

Liquid-In-Glass Thermometer FAQs (Frequently Asked Questions)

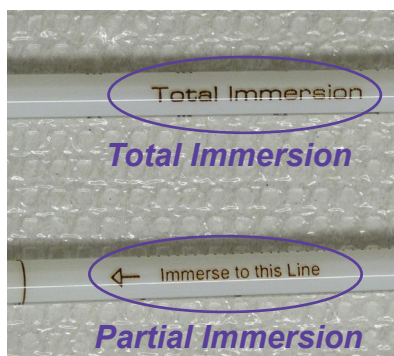
Product Related Questions

How do partial and total immersion liquid-in-glass thermometers differ?

Liquid-in-glass thermometers can be used to measure atmospheric temperature, semi-solids, or liquids. The main difference between partial and total immersion thermometers is the application in which they should be used. If the depth of the test sample is shallow, a partial immersion thermometer is usually necessary.

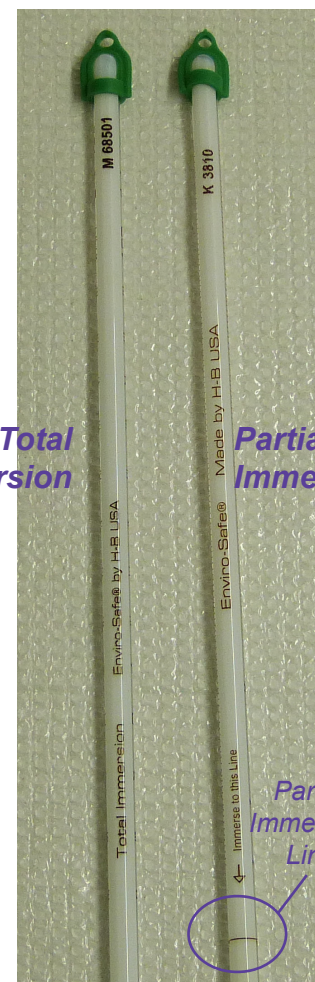
Thermometers manufactured for **total** immersion indicate an accurate temperature reading when the thermometer is immersed to the level of the liquid in the capillary column. To begin, immerse the thermometer to the top of the liquid column as the temperature rises or falls adjust the thermometer until an accurate reading is achieved.

Thermometers manufactured for **partial** immersion indicate accurate temperatures when the thermometer is immersed to the specific depth indicated by the immersion line on the individual thermometer, and regardless of the of the liquid in the column. Partial immersion thermometers are appropriate for any application where total immersion is impractical or impossible, such as in a shallow water bath.



How do I know if a thermometer is total immersion or partial immersion?

Whether a thermometer is total immersion or partial immersion is generally printed on the back side of the glass. Partial immersion thermometers will also have a line showing the depth to which the thermometer should be submerged.



Can I use a total immersion thermometer in a partial immersion application or vice versa?

Yes, but it is not practical. If total immersion thermometers are used at partial immersion depths (or vice versa), inaccuracies will occur. These inaccuracies increase as the temperature increases above room temperature; temperature readings can vary 5 to 10 degrees. If, in a rare case, you must use a total immersion thermometer in a partial immersion application, corrections for emergent stem must be obtained to achieve an accurate reading. To reduce errors, use the correct thermometer to meet your application requirements.

To see a video demonstrating these differences visit: <http://www.youtube.com/watch?v=3yd0lboA3LE>

What is the difference between a “calibrated” and a “standardized” thermometer?

All thermometers are standardized, but not all thermometers are calibrated.

In order to manufacture a thermometer, the instrument must be compared to a traceable reference standard. Standardization during manufacturing establishes the guidelines for line and number placement on the glass, thus the thermometer has been *standardized*.

If a thermometer is calibrated (in the past the term certified may have been used) this means that after the instrument is manufactured, it is compared to a instrument that was certified by an outside body at a specific point or points along the scale. The results of this calibration are recorded on an official report. This report of calibration accompanies the calibrated instrument after the calibration process.



