Technical Publication

Improved Gas Flow Monitoring in Heat Treating Processes Leads to Higher Efficiencies and Lower Costs

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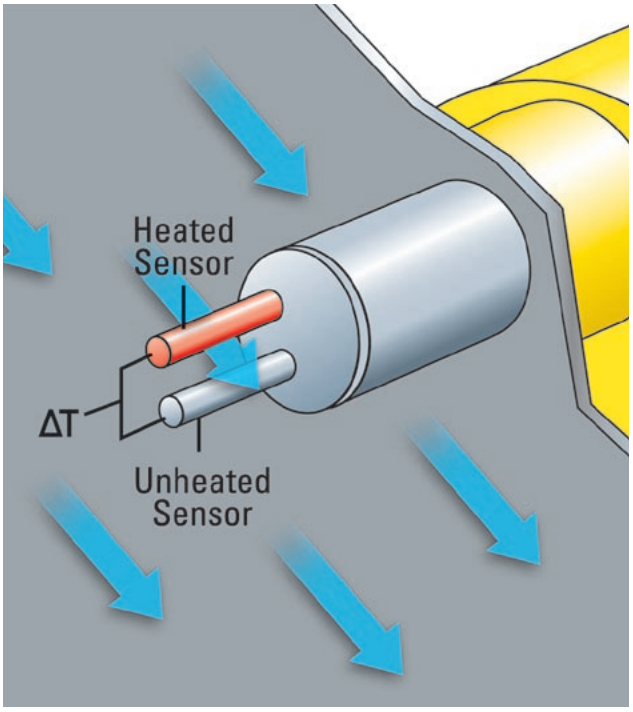
It can be difficult at times to accurately monitor the use of consumables in many heat treating processes. A lot of the existing technology falls short when it comes to being highly accurate, capable of measuring a broad flow range, suitable to various gases, and economical enough to be used throughout a facility. It seems that you must constantly make concessions when trying to meet your process quality and consumables cost objectives.

Fortunately, advancements in gas flow measurement allow you to achieve higher efficiencies, reduce costs and improve your overall process control. There are now flow measuring devices that are well suited to the various gases (air, natural gas, hydrogen, oxygen, nitrogen, etc.) used as fuel mixtures and to either blanket or quench materials being treated.

When searching for a solution, look for flow meter technology that is specifically developed to be extremely accurate in gas applications. A qualified manufacturer can provide you detailed information regarding how the mass flow meter performs in gas and air feed lines to furnaces, burners, industrial ovens, heat treating systems, boilers, and power co-generation equipment used in your industry. An appropriate mass flow meter will also provide highly repeatable readings that allow the user to maximize efficient gas usage, and result in minimizing emission output.

Products now exist that combine highly reliable, no-moving parts thermal mass flow sensing technology with built-in flow conditioning to achieve ±1% reading, ±0.5% full scale accuracy, in line sizes from 0.25 to 2.0 inches (6 to 51mm). Unlike differential pressure measuring devices, regular recalibration of a thermal instrument is not required to ensure accuracy over the service life of the meter. This functionality sets a new industry price-performance standard for mass flow measurement accuracy at an economical installed cost — with low maintenance and low lifecycle costs as well.

Regardless of the technology, accurate flow measurement requires sufficient upstream/downstream straight-runs to establish a fully developed and repeatable flow profile. In many heat treating applications, either space limitations or other devices, such as valves or elbows, make it near impossible to install a flow meter under ideal conditions. The result is swirl and flow velocity profile disturbances that invalidate the accuracy of the instrument. If your actual flow conditions result in uncertainties of 5% or higher, there is no benefit to purchasing a meter with a published ±0.5 accuracy. Thermal technology provides a solution to the limited-space problem through the use of built-in flow conditioning that eliminates disturbances while reducing the necessary pipe straight-run by up to 70%.



Thermal dispersion technology

Unfortunately, not all integral flow conditioners provide the same benefits. Some products (e.g. vanes, perforated plates, tube bundles, v-cones, etc.) do a fair job of either eliminating swirl or improving velocity profiles, but not both simultaneously. They also come at the additional cost of higher pressure drops across the instrument, resulting in increased energy requirements. There is one design that features an engineered array of tabs that provides rapid cross-stream mixing to remove swirl and velocity problems, creating a smooth, fully developed flow profile for accurate measurement. Compared to the other types of commercially available flow conditioners, the pressure loss associated with this unique technology is significantly decreased, reducing plant energy costs by optimizing throughput.

Thermal mass flow meters with integral flow conditioning, such as FCI's ST75V, provide the capability to measures process gas or air flows from 0.01 SCFM (0.01 NCMH) to 559 SCFM (950 NCMH). This technology also allows for flow rate turndown ratios as high as 100:1 with a single instrument as opposed to other technologies that require multiple instruments in

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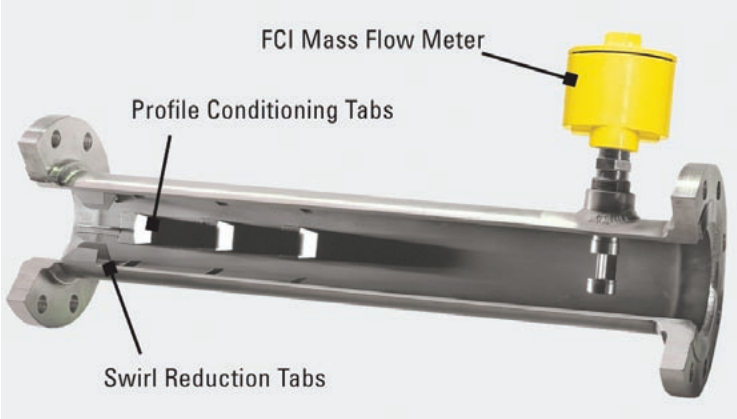

Flow conditioners can improve flow measurement accuracy

parallel to achieve these capabilities (eg differential pressure transmitters, turbine, etc.). This makes it an extremely suitable instrument when applications require both low and high flow measuring capabilities. In addition, superior installed accuracy is achieved by selecting a manufacturer with a highly capable NIST certified calibration laboratory. Select companies can calibrate flow meters to your specific process conditions and media, which will benefit the end user by eliminating uncertainties associated with the practice of using an air equivalency.

Making a well informed decision regarding which mass flow meter technology is best suited to your application can be challenging, but when you partner with an experienced manufacturer that fully understands your process requirements you can better achieve your objectives. Accurate and repeatable flow readings can help you ensure that you are making the most of your consumable gases by improving your process controls. The elimination of flow uncertainties associated with actual versus ideal conditions can also result in significant savings over the course of a year. To better accomplish this, thermal mass flow meters with integral flow conditioning should be given strong consideration when you are looking to improve upon your existing gas flow monitoring systems. ■