

THERMOMETERS

Another major cause of foodborne illness in restaurants is time-temperature abuse of potentially hazardous food. This is when potentially hazardous food is at temperatures between 41° (5°C) and 135°F (57°C) -- the temperature danger zone -- for four hours or longer. When food is in this temperature range for more than four hours, harmful bacteria can grow and multiply.

The best way to avoid time-temperature abuse is to minimize the amount of time that potentially hazardous food is in the temperature danger zone. Do so by:

- periodically checking the temperature of potentially hazardous food during storage, after cooking, and while holding before serving.
- monitoring how long potentially hazardous food is in the temperature danger zone particularly after it is removed from temperature control (such as taking it out of the refrigerator or removing it from an oven);
- placing thermometers in refrigerators and hot-holding cabinets;
- using properly calibrated food thermometers to check food temperatures;
- regularly recording temperatures and the times they are taken; and
- preparing procedures to take (also known as corrective actions) when time-temperature abuse of a food occurs.

Different Types of Food Thermometers

Bimetallic Stemmed Thermometer. This is the most common and versatile type of thermometer used in a restaurant. It should have: an adjustable calibration nut to keep it accurate; easy-to-read numbered temperature markings; a dimple to mark the end of the sensing area; and accuracy. This food thermometer measures the temperature of a food in about 15 to 20 seconds. It is not designed to remain in the food while the food is cooking. Rather it should be used near the end of cooking to check the internal temperature of the food.

The probe of the thermometer must be inserted the full length of the sensing area (usually 2 to 3 inches) to get an accurate temperature reading. If measuring the temperature of a thin food, such as a hamburger patty or boneless chicken breast, the probe should be inserted through the side of the food so that the entire sensing area is positioned through the center of the food.

Thermocouples and Thermistors. These types of thermometers measure temperatures through a metal probe or sensing area and results are displayed on a digital readout. Of all food thermometers, thermocouples read and display the final temperature the fastest, within 2 to 5 seconds.

Because thermocouple thermometers are so quick, the temperature can be easily checked in a number of locations to ensure food is properly cooked. This is especially useful when cooking large foods, such as roasts or turkeys, because checking the temperature in more than one place is recommended. The thin probe of the thermocouple also enables it to accurately read the temperature of thin foods, such as hamburger patties, pork chops, and chicken breasts.

Infrared Thermometer. An infrared thermometer is used to measure surface temperatures. It cannot be used to measure the internal temperature of a food.

Time-Temperature Indicators (TTI) and Other Time-Temperature Recording Devices. These are sometimes attached to the food packaging to determine if the food temperature has exceeded safe temperatures during shipment or storage. If the indicator shows that the temperature has exceeded a safe temperature, reject the food.

Single-use temperature indicators. One new type of “thermometer” is the disposable temperature indicator. Several brands are available and are very easy to use. These temperature indicators are designed for specific temperature ranges, such as between 160°F (71°C) and 170°F (77°C). The sensors on disposable thermometers are made from special temperature-sensitive materials. The sensor is inserted into a food. When the food reaches the proper temperature, the sensor changes color. They are designed to be used only once. However, if the desired temperature has not been reached, they can be reinserted until the temperature is reached. These sensors cannot be left in a food while it is cooking. They should be used near the end of cooking.

Refrigerator/freezer thermometers. It is important to check the temperature of refrigerators and freezers at least once a day. Refrigerators should be set no higher than 39°F (4°C). Frozen food maintains best quality for the longest time when the freezer is at 0°F (-18°C) or colder. Place at least one refrigerator/freezer thermometer in the warmest location of the refrigerator, on the top shelf near the door.

General Thermometer Guidelines

- Keep thermometers and their storage cases clean.
- Calibrate thermometers every day or every time they are dropped to ensure accuracy. This only applies to bimetallic stemmed thermometers as the other types of thermometers must be returned to the manufacturer for calibration.
- Never use a glass thermometer that is filled with mercury or spirits to monitor the temperature of food.
- Measure the internal temperature of a food by inserting the thermometer stem or probe into the thickest part.
- Wait 30 seconds or until the indicator stops moving before recording the temperature.

How to Calibrate Bimetallic Stemmed Thermometers

Calibration is the process of checking the accuracy of a bimetallic stemmed thermometer. Read the manufacturer instructions to determine how to calibrate other types of thermometers. Generally many have to be returned to the manufacturer to be calibrated. Calibrate all food thermometers at least once a day or every time it is dropped.

Two accepted methods for calibration are the boiling-point method and ice-point method. Both are described below.