What is the difference between a Traceability Certificate and a Calibration Report?

Traceability Certificate:

Enviro-Safe[®], **Easy-Read**[®], **Double-Safe**[™] and **FRIO-Temp**[®] thermometers are supplied with a traceability certificate. This statement is your recorded assurance that the instrument you received was manufactured by comparison to a measurement instrument, standardized to a national standard (NIST), with an identified, unbroken chain of measurement uncertainty.

The accuracy stated is the allowable tolerance, or maximum error, acceptable with a particular instrument in relation to the “true” value. This is normally stated as a value, plus or minus. For example, if a thermometer has a $\pm 1^\circ$ maximum scale error it means that at any given point on the scale, the instrument could read up to one degree above, or one degree below the test point. At 20° centigrade, a thermometer may read up to 21°C or down to 19°C and still meet accuracy requirements.

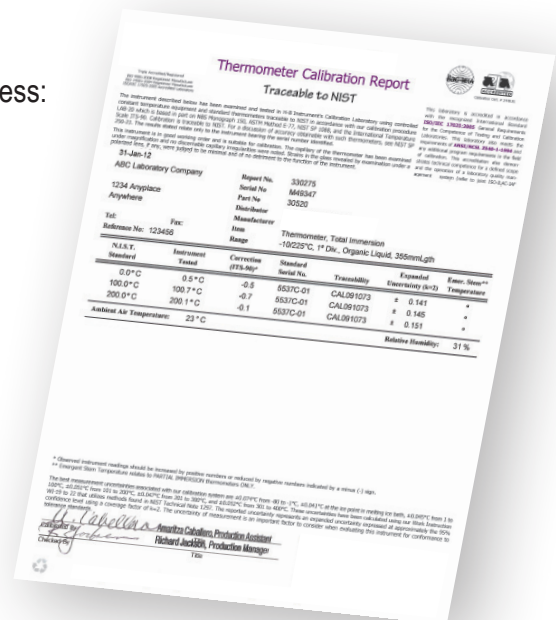
Calibration Report:

A calibration report records the calibration of an instrument. Calibration of an instrument requires completion of a three step process:

- 1) Comparison of an instrument to a standard.
- 2) Documentation of the standard’s traceability to the national standard in SI units accompanied by an unbroken chain of identified uncertainty.
- 3) Statement of the variance of the instrument from the standard in specific measurements.

Calibration essentially verifies that an instrument meets stated accuracy and further gives specific correction values in order to use the instrument precisely in an application. This is also known as “measurement traceability.”

Most thermometers have a traceability certificate, but only calibrated thermometers have calibration reports.



What liquid-in-glass thermometers have high resolution and high accuracy?

VWR offers 'ASTM Like' liquid-in-glass thermometers with high resolution and accuracy. Each thermometer is also individually serialized and packaged. ASTM stands for the American Society for Testing and Materials which is an independent, private organization that establishes and publishes standards for use in industry. Although these thermometers can be used in any suitable application each model is designed and specified for specific applications and they generally feature a shorter scale than a regular thermometer. VWR refers to our thermometers as ASTM like because the ASTM guidelines call for mercury filled thermometers and as part of our environmental stewardship VWR has made a commitment to phasing mercury filled instruments from our product line.



TEMPERATURE

What are the most common glass thermometer lengths, and what are their conversion lengths?

203 mm = 8" in length

305 mm = 12" in length

405 mm = 16" in length

TIME

These are the most common lengths for thermometers.

Convert mm to inches and vice versa using the following formulas:

To convert inches to mm, multiply total inches by 25.4 (8" x 25.4 = 203.2 mm)

To convert mm to inches, divide total mm by 25.4 (203 mm / 25.4 = 7.99")

DENSITY

How do you convert °C to °F and vice versa?

