



chapter 4

The Flow of Food: An Introduction

Hazards in the Flow of Food	Monitoring Time and Temperature	
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((NEWS)) University Outbreak

An outbreak of *Salmonella* spp. sickened 32 visitors to a university located in the northeastern United States. The sickened guests had attended a luncheon hosted by the chancellor during graduation weekend. Reports of illness flooded the local media, the university's on-campus clinic, and the local regulatory authority. Symptoms included stomach pain, nausea, diarrhea, chills, and vomiting.

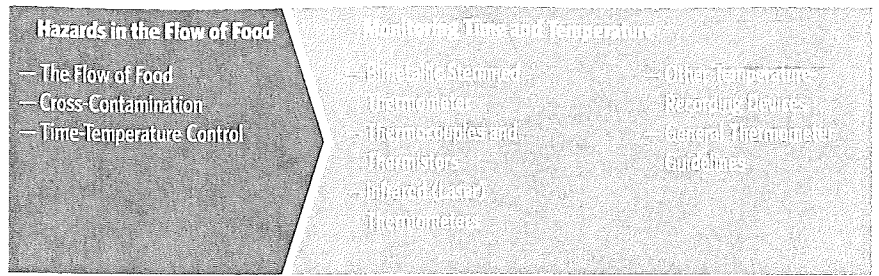
It was determined that a new food handler at the dining facility had cross-contaminated romaine lettuce used for a chicken Caesar salad served at the luncheon. In her haste to catch up during a busy shift, the food handler chopped the lettuce on a cutting board that had been used to prep raw chicken for the salad. The cutting board had not been cleaned and sanitized between uses.

The university's contractor for foodservice announced that they would work closely with the local inspector to correct the problem. They would also immediately implement a program that would prevent cross-contamination in the future.

You Can Prevent This

As you can see in the story above, preventing cross-contamination is critical for keeping food safe. But you must also control time and temperature when handling food. In this chapter, you will learn about the following tools and practices to help you keep food safe.

- Preventing cross-contamination
- Preventing time-temperature abuse
- Using the correct kinds of thermometers to take temperatures












Hazards in the Flow of Food

To keep food safe, you must apply what you learn in the ServSafe program throughout the flow of food. This requires a good understanding of how to prevent cross-contamination and time-temperature abuse.

The Flow of Food

The path that food takes through your operation is called the flow of food. It begins when you buy the food and ends when you serve it.

	Purchasing	chapter 5
	Receiving	chapter 5
	Storing	chapter 5
	Preparation	chapter 6
	Cooking	chapter 6
	Holding	chapter 7
	Cooling	chapter 6
	Reheating	chapter 6
	Serving	chapter 7

You are responsible for the safety of the food at every point in this flow—and many things can happen to it.

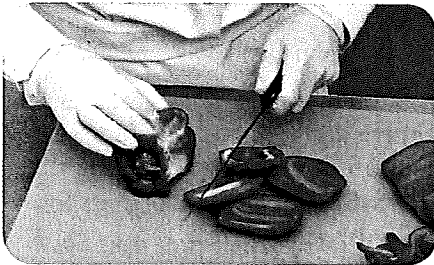
For example, a frozen food might be safe when it leaves the processor's plant. However, on the way to the supplier's warehouse, the food might thaw. Once in your operation, the food might not be stored correctly, or it might not be cooked to the correct internal temperature. These mistakes can add up and cause a foodborne illness.

Cross-Contamination

Pathogens can move around easily in your operation. They can be spread from food or unwashed hands to prep areas, equipment, utensils, or other food.

Cross-contamination can happen at almost any point in the flow of food. When you know how and where it can happen, it is fairly easy to prevent. The most basic way is to keep raw and ready-to-eat food away from each other.

Here are some guidelines for doing this.

