Density Altitude

What Is Density Altitude?

Density altitude is pressure altitude corrected for nonstandard temperature. As temperature and altitude increase, air density decreases. In a sense, it's the altitude at which the airplane "feels" its flying.

How Will High Density Altitude Affect Flight?

On a hot and humid day, the aircraft will accelerate more slowly down the runway, will need to move faster to attain the same lift, and will climb more slowly. The less dense the air, the less lift, the more lackluster the climb, and the longer the distance needed for takeoff and landing. Fewer air molecules in a given volume of air also result in reduced propeller efficiency and therefore reduced net thrust. All of these factors can lead to an accident if the poor performance has not been anticipated.

Technical Information

Tips for Flying in High Density Altitude Areas

- Fly in the evening or early in the morning when temperatures are lower.
- Call a local instructor at your destination airport to discuss density altitude procedures at that airport.
- Before flying to a high-elevation airport, know whether your aircraft climbs more efficiently with the first increment of flaps. Many aircraft do, but results vary and that first notch of flaps may add more drag than lift.
- Be sure the aircraft's weight is below 90 percent of maximum gross weight (or less).
- Don't fill the tanks to the top (see previous tip).
- Fly shorter legs and make extra fuel stops (tough suggestion to accept, but it results in less exciting takeoffs).

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- Be ready to ferry one passenger to an airport with a lower density altitude, then come back for the other. If you are unsure of conditions, fly around the pattern once alone without baggage to test your aircraft's performance.
- Have 80 percent of your Vx speed at the runway's halfway point, or abort. That means having about 48 knots IAS in a Cessna 172 at the halfway point.

Calculating Density Altitude

Density altitude in feet = pressure altitude in feet + (120 x (OAT - ISA temperature))

- **Pressure altitude** is determined by setting the altimeter to 29.92 and reading the altitude indicated on the altimeter.
- **OAT** stands for outside air temperature (in degrees Celsius).
- **ISA** stands for standard temperature (in degrees Celsius).

Keep in mind the standard temperature is 15 degrees C but only at sea level. It decreases about 2 degrees C (or 3.5 degrees F) per 1,000 feet of altitude above sea level. The standard temperature at 7,000 feet msl, therefore, is only 1 degree C (or 34 degrees F).
For example, the density altitude at an airport 7000 feet above sea level, with a temperature of 18 degrees Celsius and a pressure altitude of 7000 (assuming standard pressure) would be calculated as follows.

- 18 – 1 = 17
- 17 x 120 = 2040
- 2040 + 7000 = **9040** feet Density Altitude

This means the aircraft will perform as if it were at 9,040 feet.

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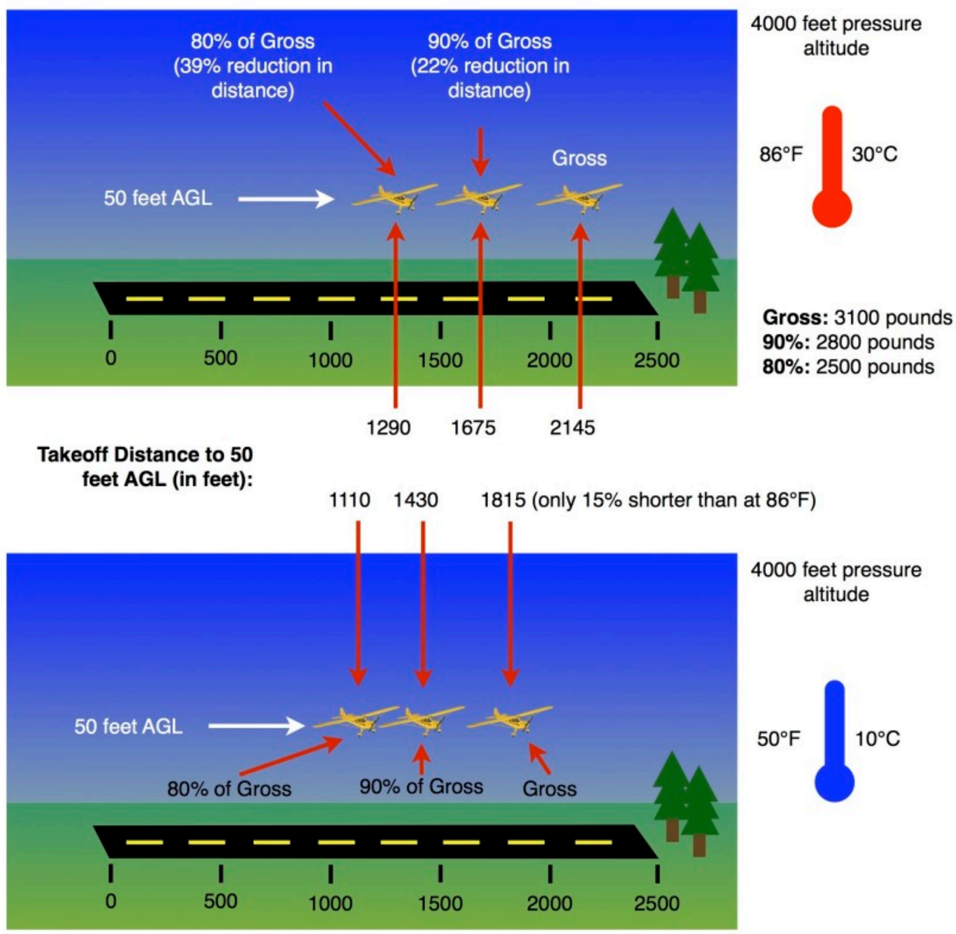
Examples – Use E6B

EX 1. OAT = 33 deg C, PA = 600’, Density Altitude = _______

EX 2. OAT = -30 deg C, PA = 10,500’, Density Altitude = _______

EX 3. For example 2, estimate true altitude, assume baro pressure is 29.92” Hg, True Altitude

Effect of weight reduction versus temperature reduction on a 1981 Cessna 182 Turbo (weight vs. density altitude)



Conditions: Flaps 20 degrees, 2400 RPM and 31 inches Hg prior to brake release, Mixture full rich, Cowl Flaps open, Paved, Level, Dry Runway, Zero Wind. Increase distances by 15% for a dry, grass runway.