Flowmeter selection: Right size, right design

How many process plants suffer with poorly sized and poorly selected flowmeters? Why does this seemingly simple selection task get so complicated?

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At a recent industry event, an expert suggested that 70% of installed flowmeters are either the wrong technology or the wrong size (generally too large) for the application. The specific statistic is debatable, but most who travel in process industries agree with the general implication. Unfortunately, the reasons for this are often symptomatic of larger industry related issues.

While selections of a physically incompatible technology (For example, using a magnetic flowmeter for a non-conductive liquid.) are generally very rare, less than optimal choices are more common, and oversized devices turn up in to some extent in virtually any plant environment. Ultimately, selection problems emerge more from misunderstandings related to the process than misunderstandings of flowmeter technologies.

Process ignorance

"Fitting the technology ultimately comes down to the question,‘why do you want to measure this?'" says Peter Kucmas, product manager for flow at Endress+Hauser . Unfortunately he finds that many customers have a hard time answering even that most basic question. The solution has to be a process of probing for knowledge with the user. He advises, "Get the detail for the application: What is the flowmeter for? What is it doing? It's easy to write the range on a spec sheet, but what are the process dynamics and are they important? We, as instrumentation manufacturers, have to deal with people that aren't necessarily intimate with the process. So the knowledge of why that process measurement is needed gets watered down."

Melissa Schumann, instrumentation product specialist for Turck , finds that customers' assumptions and expectations can overwhelm accurate process knowledge. "Flow is a difficult thing for people to understand, and it's not an easy thing to sell," she says. "People don't know what they need in a given situation. We sell a lot of flow/no-flow switches, and a lot of times customers ask for the top-of-the-line with all the bells and whistles for something like a cooling water line, and all they need to know is if the coolant is flowing. People think a flowmeter should be expensive and they expect all these features, but they don't need all those things if all they want to know is if they have flow in a line or not."

Inadequate process knowledge can create quite a variety of problems. Appropriate ranging is the most obvious, but there are more subtle issues, including:
• Fluid dynamics-pressure fluctuations, temperature, etc.;
• Liquid characteristics-viscosity, density, conductivity, etc.;
• Process variability-how minimum/maximum flows routinely differ; and
• Accuracy requirement-how critical is the measurement to the process.
Answering these accurately can have a profound effect on choosing the most appropriate and cost-effective sensor technology.

On the other hand, Mike Bess, test engineering and calibration lab manager for FCI , has found some customers that run continuous processes simply get used to what they see, rather than the specifics of what the data means. He says, "Some users just want to be able to say,‘whenever I see my meter

reading this, I know my process is working right.' For a lot of people, that's fine. This makes repeatability more important than accuracy."

Sizing habits

Over-sizing is a problem because all flow sensing technologies have a threshold below which they cease to perform accurately or perform at all. The limits of this turndown ratio vary widely, but the closer you operate to the threshold, the poorer the overall performance.

"Usually over-sizing is the result of matching the line size rather than the flow," says Wade Mattar, flow product manager at IPS Foxboro . "Or they size for a higher anticipated volume that they may not get to for years, if at all. In the meantime, they have a flowmeter that isn't right for now."

Mike Dyer, applications engineer for McCrometer , concurs with that observation. He adds, "The most common misunderstanding is that customers think,'if I overstate my required flow, that's good.' They give you a flow value of 10,000 lbs. per hour. But in reality they don't know, and they're really operating at below 1,000 lbs. per hour. They figure that if it can handle 10,000, it can handle anything below that. But it doesn't go from 0 to 10,000. No meter has an infinite turndown."

Buying rituals

Often what process knowledge there is doesn't make it through the purchasing department during the bidding. Chris Cotellese, senior application engineer for Siemens , has seen that system work many times: "In most cases there's a specification that's written by an engineer for a project, and somebody starts developing the details. Depending on that design engineer's expertise and experience, he or she tries to write the spec so it doesn't point at one particular vendor. But in trying to make it generic, a lot of good information gets taken out and it's not specific enough to help us select the right instrument."

