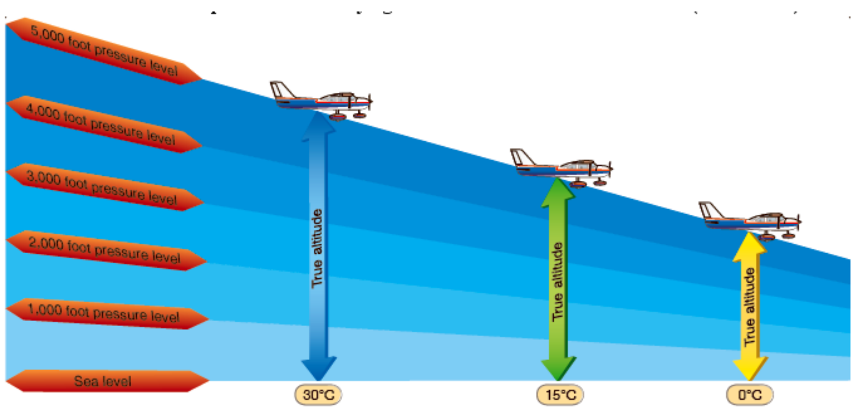
Oral Questions (Altimetry, Airspeeds)

<u>What are the limitations that a pressure altimeter is subject to?</u>

A pressure altimeter is also known as a sensitive altimeter, one with an adjustable barometric scale. The adjustable barometric scale is called the "Kollsman window."

Limitations:

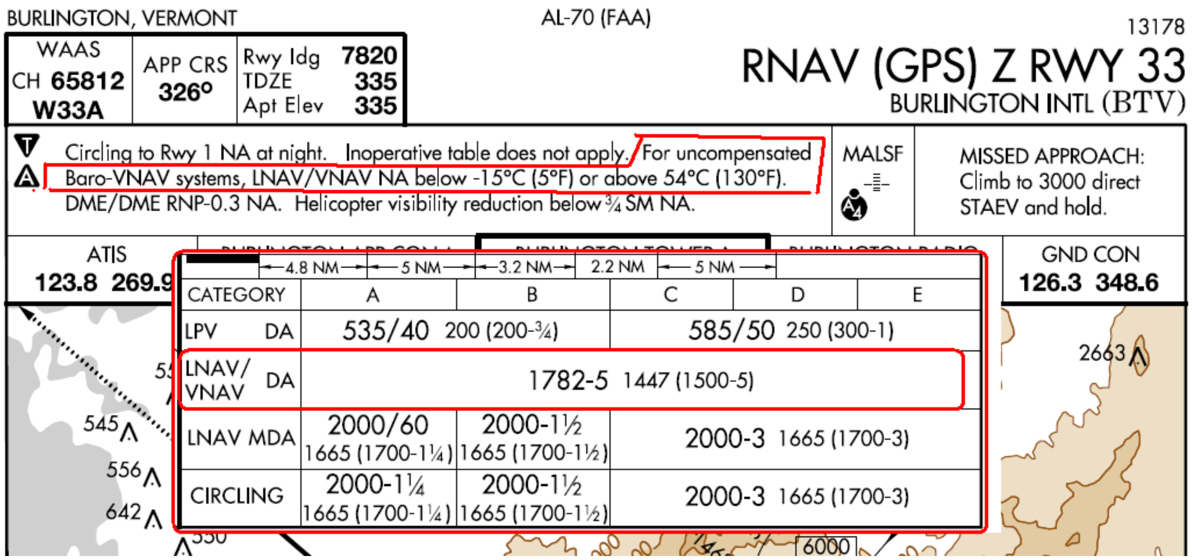
- **Mechanical Error**. An altimeter is a mechanical instrument with gears, so the mechanical items may break. Mechanical error is generally addressed through the preflight check and making sure that when the local altimeter is set, the altimeter reads within 75 feet of surveyed elevation.
- **Inherent Altimeter Error**. The altimeter can only sense pressure. The altimeter displays sensed pressure as altitude based upon a standard atmosphere (i.e., a conversion built into the altimeter instrument).
    - Generally, remember, if colder than standard, you will be lower than altimeter indicates. The picture below helps you conceptualize the "why." Said with altimetry terms, "When temperature is colder than standard, True altitude will be lower than Indicated altitude."
    - Some advanced altimeters have "compensated altimeter systems," that compensate for low temperatures. We don't have this.



- **Nonstandard Pressures on Altimeter**. Essentially, not using the most current altimeter setting, or a rapidly changing altimeter setting.

Keep in mind, your Mode C transponder transmits pressure altitude to ATC, using a separate digital sensor from your altimeter (a black box, if you will). ATC corrects the received pressure altitude for local pressure. Your Mode C and altimeter (corrected for local) must be within 125 feet of each other.

- **Additional Implications.** Instrument approach charts may have temperature limits that are important to understand. Here is an excellent article by Jeppesen on the topic and on other features of GPS approach charts, http://jeppesen.com/download/aopa/apr00aopa.pdf
    - Note the limit at BTV in the notes section. It does not apply to "LNAV MDA" directly! But only to the LNAV/VNAV DA (1782-5) that are suing "BARO-VNAV" systems (we don't' have); thus, this limitation does NOT apply to WAAS GPS receivers…see AIM 5-4-5(f). BUT you still should use caution when it is really cold and flying a LNAV MDA, if you are going to minimums.



