PRESSURE SOLUTIONS

P102 Pressure Units

Pressure is defined as force per unit area.

The SI unit of force is the Newton, defined as the force required to accelerate a mass of 1 kg by 1 m/s^2.

The SI unit of area is the square metre.

The fundamental unit of pressure is the Pascal. 1 Pa = $1N/m^2$. This is known as a derived unit, since it is derived from the fundamental units of mass, length and time.

This is far too low a pressure to be useful in real life.

SI permits the use of multiples and submultiples to create units which are more useful.

The common multiples used with the Pascal for pressure are kilo (1 000 = 10^3) and mega (1 000 000 = 10^6). The Pascal is also used for stress, where the Giga (1 000 000 000 = 10^9) multiple may be used.

The kilopascal (kPa) is the most common multiple used in industry. Atmospheric pressure is about 100 kPa at sea level. Megapascals (MPa) are mostly used for hydraulic pressures.

In some countries, bar is used, where 1 bar = 100 000 Pa. This is not a true SI unit, as multiples of = 10^3 are used in the SI system.

We try to express quantities in integers to a maximum of 4 digits, thus 6 000 Pa, 10 kPa, 6000 kPa, 10 MPa etc.

The System Internationale (SI) is a logical and consistent set of units. Earlier days saw a wide variety of units, such as the imperial lbf/in^2, and metric kgf/cm^2. These are both arbitrary and difficult to use since they require application of the gravitational constant which varies from place to place. They are no longer legal in South Africa.

In addition to conventional force over area type units, which includes such American oddities as oz/in^2, there is a range of head based units, which are correct for measuring level, but should not be used for pressure. These include metres of water, cm of mercury, feet of seawater etc. Head is defined as pressure at the foot of a column of fluid. These units require care, since to be meaningful, they need a temperature linked with the description, ie feet of water at 60ºF, metres of water at 20ºC; metres of water at 34ºC etc. Remember that liquids expand when heated and contract when cooled, so the height of a column of water to produce a set pressure does vary with temperature. The formula is (h x A) x ρ x g / A where h = height of column, g = local value of gravity and ρ = density.

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