Sometimes more can be accomplished when there is a closer relationship between customer and vendor, but given the changing personnel situation at most companies, such relationships are harder to develop. John Lusby, field solutions product sales specialist for Honeywell Process Solutions thinks back to a simpler time. "I spent the early part of my career with Fluor Corporation," he says. "The Fisher rep would sit next to me and we'd size valves together. I'd use his tools, input, and suggestions, and I think I did a pretty good job. There's less of that being done now, and fewer people to do it. I think we've lost an entire generation of instrumentation engineers who can do this type of sizing and selection work."

Installation problems

Manufacturers are normally very specific about how to mount and position flowmeters for best performance. And yet customers seem willing to ignore clear instructions on matters like straight pipe runs. Mike Dyer, applications engineer for McCrometer, says you ignore those instructions at your peril. "If the manufacturer says it needs 10 diameters of straight pipe, you need to give it 10 diameters. But some will put it in with three diameters, and then they say it isn't accurate and they don't know what to do after that."

While different technologies have their own specific mounting requirements, there are practices with piping for liquids that should be avoided universally:
- Installing flowmeters with downward flow;
- Placing devices where trapped air keeps the pipe from filling;
- Placing devices where sediment and debris accumulates; and
- Allowing uneven filling or clogging of impulse lines to DP (differential pressure) sensors.

Not keeping current

While basic flowmeter technology doesn't change all that much, the capabilities of the electronics that interface with the sensor have evolved quite a bit over the last 10 or 20 years. The result is instrumentation that is more stable, has wider turndown range, and higher accuracy. In many respects, these improvements have made choosing technology more foolproof in that the devices can better correct for some poor choices.

Tom Johnson, vortex and magnetic flowmeter marketing manager for Rosemount, says that some selection guidelines have been around quite a while. "When people are sizing flowmeters in general,

they tend to use some legacy information and not the most up-to-date data for making decisions," he notes. "You might end up with the wrong size meter because you haven't looked at the latest innovations."

Joel Lemke, DP flowmeter marketing manager for Rosemount, adds, "People use a lot of old rules of thumb for selecting meters. On the manufacturing side, we are trying to make them better every day, and they are a lot better than they used to be. Some of the accuracy improvements we've made make our products more usable and they cover more range, addressing some of the sizing problems more commonly encountered."

There are legacy guidelines that cause users to apply less-than-optimal technologies or create process restrictions that don't need to be there. Lusby cites a specific example that he's seen: "The most common flowmeter technology is an orifice plate and a DP transmitter. Most orifice plates are designed to produce about 100 in. of water pressure differential. The reason this is so is that years ago you couldn't get a good transmitter that could go much below that. The technology didn't exist, but it does now. Have we changed that guide? No. It's still 100 in. of water. With a current smart transmitter, a 0-400 in. of water transmitter is good even if you use it at 1 in. That was unheard of 30 years ago."

Countering brain drain

One of the biggest problems industry-wide is the loss of qualified instrumentation engineers. Few companies have enough people with adequate knowledge and time to do these tasks as they should be done. Endress+Hauser's Kucmas observes, "As companies move more of their workload out, you no longer have the people with process-specific know-how, so they rely on engineering firms to do the work for them. Those firms can do a good job, but to any specific plant, they're still generalists."

So who's left to do the work? Mattar adds, "Users don't have groups of instrument experts any more. With downsizing, they have to depend on manufacturers. It has become more of an act of faith for the users because the primary expertise is with the vendors now. We do our best not to let them down."

Ultimately, nothing can substitute for an intimate knowledge of a process and its specific needs when it comes to selecting any type of instrumentation. When those people are lost or in such few numbers that they're spread too thin to be effective, poor choices are made that compound problems. The old saying that there's never time to do it right, but there's always time to do it over becomes the operating philosophy for too many companies.

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“Flowmeter Selection: Right Size, Right Design,” also available at
http://www.controleng.com/search/search-single-display/flowmeter-selection-right-size-right-design/a0a656a39f.html

and at: http://e-ditionsbyfry.com/Olive/ODE/CTL/Default.aspx?href=CTL/2009/09/01