What's the Difference Between Gauge, Absolute, Differential, and Sealed Pressure?

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A concise primer on pressure and units used to measure it.

Pressure, the measure of a force on a specified area, is a straightforward concept. However, depending on the application, there can be many different ways of interpreting pressure. Here are some guidelines that can help identify types and units of pressure measurement, while discussing when and why certain pressure measurements are used.

Different types of pressure

There are several ways pressure can be referenced. To accurately identify and relay pressure measurements, the application must be considered. Pressure sensors use the following references:

Gauge Pressure uses a reference to the atmosphere around the sensor. Because the sensing element has a deflection due to a pressure change, a reference point is needed to know exactly what pressure is being measured. Pressure sensors that use gauge pressure—typically seen in PSIG, BARG, and kPaG —have some type of vent. This vent can be built in to the sensor or even through a tube in the electrical connection. The vent is positioned to use atmospheric pressure as a reference point for the sensor to measure the media. One common reason for using gauge pressure is to ensure that with any location throughout the world, the sensor will always reference the location in which it is installed.

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Absolute Pressure a perfect vacuum as its reference. This type of pressure reference is the gauge pressure of the media plus the pressure of the atmosphere. As locations change, especially when dealing with elevation changes, the reference point can change because of atmospheric pressure differences. Using an absolute pressure sensor eliminates the reference to a varying atmospheric pressure and relying on a specific pressure range for reference.

Differential Pressure can be a little more complex than gauge or absolute, but is simply measuring the difference between two medias. Although most gauge pressures are technically a differential pressure sensor—measuring the difference between the media and atmospheric pressure—a true differential pressure sensor is used to identify the difference between the two separate physical areas. For example, differential pressure is used to check the pressure drop—or loss—from one side of an object to the other.

Sealed Pressure is less common than the previous three but still has a place within the pressure world. Sealed pressure uses a pre-determined reference point, not necessarily vacuum. This allows for pressure measurement in locations that will vary with atmospheric changes. Because of the pre-determined reference point, no venting is needed on the sensor

Units of Pressure

When measuring pressure, several units are commonly used. Most of these units of measurement can be used with the international system of units, such as kilo, Mega, etc. These units are defined as follows:

PSI (pounds per square inch): This is the unit of measure for one pound of force applied to one square inch of area. PSI is a typical unit of pressure in the United States.

BAR: One bar equals the atmospheric pressure on the Earth at sea level. The BAR unit was created in Europe and is still commonly used there.

PA (Pascal): One Pascal equals one Newton of pressure per square meter.

InHg (inches of mercury): This is the pressure exerted by a one inch circular column of mercury, one inch tall, at gravity and 0°C (32°F). InHg are typically used barometric pressure.

Torr: This is the pressure exerted by a one millimeter tall circle column of mercury. It was also knows a millimeter of mercury (mmHG). It is equal to 1/760 atmospheres.

InH_2O (inches of water): This is the unit of measure for a one inch circular column of water, one inch tall, at gravity and 4°C (39.2°F). It is typically used for a differential pressure measurement or in low pressure water applications.

In many applications, absolute pressure is specified without any real need for it. There is a misconception that all pressure measurement needs to be absolute. While there is certainly a need for absolute pressure measurement, most applications only need gauge pressure or an alternative. By understanding the application details, selecting an appropriate pressure sensor can be easy. A correct pressure sensor allows for more precise processes and for a proper outcome in the most efficient and economical way.

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