

Department of Transportation  
 FEDERAL AVIATION ADMINISTRATION  
**IFR PILOT EXAM-O-GRAM\* NO. 10**  
 ALTIMETRY

In spite of the importance of the pressure altimeter, almost fifty percent of the applicants taking the Instrument Pilot Written Tests demonstrate a knowledge deficiency concerning the effect of atmospheric pressure and temperature changes on this instrument. The effects of other altimeter errors will not be considered here since it is assumed that the static pressure system and altimeter of the aircraft being flown have been tested in accordance with FAR 91.170.

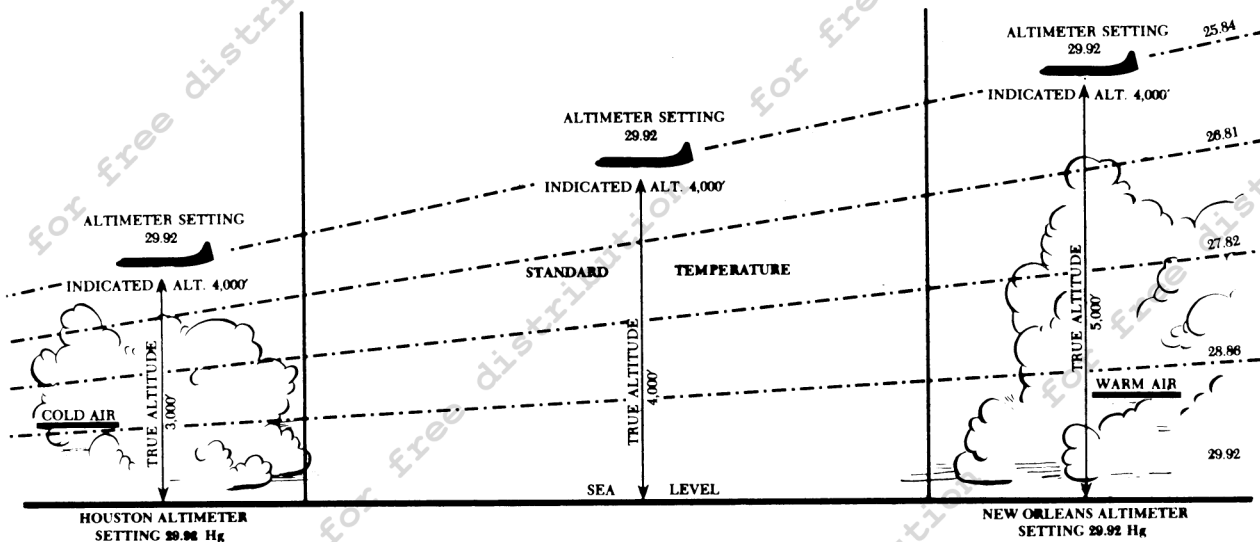
**ATMOSPHERIC TEMPERATURE AND PRESSURE ERRORS:** Normally the effects of atmospheric temperature and pressure changes may be summarized by the adage, "Cold or low, look out below." When flying from a warm area to a cold area (assuming little or no pressure change) or from a high pressure area to a low pressure area (assuming little or no temperature change), your aircraft is lower than indicated altitude, unless the altimeter has been adjusted to compensate for the change.

An altimeter is accurate at all altitudes only when the conditions of a Standard Atmosphere exist. In general, a standard atmosphere occurs when the

1. sea level barometric pressure is 29.92" Hg.,
2. sea level free air temperature is +15°C, and
3. temperature decreases 2°C with each 1000 foot increase in altitude.

Since the above conditions rarely exist, the altimeter requires correction.

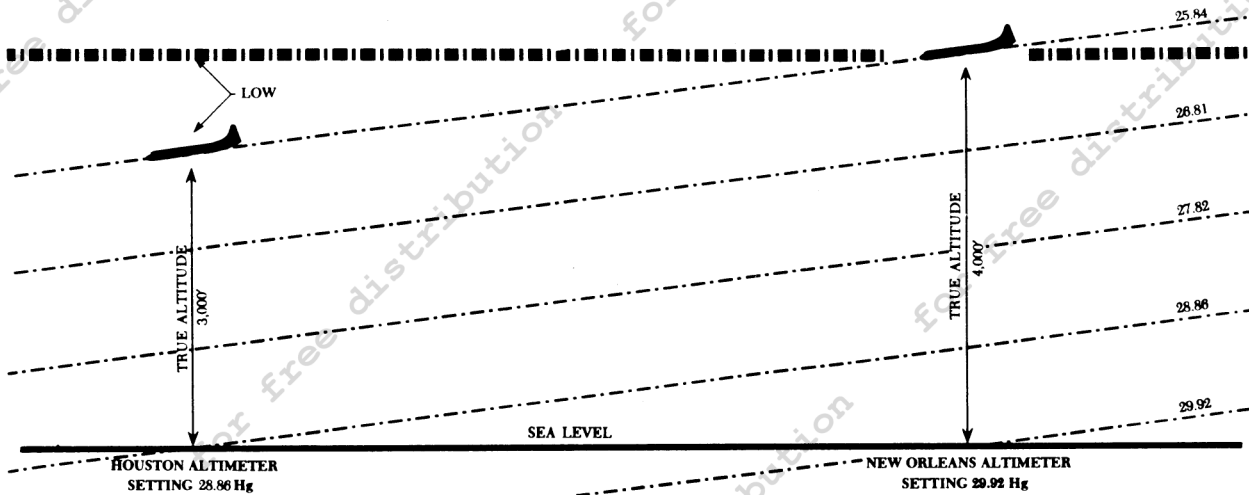
The altimeter is a pressure measuring device and when set at 29.92 will indicate 4000 feet at a level where the atmospheric pressure is 25.84" Hg. The true altitude at which this pressure actually exists may be more or less than 4000 feet. As shown in Figure 1, on a warm day the expanded air is lighter in weight per unit volume than on a standard day or a cold day. Therefore, the pressure level where the altimeter will indicate 4000 feet is higher than it would be under standard conditions. On a cold day the reverse would be true and the 4000 foot pressure level would be lower.



True Altitude Decreases When Going Into Cold Air

(Figure 1)

Changes in surface pressure may also affect the pressure levels at altitude. You can see from Figure 2 that an aircraft flying into an area of lower pressure will be lower than indicated altitude unless the altimeter is adjusted to the local altimeter setting.



True Altitude Decreases When Going Into Low Pressure (Figure 2)

**ALTIMETER SETTING:** The local altimeter setting "corrects" for the difference between existing pressure and standard atmospheric pressure. Whether local pressure is higher or lower than standard, when the aircraft altimeter is set to the local altimeter setting (assuming no setting scale error) it will indicate true altitude (MSL) at ground level. The indicated altitudes above ground level are normally not true altitudes because of nonstandard lapse rates. The point to remember is that when all aircraft operating below 18,000 feet are using the current local altimeter setting, they have a common reference for indicated altitude. (See **ALTIMETRY - Airman's Information Manual** for additional details.)

**SUMMARY:**

1. For normal operations (except to determine true airspeed, true altitude, engine operation, etc.) pilots should disregard the effect of nonstandard temperatures. However, both low temperatures and low pressures should be considered when selecting altitude for terrain clearance purposes.
2. If the local altimeter setting is lower than the setting on the kollsman dial, the aircraft will be lower than indicated altitude. A reverse situation is also true.
3. Both pressure and temperature must be considered when determining the relation of indicated altitude to true altitude.

\* Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

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