



Facts about Thermometers and Temperature

These facts are based on the top inquiries
from our 1-800-4-TEST-LAB toll-free line

The solutions come from our experts

Your inquiries are welcome!



H-B Thermometer Facts: Handle With Care



Fact #1: All thermometers can separate; it is in their nature

Solution: Proper shipping and storage of thermometers can help prevent separation

When shipping thermometers, pack them on an angle using packing peanuts & bubble wrap. This will also prevent thermometer breakage.

Store all thermometers at an angle with the bulb lower than the expansion chamber. H-B Instrument offers two storage trays with a built in angle for proper storage.



Size

Three slots, set of five
Fourteen slots, set of two

Dimensions

4 x 17 x 1¼"
17.4 x 13.4 x 1.2"

Cat. No.

31297
31295

Fact #2: In the event of separation, thermometer liquid can be reunited

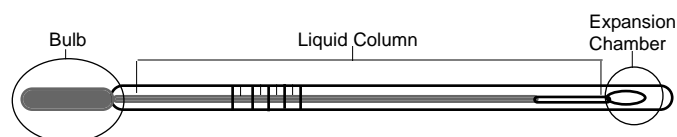
Solution: Our reuniting instructions can help get your thermometer up and working again in no time (Always wear safety glasses & gloves):

Cooling Method

1. Prepare a solution of shaved ice and salt or CO₂ (dry ice) and alcohol
2. Place the thermometer bulb in the solution, keeping the thermometer upright
3. Allow the liquid column to retreat into the bulb
4. Swing the thermometer (bulb down) in an arc, forcing the trapped gas to rise above the column
5. Allow the thermometer to warm slowly in an upright position

Heating Method

1. Heat the thermometer bulb in an upright position in warm liquid, warm air, or over a flame
2. Allow the liquid column to rise until the separated portion of the column enters the expansion chamber (NOTE: Over-filling the expansion chamber will break the thermometer)
3. With the thermometer in an upright position, gently tap it allowing the gas separating the column to rise above the column
4. Allow the thermometer to cool slowly in an upright position



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Fact #3: If not used properly, thermometers can give inaccurate readings

Solution: Total immersion thermometers must be immersed to the level of the liquid you are measuring. Whereas partial immersion thermometers must be immersed to the line marked on the thermometer.*

The main difference between total and partial immersion is the method in which they are calibrated and how they are used. Thermometers calibrated for total immersion are accurate when the thermometer is immersed to the liquid level in the capillary. For example, if using a total immersion thermometer for measuring atmospheric temperature, semi-solids or liquids, the thermometer must be immersed to the tip or meniscus of the liquid column. Simply put, immerse the thermometer to the temperature point you are trying to measure. Thermometers calibrated for partial immersion are accurate when the thermometer is immersed to a specific depth, such as 76mm. Partial immersion is appropriate for any application where total immersion is impractical or impossible, as in a shallow water bath.

If total immersion thermometers are used at partial immersion depths (or vice versa), inaccuracies will occur. These inaccuracies increase as the temperature increases.

* In a rare case you need to use a partial immersion thermometer in a total immersion application, corrections for emergent stem must be obtained to achieve an accurate reading.

Fact #4: Calibrated and certified thermometers are not the same

Solution: All thermometers are calibrated, but not all thermometers are certified.

In order to manufacture a thermometer, the instrument must be **calibrated** against a reference standard. **Calibration** during manufacturing establishes the guidelines for line and number placement.

If a thermometer is **certified** this means that after the instrument is manufactured, it is once again individually calibrated against a reference standard at a specific point or points along the scale. The results of this special second calibration are recorded on an official report from the manufacturer. This report accompanies the certified thermometer when purchased.

Fact #5: Thermometers may need to be recalibrated; does yours needs it?

Solution: There are several reasons why thermometers may need to be re-calibrated:

1. ISO 9000, Quality Control, and other regulations require Reports of Calibration for thermometers
2. Reports of Calibration with corrections allow one to calibrate or check other thermometers within certain tolerances
3. There is a need to know how accurately a thermometer is reading or if it is still accurate to specifications
4. There is a need to know, for an application, what the thermometer is reading to a high degree of accuracy or between divisions

H-B Instrument offers a very successful calibration program. Call 1-800-4-TEST-LAB for details.

