APPLICATION GUIDE

How **DUE SOUTH** had a Director of Bulk Operations replacing technology

Whether it's measuring nitrogen at a bulk distribution system, or to measure nitrogen blanketing at the tank farm, the thermal mass flow meter provides cost-efficient and accurate measurement solutions.

BULK NITROGEN DISTRIBUTION SYSTEM

The old saying, "Birds fly south for the winter" may have been coined by process and plant engineers tired of repairing or replacing flowmeters. Flowmeters are often the most under serviced pieces of equipment in process automation when it comes to maintenance and prevention best practices. Unfortunately, nothing runs efficiently without an accurate flowmeter and a process becomes inefficient when they don't operate properly or completely fail. Many times, the flowmeter manufacturer is seen as the problem, when in fact the process or the surrounding equipment configuration is the cause. Engineers and technicians looking to optimizing their process for productive operation can start with flowmeter installation, and protecting the flowmeters against common hazards. Flowmeter protection improves end product or batch quality, reduces material costs, eliminates waste and lowers maintenance costs. Taking good care of your flowmeter delivers a positive payback. Here are some simple strategies that can be employed—starting with an analysis of process media flow rates.

Protecting Your Process—24/7

Today's highly competitive global market finds demanding process industries such as industrial coatings (Figure 1), transforming their plants into 24/7 lean operations. The result is that the flowmeters in most plants are capturing flow data to keep up with material through-put objectives and demand. One of the most common hazards to efficient flow operation is irregular material flow, which can result in three negative conditions: (1) product waste, (2) increased maintenance, and (3) excessive operational costs.

How does this relate to the title of this article? The Director of Bulk Operations inherited an industrial coatings plant from his parent company. The initial on-site visit revealed two flowmeters were not displaying flow data or transmitting the critical Nitrogen consumption data through his supply chain network. While on-site, he called K&I and made me aware of the two issues. My response was, **"Are the meters facing south?"**

Monitoring for DUE SOUTH Installation

The first step in protecting your process and flowmeters starts with analyzing the current or proposed installation.

Figure 1. Today's demanding industry applications require highly efficient flowmeter operation.

You want to analyze the surrounding environment for the installation to optimize efficiency and longevity of your flowmeters. Straight run of pipe necessary for laminar flow (the bullet shape as I call it) creates optimum accuracy. However, environmental conditions also play a major factor in performance. "Birds fly south for the winter" for warmer weather and more sun. Instruments, especially with LCD's (Liquid Crystal Displays) don't fare well with long exposure to direct sunlight.

Installation of the LCD on an instrument facing DUE SOUTH is just asking for problems. Direct prolonged exposure to sunlight will damage LCD's, the PCB Boards they sit upon and may potentially damage the entire set of electronics. Direct sunlight will also damage rubber seals on meter housings, gaskets, and rubber grommets on conduit fittings which leads to potential water damage to electronics during inclement weather. If your flowmeters are located close to a continuous water source that is flaking snow onto instruments (as shown in Figure 5) you may be creating a path for damage. Our own body has skin that is sensitive to environmental changes and yes, even instruments, particularly flowmeters with LCD's can fry up when facing DUE SOUTH.

Figure 2. Fox Thermal adjustable sensor heads help eliminate display orientation issues, flow direction issues and installation requirements for sunshades, and other process equipment

The chief culprit when it comes to damaged LCD's is the build-up of heat from prolonged exposure to direct sunlight. When there isn't a sun-shade there to provide protection, the sunlight can destroy displays, seals, gaskets, etc. If repair is even possible, it is going to be a very expensive proposition due to repair costs and down time. When the Director of Bulk Operations called me, I shared with him, "from the SN# you gave me the existing meters are probably 10-15 years old. The problem came from the meters facing due south, it fried the displays and probably fried the electronics as well." There is newer technology that avoids this issue, and its field adjustable to adapt to the environment.

Eliminating Installation Errors

Flowmeters require a stable ambient environment to ensure efficient operation. Installation errors often result in poor performance as well as eventual failure, a condition quickly identified on critical consumption billing. Fox Thermal, one of the leading gas flowmeter manufacturers, offers an adjustable display head that eliminates orientation issues, flow-direction issues and the need for a sunshade or other process equipment.

