Application sheet

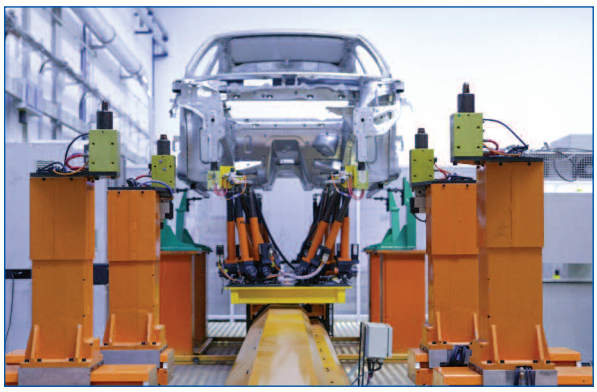
Thermal mass metering in a car manufacturing plant

Energy consumption is a hot topic for British businesses facing rapidly rising energy costs. Changes in compressed air consumption can have a big impact on energy saving campaigns as compressed air is the most expensive utility available. Through good housekeeping and the application of the latest technology, energy savings of up to 30% could often be found on many UK sites.

The Application

A major UK car manufacturer recently decided to look into reducing compressed air consumption and discovered that its existing instrumentation wasn't up to the job.

The site uses up to 20,000 standard cubic feet per minute of compressed air around the site for various uses including instrumentation, robotic equipment and manual tools. The biggest consumers of compressed air on the site are presses, which use high-pressure air to produce the bodywork for the cars. Each consumer takes its supply from a ring main which is fed by two compressor houses, one at the north end of the factory and the other at the south end.



The Problem

Monitoring compressed air usage was a huge problem for the site. The existing metering system struggled to cope with the unusual set up of the site's compressed air distribution system.

The trouble with the old set up was that it could only provide accurate measurements if the air flowed in one direction, while the dual compressor houses meant that the air in the main might be flowing in either direction at any given time and could swap direction without warning. According to the firm that runs the company's utilities, this meant that its old meters were giving readings that could be wrong by up to 50%.

The Solution

Eight ABB Sensyflow iG thermal mass flowmeters complete with paddle switches were installed on site. The Sensyflow iG is part of the Sensyflow family of flow meters, specifically designed for use in compressed air systems. As the meter is for use with compressed air, the response time is quicker than a standard flowmeter at less than 0.5 seconds. The paddle switches provide instant indication of the direction of flow. Although the ABB meters are primarily designed for unidirectional flow, ABB's expertise in installation and calibration is enabling the meters to perform accurately, even in this difficult situation.

As well as helping the car manufacturer pinpoint any operations that are using more compressed air than they need to, the new monitoring system also helps the company detect leaks.

Technical data

Current estimates suggest that the leak from a single five-millimetre hole in an airline costs around £1,400 per year, yet manual surveys miss an estimated 10% of compressed air leaks at any one time. Worse still, a survey of typical industrial sites found that compressed air leakage accounted for a shocking 39% of demand on average. Thermal mass meters can detect tiny leaks in comparison with manual surveys. They also operate continuously, so they can spot a problem as it develops.

Leak detection is typically carried out at night, while the air main is pressurised but the legitimate users are off-duty. Accurate leak detection demands a meter that can measure very low flows, which is another reason to opt for thermal mass flowmeters. Thermal mass units have a turndown ratio of 150:1, compared to between 30 or 40:1 for vortex meters and just 4 or 5:1 for orifice plates.

How do they work?

Thermal mass flowmeters work by measuring the amount of heat that a gas carries away from a probe tip as it flows past. A reference probe checks the temperature of the surrounding gas, while the measurement probe is maintained at a constant, higher temperature. The amount of heating energy required to keep the measurement probe up to temperature depends directly on the mass of the passing gas.

This is a direct measurement of the mass flow so it is more straightforward than techniques that derive the mass indirectly. For example, a volumetric flowmeter would also need to know the temperature and pressure of a gas in order to compute its mass flow, which means buying and maintaining extra instrumentation.

In addition, thermal mass flowmeters take measurements using two small probes on the end of an insert. This causes only a minor obstruction in the surrounding flow, so that correctly sized thermal mass flowmeters offer an extremely small pressure drop of between one and two millibars. Vortex meters instead drop the pressure by between 50 and 100 millibars, while the drop across an orifice plate is even higher. In compressed air applications this can have a knock on effect on efficiency, since tool power drops by some 2.5% for each 100-millibar drop in compressed air pressure.

Compressed air is a valuable resource that is only becoming more expensive as energy costs rise. With the arrival of innovations designed to help keep the cost of metering down (see below), asking whether you can afford to install accurate meters is missing the point. A better question to ask is, can you afford not to?

ABB Sensyflow flowmeters

- Specifically designed for compressed air and gas/mixed gas applications
- Hazardous area protection to Zone 0 possible
- Quick response time
- Compact and remote designs available
- Insertion, wafer and flanged versions available
- Measurements in line sizes from DN25 to DN3000 possible

For more information on ABB's thermal mass flowmeters, email **moreinstrumentation@global.abb.com** or call **0870 600 6122**

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