Introduction:
Many things can happen to a product on its path through the establishment— from purchasing and receiving, through storage, prep, cooking, holding, cooling, thawing, reheating and serving— known as the flow of food. The safety of the food you serve at your establishment will depend largely on your understanding of food safety concepts throughout the flow of food, especially the prevention of cross-contamination and time and temperature control. It also depends largely on your ability to develop a system that prioritizes, monitors and verifies the most important food safety practices.

Preventing Cross-Contamination
A major hazard to the flow of food in your operation is cross-contamination, which is the transfer of microorganisms from one food surface to another. They can be transferred from food on unwashed hands to prep tables, equipment, utensils, cutting boards, dish towels, sponges or other foods. Cross-contamination can occur at almost any point in an operation. Prevention starts with the creation of barriers between food products. These barriers can be physical or procedural.

Physical Barriers for Preventing Cross-Contamination
- Assign specific equipment to each type of product, for example, color coded cutting boards - this does not eliminate the need to follow proper practices, such as cleaning and sanitizing
- Clean and sanitize all work surfaces, equipment and utensils after each task - make sure employees know which cleaners and sanitizers to use for each job. Sanitizers used for food contact surfaces must meet local or state codes.

Procedural Barriers for Preventing Cross-Contamination
- When using the same prep tables, prepare raw and ready-to-eat foods at different times
- Purchase ingredients that require minimal preparation

Time and Temperature Abuse
Another big factor in foodborne illness outbreaks is time and temperature abuse. Disease causing microorganisms grow and multiply at temperatures between 41°F and 135°F, which is why this range is known as the temperature danger zone. Whenever food is in the temperature danger zone, it is being abused. To keep food safe throughout the flow of food, you must minimize the amount of time it spends in the danger zone. Common opportunities for time temperature abuse of food include:
- Not cooking food to its minimal internal temperature
- Not cooling food properly
- Failing to reheat food to 165°F for fifteen seconds within two hours
- Failing to hold food at a minimum internal temperature of 135°F or higher, or 41°F or lower

Employ the following procedures to avoid time temperature abuse:
- Decide the best way to monitor time and temperature in your establishment - determine which foods should be monitored, how often and by whom. Then assign responsibilities to employees in each area.
- Make sure the establishment has the right kind of thermometers available in the right places
- Regularly record temperature and the times they are taken, Print simple forms employees can use to record temperatures and times throughout the shift.
• Incorporate time and temperature controls into standard operating procedures for employees. These might include:
  o Removing from the refrigerator only the amount of food that can be prepared in a short period of time.
  o Refrigerating ingredients and utensils before preparing certain recipes, such as tuna or chicken salad.
  o Cooking potentially hazardous foods to minimum internal temperatures.
• Develop a set of corrective action - decide what action should be taken if time and temperature standards are not met.

Monitoring Time and Temperature
To manage both time and temperature, you need to monitor and control them. The thermometer may be the single most important tool you have to protect your food.

Choosing the Right Thermometer
There are many types of thermometers used in an operation. Each is designed for a specific purpose. Some are used to measure the temperature of refrigerated or frozen storage areas. Others measure the temperature of equipment, such as ovens or ware washing machines. Perhaps the most important types are thermometers that measure the temperature of food. The most common types used in establishments are the bimetallic stemmed thermometer, the thermocouple and the thermistor. Infrared thermometers are also becoming increasingly popular.

Bimetallic Stemmed Thermometer
The most common and versatile type of thermometer used in the restaurant and foodservice industry is the bimetallic stemmed thermometer. This type of thermometer measures temperature through a metal probe with a sensor in the end. These thermometers often have scales from 0oF to 220oF. this makes them useful for measuring temperatures of everything from incoming shipments to the internal temperature of food in hot-holding units. When you select this type of thermometer, 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
  • accuracy to within \( \pm 2oF \)

Thermocouples and Thermistor
These measure temperatures through a sensing area on the tip of a metal probe and display the results on a digital readout. This means that you do not have to insert them into food to get a correct reading. Many come with interchangeable temperature probes designed to measure the temperature of food and equipment (see page 5-5). For example, an immersion probe to check liquids (soups and sauces); surface probe - used to check flat cooking equipment; penetration probe - check internal temperature of thin food, such as hamburger patties or fish filets; air probe - check temperatures inside refrigerators and ovens.
Infrared Thermometers

Infrared thermometers use infrared technology to produce accurate temperature readings of food and equipment surfaces. Infrared thermometers are noncontact thermometers that, when used properly, can reduce the risk of cross-contamination. When using infrared thermometers, remember:

- Infrared thermometers should not be used to measure air temperature or the internal temperature of food. They are designed to measure surface temperature only.
- Do not take temperature measurements through glass or shiny or polished metal surfaces such as stainless steel or aluminum.

Time Temperature Indicators (TTI's) and Other Time Temperature Recording Devices

Some instruments are designed to monitor both time and product temperature. The time temperature indicator is one example. Some suppliers attach these self-adhesive tags or sticks to a food shipment to determine if the product’s temperature has exceeded safe limits during shipment or later storage. If the product’s temperature has exceeded these limits, the TTI provides an irreversible record of the incident. A change in color inside the TTI window notifies the receiver that the product has undergone time temperature abuse.

General Thermometer Guidelines

It is important to know how to use and care for each type of thermometer found in your establishment. Keep these in mind:

- Keep thermometers and their storage containers clean. Thermometers should be washed, rinsed and sanitized before each use.
- Calibrate thermometers regularly to ensure accuracy (± 2oF)
- Calibrate thermometers whenever dropped or bumped
- Never use glass thermometers filled with mercury or spirits to monitor food temperature
- Glass thermometers can become a physical hazard if they break. They must be enclosed in a shatterproof casing if used.
- Measure internal temperature of food by inserting the thermometer stem or probe into the thickest part of the product.
- When using a bimetallic stemmed thermometer, insert the stem all the way into the food up to the dimple to ensure accurate readings
- Wait for the thermometer’s reading to steady before recording the temperature

How to Calibrate Thermometers

Calibration is the process of ensuring that a thermometer gives accurate readings by adjusting to a known standard. There are two methods commonly used:

- Boiling Point Method
- Ice Point Method
  1. Fill a deep container with ice
  2. Add water to make a slurry
  3. Insert thermometer, do not let it touch the sides or the bottom of the container
  4. Wait for needle to steady
  5. Adjust to 32oF, using tool to turn calibration nut