WEATHER

You can use these two formulas to convert any temperature:

$$^{\circ}\text{F} = 9/5 \text{ } ^{\circ}\text{C} + 32$$

$$^{\circ}\text{C} = 5/9 (\text{ } ^{\circ}\text{F} - 32)$$

Most liquid in glass thermometer are only in °C or °F, so try to pick the unit that best matches your purposes.

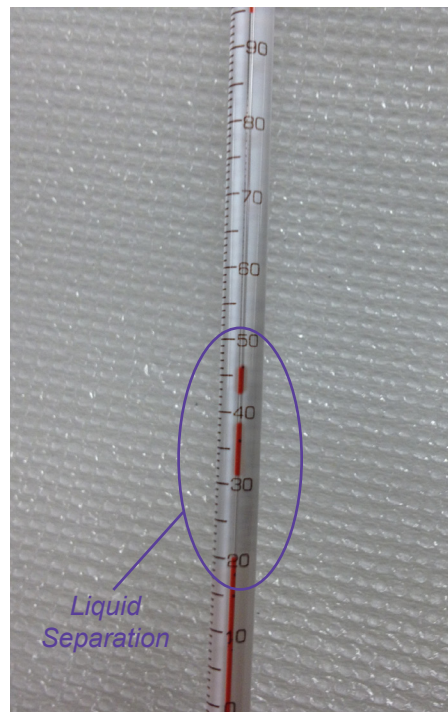
Troubleshooting Questions

If the liquid in the column of a thermometer is separated, is the thermometer faulty?

Absolutely not! The liquid in any glass thermometer, regardless of type (e.g. mercury-filled, spirit-filled, etc.) can be separated within the liquid column. This may be a result of shipping and handling, or improper storage after the thermometer has left VWR's possession.

Two simple methods have been developed to reunite separated fluid in a thermometer column. If employed correctly, the reunited liquid column will be as good as new.

NOTE: For each method we suggest you wear safety glasses and gloves when working with glass instruments.



Cooling Method

Prepare a solution of shaved ice and salt or a solution of CO₂ (Dry Ice) and alcohol. Place the thermometer bulb only in the solution. Keep the thermometer upright. Allow the liquid column to retreat into the bulb, swing the thermometer (bulb down) in an arc forcing the entrapped gas above the column. Allow the thermometer to return to room temperature slowly in an upright position.

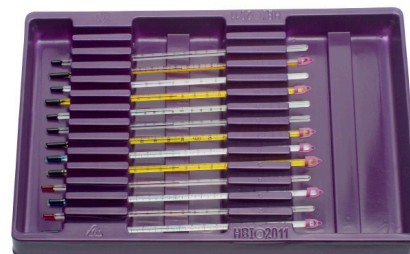
Heating Method

Heat the thermometer bulb in an upright position away from your face in warm liquid, air, or over a soft flame enough to allow the liquid column to rise slowly until the separated portion of the column enters the expansion chamber at the top of the thermometer. Note that applying heat for too long will over-fill the expansion chamber which will break the thermometer. Tap the thermometer bulb gently on the tabletop in an upright position allowing the gas separating the column to rise above the column. Allow the thermometer to cool slowly in an upright position.

To see a video on these methods of reuniting thermometers visit: <http://www.youtube.com/watch?v=ZDM3U7IPLXk>

What is the best way to store a liquid thermometer?

