus Normal Operation

Condition	Flow, gpm	Head, ft	Head, psi	Density, lb/ft^3	Overall Efficiency, fraction	Power, hp
Startup	1,500	550	191	50.0	0.57	294
Normal	2,250	460	111	34.9	0.67	218

Table 1. Startup requires power draw close to thermal protection trip point.

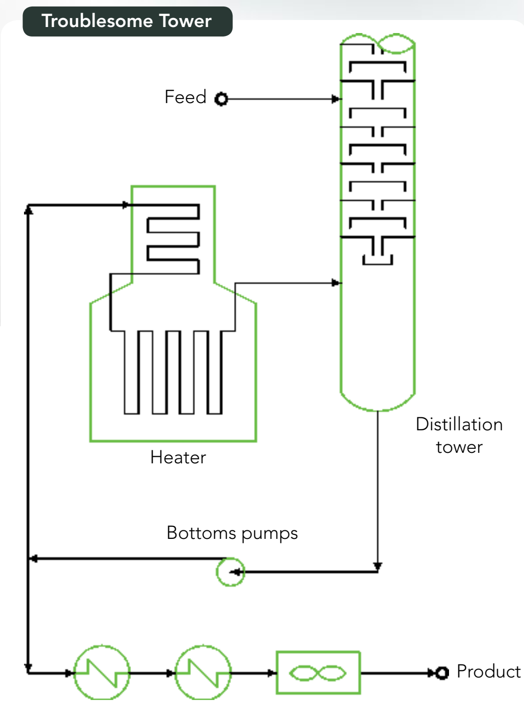

Figure 2. Circulation of cold viscous bottoms at startup posed motor cutoff risk.

driver and coupling, as well as an allowance for efficiency changes due to high viscosity at the startup condition. Designers should have factored in the need for some extra startup power.

Good practice requires thinking about different operating points. Consider, for instance, startup at cold conditions, higher viscosity operation, pumping heavier fluids, and installing larger diameter impellers in the future.

Many companies, as standard practice, buy pumps with some room to increase impeller size later to boost capacity. Greater throughput plus higher discharge head from a larger impeller rapidly raises the pump power required. Prudent engineering practice is to select a motor sized for the maximum impeller that fits in the casing.

In the end, economics sets the best motor sizing choice. Higher investment now for a larger motor saves money in both the motor, electrical systems and, perhaps, foundation later. It also enhances pump reliability. Power consumption costs really don't change a lot with larger motors.

Of course, this logic only goes so far. Multiple margins for cold startup conditions with larger impellers may lead to drastic oversizing. Motors that run at small fractions of their design load have lower efficiency.

Use engineering judgment to choose the right motor size. Large motors with significant capital costs may require a true lifecycle analysis of total system cost.

ANDREW SLOLEY, Contributing Editor
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Choose a Storage Tank

Five important factors can help determine the right tank for your needs

By CST Storage

IN THE market for a new storage tank? As you search for the most economical tank that will provide you with long-term satisfaction, consider some important factors:

1. Construction materials: While accommodating large volumes, concrete is porous, so consider its freeze-thaw cycles, which expose cracks and allow corrosion. Field-welded steel tanks accommodate large volumes, but require weld inspections on site, resulting in longer construction cycles. Bolted steel tanks are constructed of individual panels coated at the factory prior to shipping, enabling them to be constructed onsite quickly and efficiently.

2. Coatings: All materials are abrasive and aggressive toward tank walls. The tank's only protection lies in the quality of its coating. Field-welded tanks require field-applied coatings, which are subject to inconsistent cures due to weather, environment and missed spots. Coatings applied at the factory, such as those for bolted steel tanks, yield a highly monitored consistent application process and abrasion resistant cure.

3. Design: Tanks may be tall and slender (standpipes) or short and wide. Individual application, available space and environmental conditions such as high winds or strong seismic activity will determine the best design for your application.

4. Expansion and Moving: Need to accommodate a growing business? Concrete and field-welded tanks are not moveable or expandable. Because of their individual panel design, bolted tanks are able to do both, and at a more economical cost than purchasing new tanks.

5. Choose a Manufacturer: Request job histories and client references to ensure your manufacturer has significant experience in your specific application. Conduct a total life cycle cost analysis of your options to uncover the best ROI for your tank options once maintenance, repainting and out of service costs are considered.

