



## MASS FLOW SENSING IMPROVES LEAK TEST EFFICIENCY

*Mass flow meters reduce risk of measurement error and provide a reliable, quantitative measurement of product quality and production process control.*

In the leak testing application, mass flow meters offer advantages unmatched by other instruments. Today, leak testing must be not only precise, accurate and irrefutable, but also easy-to-use, fast and efficient. With mass flow sensing, dry air leak testing satisfies today's stringent production testing requirements and provides consistent, accurate readings that can be stored electronically for analysis. This method is also ideal for automated test systems, accelerating the test cycle and reducing the need for skilled operators.

### CONVENTIONAL TECHNIQUES

Traditionally, several methods have been used in leak testing. When it is only necessary to establish whether or not a leak exists, bubble testing may suffice. In bubble testing, the test item is pressurized and then submerged in a water bath. Any leaks produce easily observable streams of bubbles. Bubble testing provides only an approximate "guesstimate" of the actual leak rate, however.

Dry-air leak testing methods were developed to circumvent some of the disadvantages of bubble testing. The oldest of these technologies is the pressure-decay method. In this method, a pressure transducer is used to determine the leak rate of a test article simply by measuring pressure decay within the test article over a specified period of time, and correlating the loss of pressure to units of flow.

The pressure-decay method is extremely vulnerable to the effects of uncontrolled variables. If, for example, ambient temperature is not carefully

controlled (or at least carefully tracked and accounted for), a drop in temperature may produce a drop in pressure and therefore the appearance of a leak where no leak exists.

Another dry-air leak testing method is the differential-pressure method. The differential-pressure method is an improvement on the simple pressure-decay method.

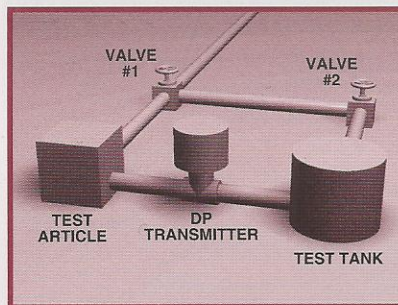


Figure 1: The Differential Pressure Method is subject to effects of uncontrolled variables.

Differential-pressure technologies use a differential pressure transducer and a reference tank, as shown in Figure 1. The test item and the reference tank are both pressurized from the same air supply. Valve 1 is closed to isolate both the test item and the reference tank from the air supply. Valve 2 is then closed to isolate the test item and the reference tank from each other. The differential-pressure transducer reads the pressure differential between the test item and the reference tank, and this reading is used to calculate the leak rate.

However, both the pressure-decay and the differential-pressure methods are indirect methods. That is, they both require that the flow rate of any leak be extrapolated from pressure data, rather than measured directly. Another disadvantage of both these methods is that they require two readings separated by some interval of time. This increases not only the time required to conduct the testing, but also increases the risk of measurement errors.

### MODERN MASS FLOW TECHNIQUES

The most modern and precise method now available to test leaks is to use a thermal mass flow meter to measure the flow rate through a test article. Thermal mass flow meters automatically compensate for variations in pressure and temperature and therefore measure the actual mass of the gas leaked.

Because this method is based on a single point measurement which is more accurate and can be completed in less time (typically < 1s) the impact

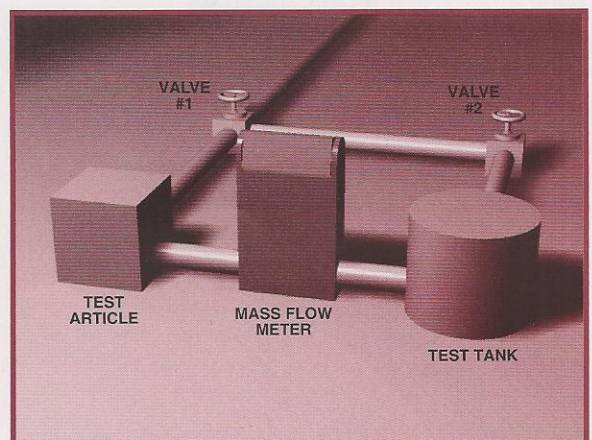


Figure 2: Mass flow meters provide a direct reading of mass flow rate without temperature and pressure compensation.

of uncontrolled variables is further reduced. When a thermal mass flow meter is used, the configuration of the test apparatus can take either of two basic forms.

The most common method is to use a precision, two-stage regulator to supply a constant volume of air, which then flows directly through the mass flow meter and into the test fixture. Alternatively, blocking valves and a reference volume supply tank can be used. In this configuration, an air supply first pressurizes the system, and the valves are then closed to block the flow of air. The air supply from the reference volume tank must then flow through the mass flow meter and into the test fixture directly to compensate for any leakage, as shown in Figure 2.

In either configuration, the thermal mass flow meter provides a fast and reliable measurement of the leak flow in standardized units of mass. Because of its exceptional low flow sensitivity this device is particularly well suited for detecting small leaks or leaks in large-volume enclosures.

### CONCLUSION

In most leak testing applications, mass flow meters are an ideal choice. They provide an economical, fast and accurate leak test, are easy to install and easy to automate. Mass flow sensing also provides high accuracy leak readings over a much wider range of leak/volume ratios and testing conditions than differential pressure systems, at a comparable cost.

### RECOMMENDATIONS

Some of the key advantages of Sierra meters in leak testing applications are:

- Detects very small leaks (high accuracy even at very low flows).
- Electronic output, no dials or gauges to misread.
- Linear 0-5VDC output. Easy data-logging; SPC-regime ready.
- Portable. Easy to use for in-process testing or special QA requirements. Can use battery or single-ended power supply.



*Sierra Model 820 displays mass flow rate in your choice of engineering units.*

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