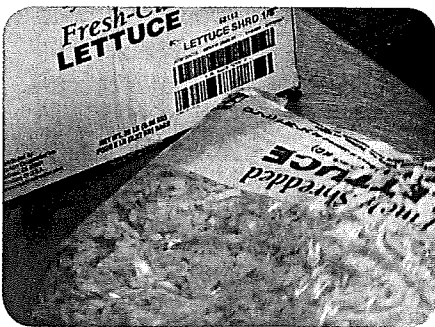


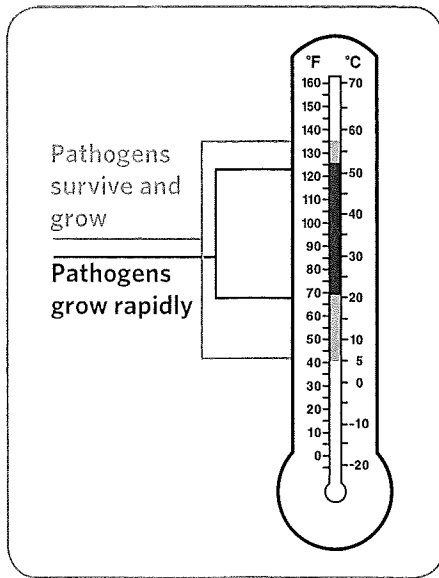
Using separate equipment Each type of food should have separate equipment. For example, use one set of cutting boards, utensils, and containers for raw poultry. Use another set for raw meat. Use a third set for produce. Colored cutting boards and utensil handles can help keep equipment separate. The color tells food handlers which equipment to use with each food item. You might use yellow for raw chicken, red for raw meat, and green for produce, as the prep chef is doing in the photo at left.

Cleaning and sanitizing Clean and sanitize all work surfaces, equipment, and utensils after each task. When you cut up raw chicken, for example, you cannot get by with just rinsing the equipment. Pathogens such as *Salmonella* spp. can contaminate food through cross-contamination. To prevent this, you must wash, rinse, and sanitize equipment. See chapter 10 for more information on cleaning and sanitizing.

Prepping food at different times If you need to use the same table to prep different types of food, prep raw meat, fish, and poultry; and ready-to-eat food at different times. You must clean and sanitize work surfaces and utensils between each type of food. For example, by prepping ready-to-eat food before raw food, you can minimize the chance for cross-contamination.

Buying prepared food Buy food that doesn't require much prepping or handling. For example, you could buy precooked chicken breasts or chopped lettuce, as shown in the photo at left.





Time-Temperature Control

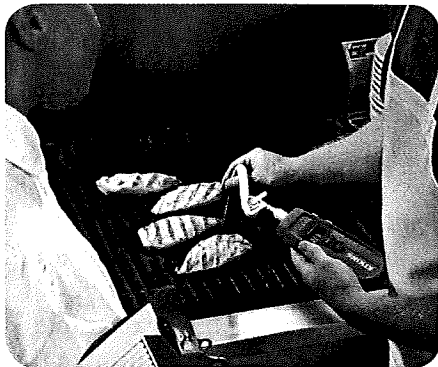
Most foodborne illnesses happen because TCS food has been time-temperature abused. Remember, TCS food has been time-temperature abused any time it remains between 41°F and 135°F (5°C and 57°C). This is called the temperature danger zone because pathogens grow in this range. But most pathogens grow much faster between 70°F and 125°F (21°C and 52°C). These ranges are shown at left. Food is being temperature abused whenever it is handled in the following ways.

- Cooked to the wrong internal temperature
- Held at the wrong temperature
- Cooled or reheated incorrectly

The longer food stays in the temperature danger zone, the more time pathogens have to grow. To keep food safe, you must reduce the time it spends in this temperature range. If food is held in this range for four or more hours, you must throw it out.