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CST STORAGE, Lenexa, Kan., provides modular, factory-coated bolted storage tanks for dry bulk and liquid applications in municipal, industrial and agricultural markets.

Measure Flow with Variable Area Meters

Consider a variety of factors when selecting this versatile device

By Jim Dillon, Global VA Product Manager, Brooks Instrument

MANY CHEMICAL processes require reliable, accurate and repeatable gas and liquid flow measurement and control. Variable area (VA) meters are extremely versatile in this arena. They are ideal for monitoring process flow, instrument impulse flow lines, purge gas flows, flows of flushing or cooling media, make-up flows, and reactor gas and liquid feeds.

VA meters are an inexpensive flow-metering device for a variety of chemical processing applications. VA meters with indicator only are still the norm; however, more VA meters are being specified with options such as flow alarms and analog output transmitters. This is happening for a couple of reasons. Monitoring a process remotely provides better control because the entire flow line can be monitored. Using a VA meter with an analog output transmitter allows one person to monitor several process lines remotely.

Another technique for monitoring a flow line is a VA meter with a flow switch. The switch can be set to trigger at a given flow rate. When the flow rate reaches the set point, a signal could cause a valve to close or open. A pump could be turned on or off or a simple light or some other signal could be activated.

The other major trend in VA meters is the transition from glass tube rotameters to metal tube rotameters. Metal tube meters are more durable and require less maintenance. Plus, if a glass tube breaks, not only is there the expense of the glass tube, there is downtime and maintenance technician time to consider, too.

SPECIFYING A VA METER

Unlike other flow meters, VA meters will respond like a canary in a coal mine when air quality changes. If process conditions change, they usually impact flow rate. For example, if the back pressure changes on gas flows, the flow rate will change. For this reason, it's necessary for engineers to take the following factors into consideration when specifying a VA meter:

Normal and maximum operating temperature and pressure: When the measured fluid is a gas or some liquids such as water or oils, it's necessary to know the operating temperature because of the impact to fluid conditions (density and viscosity). The maximum temperature is necessary because the operating temperature usually is much lower than the maximum temperature. An example of this is when an engineer selects a plastic meter based on the operating temperature but then realizes the maximum temperature far exceeds the capability of the meter. Process lines have design temperature and pressure values that often are significantly different than the operating conditions of the rotameter.

Flow rate: Know an application's required flow rate when specifying a VA meter; this is more complicated than it seems. The goal is to select a VA meter where the normal operating flow is within 60% to 80% of the meter's range, because a VA meter is more accurate in the upper part of its range. Additionally, the meter must also handle the minimum and maximum flows.

The other important component of flow rate is unit. If the unit is too small for the meter selected, the flow number can be miniscule (i.e., many zeros to the right of the decimal point) or too large. An example is liters per day for a 4-in. meter. The

Figure 1. Variable area meters can be used to test a variety of flow components and fluid handling equipment.


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maximum flow rate of the meter would be almost 2.4 million liters per day, which isn't practical on a VA meter scale. This occurs with very low flow as well. An example would be 0.0006 cubic feet per second. In both cases, it is necessary to consider a more appropriate unit.

Reference conditions and flow type: These flow rate components only apply to gases. They are used to correct the flow rate to a standard. However, it's unusual for engineers to be interested in actual volumetric gas flows. The reference condition can be variable, but end users usually know what they need prior to choosing a VA meter.

The two key reference conditions are "standard" in the United States and "normal," which is common in the rest of the world. The U.S. standard reference condition is 70° F and 1 atmosphere; the normal reference condition is 0° C and 1 atmosphere.

Fluid density and viscosity: Physical characteristics of gases and liquids such as density, viscosity, opacity or corrosiveness must also be considered. If end users are working with basic fluids such as air, nitrogen or water, it's easier to determine flow-metering needs because science has already defined how those fluids behave.

Fluid density and viscosity are important because these two values allow engineers to select the right meter size. This is called sizing. Performance data is usually collected on different VA meters so that manufacturers know which ones will fit the supplied process conditions (density and viscosity). Usually, there are many VA meters that can be used for a process, so it comes down to the end user's preferences such as options, pricing and accuracy.