Boiling-point method (This method can only be used if your elevation is 1,000 feet or less. If you do not know your elevation, it is best to check the accuracy of your thermometers using the ice-point method.)

1. Boil clean tap water in a deep pot.
2. Put the thermometer stem or probe into the boiling water so the sensing area is completely submerged.
3. Wait 30 seconds or until the indicator stops moving.
4. If the temperature is at 212°F (100°C) then remove the thermometer. It is ready for use.

-
5. If the temperature is not at 212°F (100°C), hold the calibration nut securely with a wrench or other tool and rotate the head of the thermometer until it reads 212°F (100°C) or the appropriate boiling-point temperature for your elevation.

Ice-point method

1. Fill a large container with crushed ice. Add clean tap water until the container is full.
2. Put the thermometer stem or probe into the ice water so the sensing area is completely submerged. Wait 30 seconds or until the indicator stops moving.
3. If the temperature is at 32°F (0°C), then remove the thermometer. It is ready for use.
4. If the temperature is not at 32°F (0°C), then hold the calibration nut securely with a wrench or other tool and rotate the head of the thermometer until it reads 32°F (0°C).

Measuring Food Temperatures

Temperature readings will only be correct if the thermometer is placed in the proper location in the food. If not inserted correctly, or placed in the wrong area, the reading on the food thermometer will not accurately reflect the internal temperature of the food. In general, place the food thermometer in the thickest part of the food, away from bone, fat, or gristle.

Before using a food thermometer, read the manufacturer's instructions. The instructions should tell how far the thermometer must be inserted in a food to give an accurate reading. If instructions are not available, check the stem of the food thermometer for an indentation, or "dimple." This shows one end of the location of the sensing device. Dial thermometers must be inserted about 2 to 3 inches into the food. For most digital thermometers, one only needs to a small area of the tip to get an accurate reading.

Where to Place the Thermometer

Meat. When taking the temperature of beef, pork, or lamb roasts, place the food thermometer midway in the roast, away from the bone. When cooking hamburgers, steaks, or chops, insert a thermistor or thermocouple in the thickest part of the meat, away from bone, fat, or gristle. If using a bimetallic stemmed thermometer, see "Thin foods" below. When cooking irregularly shaped food, such as a beef roast, check the temperature in several places.

Poultry. When cooking whole poultry, the food thermometer should be inserted into the thickest part of the thigh (avoiding the bone). If the poultry is stuffed, the center of the stuffing should be checked after the thigh reads 180°F (82°C), stuffing must reach 165°F (74°C). If cooking poultry parts, insert food thermometer into the thickest area, avoiding the bone. The food thermometer may be inserted sideways if necessary. When the food is irregularly shaped, the temperature should be checked in several places.

Thin foods. When measuring the temperature of a thin food, such as a hamburger patty, pork chop, or chicken breast, use a thermistor or thermocouple food thermometer if possible. However, if an "instant-read" dial bimetallic-coil food thermometer is used, the probe must be inserted into the side of the food so that entire sensing area (usually 2-3 inches) is positioned through the center of the food. To avoid burning fingers, it may be helpful to remove the food from the heat source (if cooking on a grill or in a frying pan) and insert the food thermometer sideways after placing the item on a clean spatula or plate.

Combination dishes. For casseroles and other combination dishes, place the food thermometer into the thickest portion of the food or the center of the dish. Egg dishes and dishes containing ground meat and poultry should be checked in several places.

Thermometer care

The probe or stem of a thermometer must be cleaned and sanitized before it is used. Wash carefully by hand with hot soapy water. Never immerse the entire thermometer in water as it will ruin it. After washing the stem or probe, dip it in a properly prepared sanitizing solution before use. If only measuring the temperature of ready-to-eat food, the probe or stem only needs to be cleaned, and not sanitized, between uses.

Prepared by:

Angela M. Fraser, Ph.D., Associate Professor/Food Safety Specialist
Department of Family and Consumer Sciences
NC State University, Raleigh, NC 27695-7605

The material in this fact sheet, unless otherwise identified, is based upon work supported by the Extension Service, U.S. Department of Agriculture, under special project number 2003-51110-01715, the National Integrated Food Safety Initiative of the Integrated Research, Education, and Extension Competitive Grants Program. For more information, contact Dr. Angela Fraser at 919-515-9150 or at angela_fraser@ncsu.edu.

Employment and program opportunities are offered to all people regardless of race, color, national origin, sex, age, or disability through North Carolina State University, North Carolina A & T State University, U.S. Department of Agriculture, and local governments cooperating.