In most cases, plant real estate limitations result in the placement of elbows, valves or other equipment that are too close to a flowmeter, and these devices can create footprint designs that leave no other alternative but to build a gas train that is facing DUE SOUTH. In addition

such designs can result in excess noise and turbulent flows, resulting in reduced accuracy, skyrocketing the costs of manufacturing.
A good solution to ensure an optimal flow profile for efficient operation is to install an inline flow conditioner upstream from your flowmeter. Isolating the effects of velocity profile distortions, turbulence, swirl and other flow anomalies in your pipeline will result in a repeatable, symmetric, and swirl-free velocity profile with minimal pressure loss. That may also allow for installation in a more desirable location to optimize display performance.

To increase a flowmeter's life, start with a more stable operating environment. A conditioned flow stream enters the flowmeter in a uniform and equally distributed pattern, optimizing flowmeter efficiency and extending its life while at the same time decreasing turbulence.

Figure 3. Fox Thermal Sunshades are available for the FT1, FT4A and FT4X models when less than desirable conditions exist due to weather, climates and installation.

Adjustable sensor displays (As shown in Figure 2), such as on the Fox Thermal FT1, FT4A and FT4X, have proved successful in these applications. Other display choices of flow technology include remoting the displays or using large enclosures to house several local process instrument displays. If there is no choice other than to deal with less than ideal piping configurations, a display sunshade (Figure 3) will eliminate direct and/or long exposure of displays to sunlight for flow meters and other critical process equipment.

Figure 4. The Model's FT1, FT4A and FT4X are available with inline flow bodies from ¾" to 6" line sizes with built-in flow conditioners. Approval for FM/FMc Class I, Div. 1

The Fox Thermal FT1, FT4A and FT4X in-line flow meters come standard with two flow profile conditioning plates (Shown in Figure 4) to produce rapid cross-stream mixing, forcing higher velocity regions to mix with lower velocity regions. The shape of the resultant velocity profile is "flat" and repeatable resulting in less pipe diameters needed (8-pipe diameters upstream and 4-pipe diameters downstream) from the meter spoolpiece regardless of the close-coupled upstream flow disturbances.

Incorporating several advanced designs, Fox Thermal offers the following features on their Model FT1, FT4A and FT4X gas meters.

- ***Gas-SelectX®*** - Gas selection menu allows for easy field configuration of pure and mixed gases that the user can choose from a menu of several common gases or gas mixtures for their application.
- ***CAL-V™ or Zero-Cal Check™*** – A quick and easy way to verify the calibration of the meter in the field, the test takes less than 5 minutes to run and produces a pass/fail result at the end of the test.
- ***2nd generation DDC-Sensor™*** – An all-digital design with robust ¾" probe *eliminates sensor* element vibration which can lead to metal fatigue and failure and provides a stable platform for accurate, repeatable measurement.

Figure 5. DDC-Sensor™ shown in closeup with weld mark detail on the bottom of the RTD window highlights non-cantilevered design.

Choosing A Flow Meter

When evaluating a flowmeter for Nitrogen measurement, or any application, the first step is choosing the appropriate flow technology. There are multiple flow sensing technologies available, and the major ones now include:

- Coriolis
- Differential Pressure
- Positive Displacement
- **Thermal Mass**
- Turbine
- Ultrasonic
- Vortex

Each of these technologies have their advantages/ disadvantages, depending on the media and your application's requirements. Some may be the only choice in certain media for your application. By looking at these factors, as well as your plant's layout, environmental conditions, maintenance schedules, energy cost and ROI, you will quickly be able to narrow the field to one or two best choices.

Conclusions

Don't fall into the trap of early flowmeter replacement or repair by ignoring best installation and maintenance flowmeter practices. Here are three preventive proactive steps to take to avoid early flowmeter replacement:

- When designing new plants or retrofitting old ones, be sure to consider flowmeter requirements. Optimizing your process with your flowmeter installation in mind offers a wide range of benefits: higher capacity, improved quality, lower energy costs, reduced maintenance, and increased flowmeter life.
- Consider inserting a flow conditioner to eliminate turbulent flow problems. One of the most common flowmeter problems is irregular flows caused by turbulence that frequently results when the minimum pipe straight runs required between the point of elbows, valves or other equipment are either ignored or pushed to the limits. Inserting a flow conditioner frequently eliminates turbulent flow problems.
- Another key safeguard is to protect your flowmeter from unnecessary operational and maintenance costs by choosing a technology with a no-moving parts design, which can lead to increased profitability and a leaner plant operation.