Accuracy: While there are other measurement technologies that are more accurate than VA meters, they are still widely used. They are available in all shapes, sizes and materials, and they offer several positive attributes, including easy installation, no power requirement and high repeatability.

VA meter accuracy is computed using full-scale accuracy method rather than the accuracy of the reading. VA meters are much more accurate in the upper end of a flow range, but more VA meters are used for repeatability of flow measurement. This means, given the same process conditions, the float will repeat and be at the same scale reading.

Global certifications: Flow meter project approvals and certifications can be very complex with today's shrinking planet. Previously, approvals were based on the end user's location, but now they are based on the destination country. For example, let's say a project starts with a customer in the U.S., is engineered in Singapore, purchased in Europe and delivered to China. NEPSI approvals are needed for the flow meter because the flow meter will be installed in China.

Other international approvals include:

- ATEX — Europe
- CCOE — India
- KOSHA — Korea
- GOST — Russia
- UL, CSA — North America
- IECEx — Worldwide

Today, simply meeting the process specifications for a flow meter — or any instrumentation —for the country of origin is not good enough. International approvals are often required.

APPLICATIONS FOR VA METERS

VA meters can be specified for a variety of chemical processing applications including:

- Chemical injection and dosing: Controlling the flow rate of the fluid to be added to the primary fluid.
- Boiler control: Measuring steam flow to a boiler or measuring the gases that heat the boiler.
- Coolant measurement: Measuring the coolant for a pump, process or any process where coolant supply is critical to prevent the device or machinery from overheating.
- Purge applications: Controlling the purge gas

or liquid to keep process lines clear in order to create a positive pressure; to be the shielding gas in a contained welding application; or to create a positive pressure where electrical components are installed in areas where hazardous gases could explode if they entered the electrical compartment.

- Tank blanketing: Where inert gas is the blanket over the liquid in a tank, which prevents the liquid from giving off vapors that could ignite and then explode.

VA METER USAGE IN FLOW MEASUREMENT

Device testing and metrology

VA meters can be used to test:

- Components and assemblies such as valves, radiators, plumbing fixtures, and hydraulic and pneumatic assemblies designed not to leak during use, and can be tested quickly and reliably.
- Components designed to deliver a certain flow rate at a given set of pressure conditions (orifices and nozzles), to have a certain pressure drop at a given flow rate (filters), or to have a minimum power output at a given fuel consumption (engines).
- Fluid handling equipment including pumps, injectors, dispense heads and even other flow meters.

By applying pressure or vacuum to the device under testing conditions, a VA meter can confirm the absence of flow. If testing for valve leakage, install the rotameter downstream of the valve. Pressure is applied to the valve. If the valve leaks the rotameter will show a flow rate.

Process Analyzers

Process analyzers are designed to accurately and continuously measure a target analyzer in a process stream. Sampling is the single most critical issue for process analysis. When the sampling system becomes plugged, it can cause big problems and costly, unscheduled maintenance.

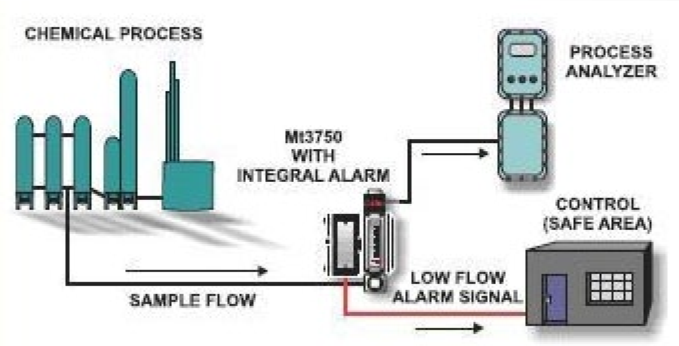

Figure 2. The variable area flow meter — with 4- to 20-mA output — continuously monitors sample flow to the process analyzer.

The variable area flow meter — with 4- to 20-mA output — continuously monitors sample flow to the analyzer, unlike a flow alarm or flow switch (Figure 2). When flow starts to drop, indicating the onset of plugging, users can schedule maintenance to clear the problem before the analyzer is starved of the sample. Rotameters without 4- to 20-mA output are often used for sample flow in analyzer applications.