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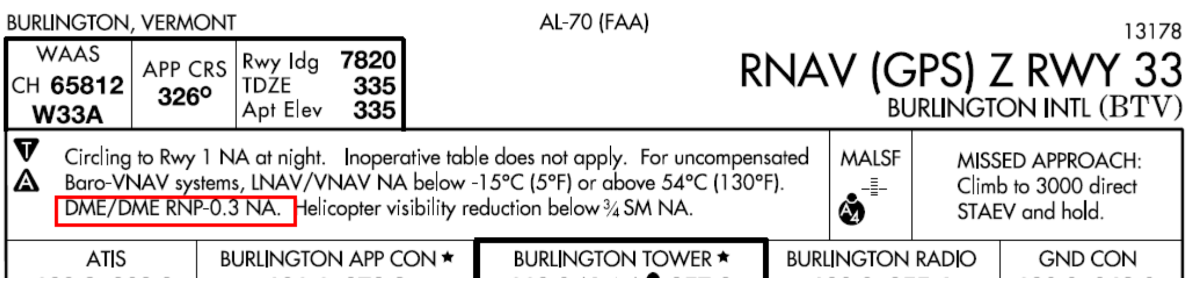
    - By the way, the "DME/DME RNP-0.3 NA" does not apply to GPS equipment, only to certain RNAV equipment (we don't have).



<u>Define/State how to determine the following altitudes ?</u>

This is actually in the Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25A)

- Indicated. What is displayed on altimeter when set to current altimeter setting.
- True. The vertical distance of the aircraft above sea level, often expressed "MSL." Altitudes on charts are shown as true altitudes. You never really know your True altitude, you can only estimate it.
- Corrected Altitude. Indicated altitude corrected for non-standard temperature, thus an approximation of true altitude (see EA-6B example below).
- Absolute. Vertical distance of aircraft above terrain, or "AGL," above ground level.
- Pressure. Altitude on altimeter when set to 29.92 (a "standard datum plane"). Necessary to calculate aircraft performance (when combined with temperature to create density altitude).
- Density. Pressure altitude corrected for non-standard temperature. So formulaically, density altitude = *f(pressure altitude, temperature)*, where *f* is some formula that your EA-6B can do.

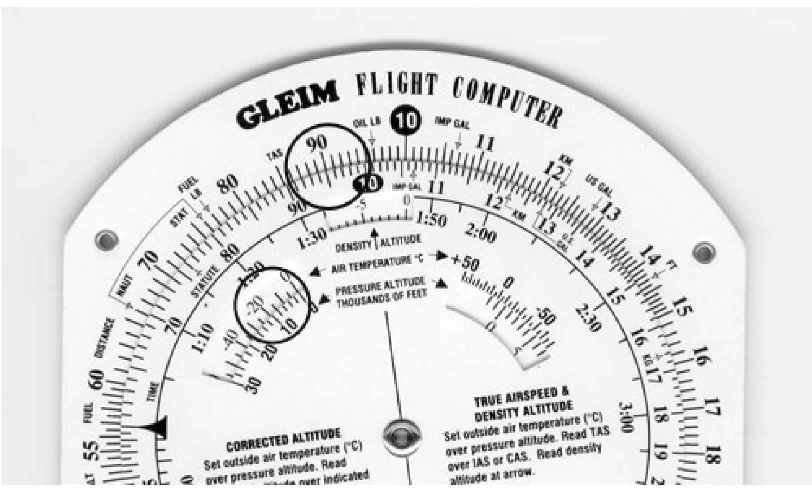
Practically, I have NEVER had a reason to calculate True or Corrected Altitude!

CORRECTED (APPROXIMATELY TRUE) ALTITUDE Back to top

A. Because temperature affects air density, variations in temperature will affect the indications of the altimeter.

1. True altitude is the actual altitude of the airplane above mean sea level (MSL).
2. Indicated altitude is the altitude read directly from the altimeter after it is set to the current altimeter setting.
3. Corrected (approximately true) altitude is found by correcting indicated altitude for nonstandard temperature and pressure.
    a. Corrected altitude is indicated altitude corrected for OAT. The term corrected (or approximately true) altitude is used since the indicated OAT does not necessarily reflect the average temperature of the column of air between the airplane and the surface.

B. **Determining Corrected (Approximately True) Altitude**



1. Rotate the inner scale until the numbers on the inner and outer scale match.
2. The window on the left side below "1:10" and "1:20" on the hour scale is used for calculating corrected altitude.
    a. OAT is read through the window at 5°C increments from -60°C to +50C.
    b. Pressure altitude, in thousands of feet, is below the window on the movable disk and is in 2,000-ft. increments ranging from 30,000 ft. to -1,000 ft.
3. The inner scale is labeled "IND ALT," which means indicated altitude.
    a. The outer scale is labeled "TRUE ALT," which means true (corrected) altitude.
    b. These labels are located between "50" and "55" on the appropriate scale.

Different Airspeeds

Acronym: "ICE-T"

- I – Indicated (IAS). What you read on your airspeed indicator, uncorrected for instrument or position errors.
- C – Calibrated (CAS). The speed the aircraft is moving through the air. It is IAS corrected for instrument and position errors. A chart in POH is needed to determine CAS.
- E – Equivalent (EAS). CAS corrected for compressibility of air. Negligible below 250 knots and below 10,000 feet (i.e., low mach numbers).
- T – True (TAS) – EAS (and for slow aircraft, like Cessna, CAS) corrected for density altitude (i.e., pressure altitude and temperature). TAS is the speed of the aircraft over the ground when there is no wind. TAS has a rule of thumb: 2% per 1,000 over IAS (so, at 10,000 feet, TAS should be 20% higher than IAS…note, since it is a "rule of thumb," I am just using IAS, since one would not use a rule of thumb conversion and take the time to open the book to convert IAS to CAS!)

Grounspeed (GS). The speed of the aircraft over the ground. It is TAS corrected for winds.