

ALL ABOUT AIR

WHITE PAPER #23 – BAROMETRIC PRESSURE © Tom Kreher

Please indulge a brief rant about the common terminology for Atmospheric Pressure, Absolute Pressure and Gauge Pressure. We specify that atmospheric pressure added to gauge pressure equals absolute pressure: $PSIG + PSIA = PSIA$. ???????

Atmospheric pressure is barometric pressure and might be designated PSIB then the equation for absolute pressure would make sense. Gauge pressure plus barometric pressure equals absolute pressure, $PSIG + PSIB = PSIA$.

Many of you know that when we use the standard atmospheric (barometric) pressure at sea level for calculations about compressed air it is an approximation from the average of the fluctuating atmospheric pressure. Also this close approximation based on the most common barometric pressure is incorrect for every application except right at sea level.

If your application is not floating in a raft in the Ocean the local atmospheric (barometric) pressure is most often lower than the standard atmospheric (barometric) pressure which is given as 29.92 inches of Mercury (Hg) and 14.7 (14.696) PSIA (Should be PSIB) and 1.013 Bar. (A bar is .986 atmospheres). One bar is 14.5 PSI.

It is uncommon for a gauge or pressure switch to show absolute pressure. When absolute pressure is required we read the gauge and add atmospheric pressure.

Most of us have been convinced that 14.7 is the atmospheric pressure. When you change the word from atmospheric to barometric it changes the perspective.

By the way what is atmospheric pressure? If we had a cubic inch of air so that any one side was one square inch and laid that on a scale in a perfect vacuum it would weigh .0000434 lbs (.075 lb/cu ft / 1728 cu in/cu ft). How the heck can it have almost 15 pounds of pressure per square inch? The air around us is stacked up approximately 200,000 feet. Let us imagine that you got on the scale and weighed 200 Lbs. If a person who weighed 150 pounds sat on your shoulders and a 100 pounder on theirs and a 50 pounder on top. You would be the only one touching the scale but the scale would show 500 pounds.

The air weighs less and has less pressure as the elevation increases. An uncorrected barometer that shows the local barometric pressure is also reporting the altitude. If a pilot zeros the altimeter on the ground at the airport before take off he essentially makes the airport ground zero. As he flies above the airport the altimeter will show the altitude based on the reduced atmospheric, barometric pressure.

This formulas, adapted from the Nosler reloading manual is for those who dislike charts because the number they need lies between listings.

$B = 14.7 \text{ psib or } 29.92 \text{ In. Hg. } h = \text{the altitude in feet } f = \text{conversion factor, } 3.69 \times 10^{-5} (.0000369)$

Atmospheric Pressure = $14.7 \times (e^{-fh})$.

Barometric Pressure = $29.92 \times (e^{-fh})$

ALTITUDE(ft)	ATMOS PRES(psi)	BAROMETER(hg)	ALTITUDE(ft)	ATMOS PRES	BAROMETER
0	14.7	29.92	6000	11.78	23.98
100	14.64	29.81	7000	11.34	23.08
500	14.43	29.38	8000	10.91	22.22
1000	14.17	28.85	9000	10.50	21.38
2000	13.66	27.82	10000	10.10	20.57
3000	13.17	26.81	15000	8.29	16.88
4000	12.69	25.84	20000	6.75	13.74
5000	12.23	24.89	25000	5.45	11.10