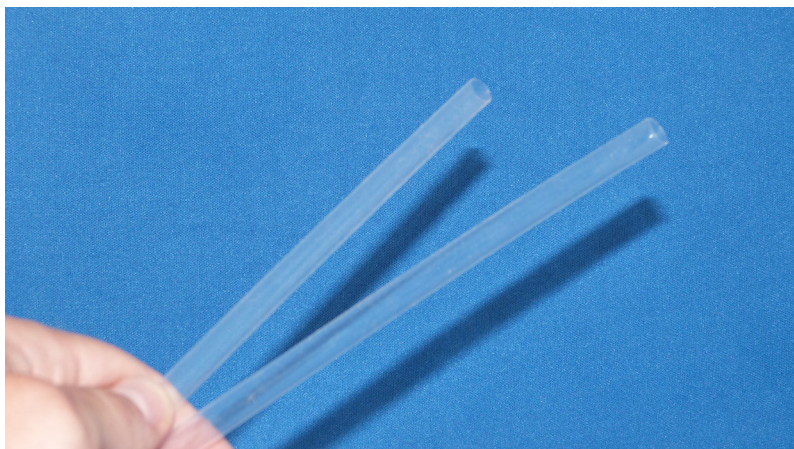
It is best to store thermometers vertically (in an upright position) or at an angle of at least 15° or more. Use a special tray or rack to store thermometers properly. Such options are very inexpensive and will help to eliminate liquid separation in thermometers. Unfortunately in real life, many thermometers are stored horizontally, usually in a drawer. Over time, this can lead to a separation in the liquid column, not to mention possible breakage from impact with other objects.



Safety Related Questions

What is PFA Safety Coating? Why is it used to coat thermometers?

PFA stands for perfluoroalkoxy copolymer resin, which is a flexible, rubbery material with a low coefficient of friction. PFA Safety Coating is transparent and designed to make thermometers less prone to breakage. In the event that the thermometer *does* break, the glass and liquid within is contained by the PFA Safety Coating. This prevents sample contamination and injury by either broken glass or liquid fill.



Does PFA safety coating affect the accuracy of a thermometer?

PFA Safety Coating does not affect the accuracy of a thermometer. But PFA Safety Coating may slow the response time of the liquid column to reach equilibrium temperature. Therefore, PFA Safety Coated thermometers are not recommended for applications involving timed tests.

Which thermometers can be PFA Safety Coated?

Any glass thermometer can be PFA Safety Coated provided it is designed to be used to measure temperatures below 260°C. VWR offers some thermometers with PFA safety coating and also provides custom PFA safety coating for select thermometers.

To see a video on the whole story of PFA Safety Coating visit: <http://www.youtube.com/watch?v=8YMoIWqo9M>

What are the different types of liquids used in liquid-in-glass thermometers?

There are many different liquids used in thermometers that range in environmental safety.

1. **Enviro-Safe**[®] liquid - (exclusive to VWR) is a non-toxic mixture of biodegradable citrus liquid and a green, non-toxic dye. This liquid is used in **Enviro-Safe**[®], **Easy-Read**[®], **Double-Safe**[™] and **FRIO-Temp**[®] thermometers.
2. Mineral Spirits - Petroleum hydrocarbon, clear odorless liquid with a petroleum odor, usually mixed with blue, red or green colored dye.
3. Mercury - Metal, molecular formula: Hg, an odorless, silvery liquid with a metallic luster. Mercury based thermometers are banned from certain states because they are toxic.
4. Mercury/Gallium - Mercury and Gallium amalgam which increases the temperature range by increasing the mercury boiling point (used in thermometers up to 620°C). Mercury based thermometers are banned from certain states because they are toxic.
5. Mercury/Thallium - Mercury and Thallium amalgam which lowers the temperature range of mercury to below -40°C by lowering the solidification point of mercury. Mercury based thermometers are banned from certain states because they are toxic.



To see a video on these different liquids visit: <http://www.youtube.com/watch?v=OiMkMzf4loI>

Why are **Enviro-Safe**[®] Thermometers safe?

The liquid inside an **Enviro-Safe**[®] thermometer has been certified environmentally friendly by an independent third party, *EnviroKleen[™]. **Enviro-Safe**[®] liquid consists of a mixture of biodegradable citrus oil and a green, non-toxic dye. The liquid is non-hazardous and is considered extremely safe in any working environment. This eliminates dangers for the user and eliminates any disposal concerns. Check the [Material Safety Data Sheet](#) for complete details. There is no thermometer like this anywhere!



*EnviroKleen[™] "Green" Certification Program was developed in order to identify the products that have the least negative impact on the environment and are safe for personal/commercial/industrial use.