VA meters are inexpensive flow-metering devices for a variety of chemical processing applications, providing reliable, accurate and repeatable gas and liquid flow measurement and control. Selecting the best product for an application requires consideration of: normal and maximum operating temperature and pressure, flow rate, reference conditions and volumetric flow type (for gasses), fluid density and viscosity, accuracy and global certifications.

JIM DILLON is the global product manager for variable area products (rotameters) at Brooks Instrument. He can be reached at Jim.Dillon@BrooksInstrument.com

Detect Leaks with Coriolis Flow Meters

A straight-tube design provides several advantages for a varnish production application

By Christoph Engelbert, BASF Coatings AG and Reiner Scheulen, KROHNE Messtechnik GmbH & Co.

MIXING, DOSING and grinding are essential processes in paint and varnish production. In order to ensure a high level of automation, it's essential to be able to measure flows accurately and reliably. As some of the raw materials used in the manufacturing process are very expensive, product wastage and equipment downtime can lead to considerable losses. This is doubly annoying — after all, the measuring technology currently available on the market can effectively prevent or at least help prevent such losses. This is illustrated in the example of BASF Coatings AG, who use KROHNE's Coriolis flowmeters to detect leakages.

THE CORIOLIS MEASURING PRINCIPLE

Coriolis flowmeters can be used to calculate the mass flow rate from the deformation of the measuring tube caused by the inertia. The media density can also be derived from the resonance frequency of the vibrating tube. The sensor in the OPTIMASS comprises a straight measuring tube, which can vibrate by a field coil attached to the center of the tube. The excitation is controlled in such a way that the measuring tube always vibrates in its resonance frequency. Two sensor coils, each of which is fitted equidistant from the field coil on each side, record the Coriolis effect. If there's no flow, both sensors record the same sinusoidal signal coming from the natural vibration of the measuring tube. As soon as a flow begins, the Coriolis force acts on the flowing mass particles of the medium and deforms the measuring tube, thus causing a phase shift between the sensor signals. The sensors measure the phase shift of the sinusoidal vibrations. This phase shift is directly proportional to the mass flow.

As the Coriolis principle allows an exact measurement of fluid and gaseous media, mass flowmeters are becoming increasingly popular. Coriolis measuring technology is already the second-most-common modern measuring method behind electromagnetic flowmeters and, together with ultrasonic flow measuring technology, boasts the fastest growth rates.

OPTIMASS IN VARNISH GRINDING

BASF Coatings AG uses KROHNE's OPTIMASS mass flowmeters in the color pigment grinding process. However, in the past, mobile paddle mixers with a volume of 12m3 were guided and connected to the mill using a hose. The mobile mixer supplies the components before the medium goes into the mill and out again. This usually happens several times to ensure that each pigment particle is pumped through the mill at least once. Due to the time it takes to complete this process, (between 36 and 48 hours in some cases) the system operates nights and weekends. BASF wanted a solution that allowed unsupervised operation of the mill by connecting a hose; however, this increases the risk of potential leakages. As the whole process takes the form of a circuit, integrating a flowmeter into the outlet could trigger a leak alarm in the event of a sudden deviation from the regular flow and automatically shut the system down. Although this type of leakage rate measurement only requires one meter, the meter must fulfill high specifications in terms of its accuracy. In addition, the properties of the media made things even more difficult.