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Fact #6: A Statement of Accuracy is different from a Report of Calibration

Solution: All *Enviro-Safe*®, *Easy-Read*®, *Double-Safe*™ and FRIO-Temp® thermometers are supplied with a Statement of Accuracy, stating that the thermometers were calibrated against a reference standard traceable to NIST (National Institute of Standards and Technology). This calibration shows that the thermometer has a scale error/tolerance within ± 1 to 2 scale divisions (depending on its range) over the entire length of the thermometer scale. There is no expiration date on this report since a properly manufactured thermometer will maintain its given accuracy as long as it is stored, handled and utilized correctly. Since specific temperature points are not tested, this is NOT a certified instrument.

Some applications require that certain thermometers be calibrated at distinct temperature points. This is done AFTER the thermometer is already manufactured. These thermometers are tested against NIST and DKD standards and a scale error is given at those temperature points showing the uncertainty of the measurement to one-tenth of the smallest division. A laminated Report of Calibration is supplied with every certified instrument stating this information. NIST recommends annual re-certification.

Fact #7: Thermometers come with a variety of liquid options, which can get confusing

Solution: **Mercury:** Metal, molecular formula: Hg, an odorless, silvery liquid with metallic luster

Mineral Spirit: Petroleum hydrocarbon, clear odorless liquid with a petroleum odor, usually mixed with blue, red or green colored diazo dye.

Enviro-Safe®: A mixture of biodegradable citrus oil (hydrocarbon) and a green, non-toxic dye (Monoazo-Anthroquinone Dye). This is
100% non-toxic • non-hazardous • biodegradable liquid

Mercury/Gallium Amalgam: Increases the temperature range by lowering the mercury boiling point (used in thermometers up to 620°C).

Mercury/Thallium Amalgam: Lowers the freezing point of mercury to below -40°C by lowering the mercury solidification point

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Fact #8: Not all thermometer liquids are non-toxic

Solution: *Enviro-Safe*® thermometers are 100% non-toxic, non-hazardous and biodegradable. The liquid inside our Enviro-Safe thermometers consists of a mixture of biodegradable citrus oil and a green, non-toxic dye. The liquid is non-hazardous and is considered extremely safe for 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!

Fact #9: Sometimes contamination of any sort can be detrimental to your sample

Solution: Teflon is a special material developed by E.I. DuPont de Nemours Company. Teflon coating involves encapsulating a thermometer within a thin layer of Teflon. Since the material is transparent when applied, you are still able to read the thermometer scale and liquid column. The main purpose of Teflon coating is safety. Once a thermometer is coated it becomes less sensitive to breakage. In the event that the thermometer does break, the liquid in the thermometer and the glass itself is contained within the Teflon. This reduces the hazards if the thermometer liquid is mercury.

Teflon coating does not affect the accuracy of a thermometer. But Teflon may slow the response time of the liquid column to reach equilibrium temperature. Teflon-coated thermometers are not recommended for applications involving timed tests.

Any glass thermometer can be Teflon coated if its range does not exceed 260°C.

Fact #10: ASTM thermometers are manufactured and designed for specific tests, but may also be used in various other applications

Solution: ASTM stands for the American Society for Testing and Materials. ASTM is an independent, private organization that establishes and publishes standards for use in industry. ASTM established thermometer standards suited for special applications. Thermometers are assigned ASTM numbers according to the specifications. Thermometers designed for specific tests may also be useful in various other applications. Therefore, it is possible to purchase an ASTM thermometer for your specific application although it was designed for another application. ASTM thermometers are manufactured to rigid standards.

NOTE: The ASTM Precision series are designed for universal applications. They are certified at five points and a Report of Calibration from the manufacturer accompanies each thermometer.

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Fact #11: Conversions are simple

Solution: For °F to °C and vice versa:

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

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

For the most common thermometer lengths:

$$203\text{mm} = 8''$$

$$305\text{mm} = 12''$$

$$405\text{mm} = 16''$$

For inches to mm:

Multiply total inches by 25.4

$$\text{ex: } 8'' \times 25.4 = 203.2 \text{ mm}$$

For mm to inches:

Divide total mm by 25.4

$$\text{ex: } 203\text{mm} / 25.4 = 7.99''$$

Fact #12: If you have any further questions we are just a phone call away

Solution: Call **1-800-TEST-LAB** and we will answer all of your thermometer needs.