



UNDERSTANDING PRESSURE MEASUREMENT

Pressure, by definition is a derived parameter. It is the combination of a mass measurement imposed upon an area. It is commonly expressed as Pounds per square Inch (PSI), Kilograms per square Centimeter (Kg/cm^2), Newton per square Metre (Pascal) or in terms of the height of a liquid column expressed as inches or millimeters of water or mercury.

GAUGE, ABSOLUTE & VACUUM

Pressure measurements are always expressed as the difference between the measured pressure and some base pressure.

Gauge pressure is measured from, or in addition to, atmospheric pressure.

Absolute pressure is measured from a base of zero pressure.

Vacuum is a measure of negative pressure and is the difference between atmospheric pressure and the measured pressure where a maximum, or perfect vacuum has no atmospheric pressure.

TYPES OF PRESSURE MEASUREMENT

Mechanical pressure gauges utilise either a hollow 'C' shaped tube (Bourdon) or a diaphragm (capsule) to transfer the pressure to a mechanical movement. These analogue instruments are used extensively because they are cheap and easy to install. However their accuracy is generally 3% full scale up to 0.1% for expensive test gauges.

Electronic pressure transducers incorporate a strain gauge diaphragm or piezo electric cell and signal conditioning electronics to convert the pressure into an electrical signal, such as 4-20mA transmitter output for process applications or mV output for direct use with instrumentation.

These devices are used where accuracy, within 1% and 0.1% typically, and/or control is required.

Electronic pressure transducers are becoming less expensive with more features such as integral digital display, electronic damping, programmable pressure range and low temperature drift for high temperature applications.

ACCURACY

With pressure instruments, accuracy is expressed as a percentage of range or full scale or as a percentage of reading. With most pressure instruments other information should be noted when considering overall instrument accuracy; hysteresis, linearity, repeatability and temperature effect

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PRESSURE RANGE

When selecting a pressure range for an instrument it is recommended that the normal operating pressure is approx 70% of the instrument range, and slightly lower, 60-65% if the pressure is fluctuating or pulsating. Also, the maximum possible process pressure should not exceed the instrument's maximum static pressure. This is typically 1.5. times the range without damaging the instrument.

Most instrument's specifications will also quote burst pressure of typically 2 times range, above which will cause permanent damage to the pressure measuring instrument.

PRESSURE SEALS AND SEPARATORS

In some applications it may be necessary to isolate the process medium from the instrument in order to protect the instrument from the medium and vice versa. Main reasons are:-

- The medium is highly viscous and will build-up in narrow channels and apertures of the instrument, producing erroneous readings.
- The medium is extremely corrosive and will attack the sensitive elements of the instrument
- The medium contains abrasive solids. Dead spots result in build-up and ultimate clogging
- The medium tends to crystallise and will result in clogging
- The temperature of the medium is outside the limits of the instrument's working temperature range
- Hygiene and antibacterial nature of the process In-place cleaning of dead spots and corners is impossible
- The medium being measured is toxic and cannot be allowed to leak into the surroundings. Safety and environmental protection demands extra counter measures.



PRESSURE and STRESS

ATMOSPHERE	1.00	=	PASCAL	101325
ATMOSPHERE	1.00	=	BAR	1.01325
ATMOSPHERE	1.00	=	Kg/cm ²	1.0333
BAR	1.00	=	ATMOSPHERE	0.98692
BAR	1.00	=	Kg/cm ²	1.02668
BAR	1.00	=	PASCAL or N/m ²	100000
BAR	1.00	=	lb/in ²	14.50377
Kg/cm ²	1.00	=	ATMOSPHERE	0.968
Kg/cm ²	1.00	=	BAR	0.98066
Kg/cm ²	1.00	=	PASCAL and N/m ²	98066
Kg/cm ²	1.00	=	lb/in ²	14.22334
Kg/Mtr ²	1.00	=	PASCAL	9.80665
N/m ²	1.00	=	lb/in ²	0.000145
N/m ² or PASCAL	1.00	=	Kg/Mtr ²	0.10197
N/m ²	1.00	=	Kg/cm ²	0.000010197
PASCAL and N/m ²	1.00	=	ATMOSPHERE	0.00000987
PASCAL	1.00	=	BAR	0.00001
kPa	1.00	=	BAR	0.01
Mpa	1.00	=	BAR	10
lb/in ²	1.00	=	BAR	0.06895
lb/in ²	1.00	=	Pa	6895
lb/in ²	1.00	=	Kg/cm ²	0.07031
lb/in ²	1.00	=	ATMOSPHERE	0.06805