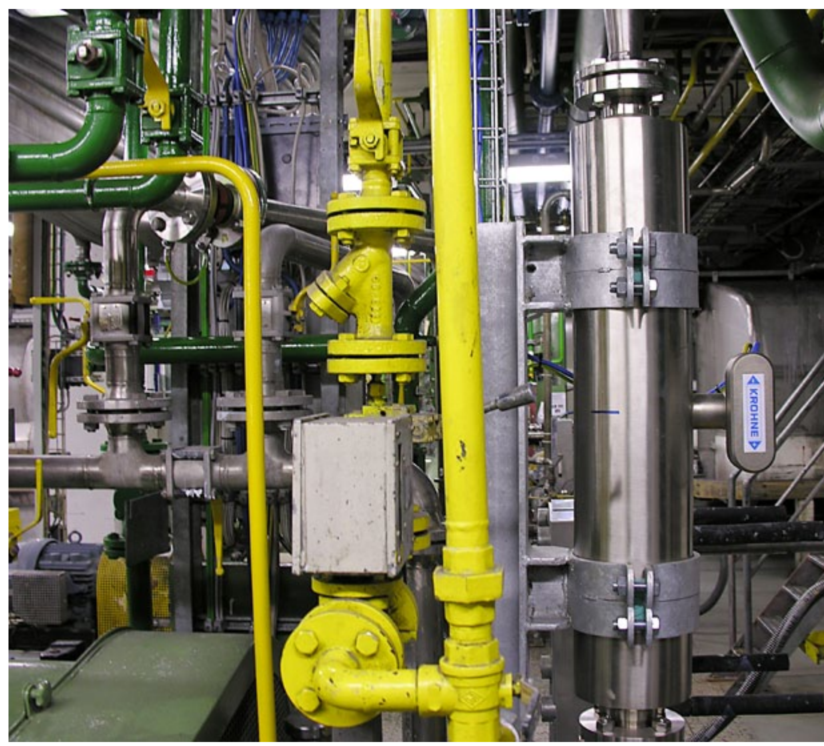

Figure 1. The OPTIMASS mass flowmeter features a straight-tube design for applications with high-viscosity media and high pigment contents.

The raw materials for varnishes are, for the most part, high-viscosity media which are processed at a low flow rate. The media have viscosities of 7,000mPas and over, and are generally also shear thinning. In other words, their behavior changes with the flow rate. In addition to the high viscosity, DN 40 flowmeters also have to cope with high pigment contents. Moreover, BASF Coatings didn't want to risk any further pressure loss by installing the flowmeter, otherwise they would have

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to increase the performance of the pump. BASF Coatings thus opted for the OPTIMASS, a mass flowmeter with a straight-tube design made for this type of application (Figure 1).

THE STRAIGHT-TUBE DESIGN

KROHNE has always relied on the straight-tube design because it offers obvious advantages compared to mass flowmeters with curved or twin tubes. A range of media, such as viscous, non-Newtonian, shear-sensitive fluids and fluids containing solids cause high pressure losses in twin tube meters. Abrasive media can corrode flow splitters and bent tubes, whereas process liquids containing fibers, such as palm oil or cellulose can accumulate in the flow splitter and cause blockages. The main advantages of straight-tube meters include:

- Less pressure loss
- Less abrasion
- Suitable even for large flow volumes
- Wide measuring range
- No risk of blockage

Straight-tube meters are also easy to clean, self draining and suitable for measuring high-viscosity media such as those processed at BASF Coatings because of their ideal proportions, i.e. a short measuring tube with a large inner diameter.

MEASURING LEAKAGE RATES

The varnish grinding system at BASF Coatings is designed for a flow rate of approximately 5,000kg/h (Figure 2). This system grinds pasty

Figure 2. The varnish grinding system at BASF Coatings is designed for a flow rate of approximately 5,000kg/h.

preliminary products which are subsequently let down and processed to become finished products. Communication with the programmable logic controller (PLC) takes place via the OPTIMASS's 4–20mA signal output. Every 90 seconds the PLC saves a flow measurement and compares it with the subsequent values. If there's a difference of 360kg/h, the system is automatically shut down (Figure 3).

When testing the measurement, the lowest detectable leak flow using the flow output signal was calculated to be 36 kg/h. Because the flow fluctuated during operation when a heat exchanger was connected, the leakage value was raised to prevent false alarms. At present, further tests are underway to halve the leakage value. These involve analyzing the flow fluctuations in various operating modes. If you take the measuring accuracy for a flow of this magnitude, the smallest leakage calculated corresponds to the measuring accuracy of the OPTIMASS. Engineers at BASF Coatings took a sample in test mode, after which the process was immediately halted. Because the company so satisfied with the pilot project using the KROHNE OPTIMASS, BASF Coatings plans to use other appliances of this type in the grinding process.

BASF COATINGS AG is part of the international coatings division of the BASF Group. The division develops, produces and markets a range of vehicle, car repair and industrial varnishes and coating materials for buildings and offers the corresponding coating processes. KROHNE develops and produces innovative and reliable process measuring technology and offers solutions for all industries throughout the world. For more information on this case study, email info@krohne.com.

Figure 3. A programmable logic controller saves the flow measurement and compares it with the subsequent values. If there's a difference of 360kg/h, the system is automatically shut down.