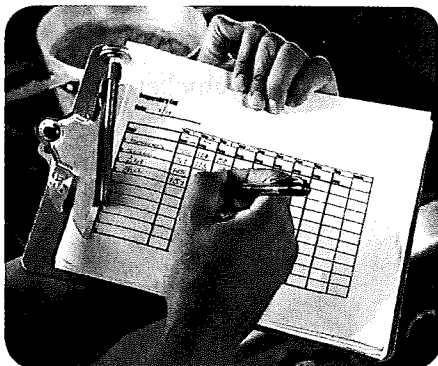
Avoiding Time-Temperature Abuse

Food handlers should avoid time-temperature abuse by following good policies and procedures.



Monitoring Learn which food items should be checked, how often, and by whom. Make sure food handlers understand what to do, how to do it, and why it is important. For example, the manager in the photo at left is making sure the cook can check the temperature of a chicken breast.

Tools Make sure the correct kinds of thermometers are available. Give food handlers their own thermometers. Have them use timers in prep areas to check how long food is in the temperature danger zone.



Recording Have food handlers record temperatures regularly, as the chef is doing in the photo at left. Make sure they write down when the temperatures were taken. Print simple forms for recording this information. Post them on clipboards outside of coolers and freezers, near prep areas, and next to cooking and holding equipment.

Time and temperature control Have procedures to limit the time food spends in the temperature danger zone. This might include limiting the amount of food that can be removed from a cooler when prepping it.

Corrective actions Make sure food handlers know what to do when time and temperature standards are not met. For example, if you hold soup on a steam table and its temperature falls below 135°F (57°C) after two hours, you might reheat it to the correct temperature or throw it out.

Hazards in the Flow of Food	Monitoring Time and Temperature	
<ul style="list-style-type: none"> - The Flow of Food - Cross-Contamination - Time-Temperature Control 	<ul style="list-style-type: none"> - Bimetallic Stemmed Thermometer - Thermocouples and Thermistors - Infrared (Laser) Thermometers 	<ul style="list-style-type: none"> - Other Temperature-Recording Devices - General Thermometer Guidelines

Monitoring Time and Temperature

To keep food safe, you must control the amount of time it spends in the temperature danger zone. This requires monitoring. The most important tool you have to monitor temperature is the thermometer. Three types are commonly used in operations.

- Bimetallic stemmed thermometers
- Thermocouples
- Thermistors

Bimetallic Stemmed Thermometer

A bimetallic stemmed thermometer, shown in the photo at left, can check temperatures from 0°F to 220°F (-18°C to 104°C). This makes it useful for checking temperatures during the flow of food. For example, you can use it to check food temperatures during receiving. You can also use it to check food in a hot- or cold-holding unit.

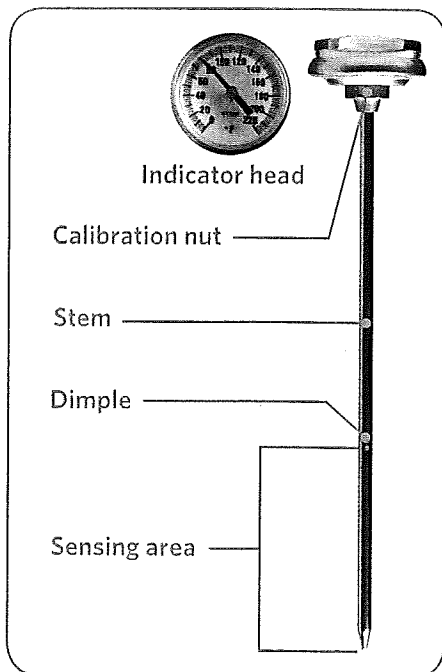
A bimetallic stemmed thermometer measures temperature through its metal stem. When checking temperatures, insert the stem into the food up to the dimple. You must do this because the sensing area of the thermometer goes from the tip of the stem to the dimple. This trait makes this thermometer useful for checking the temperature of large or thick food. It is usually not practical for thin food, such as hamburger patties.

If you buy these thermometers for your operation, make sure they have these features.

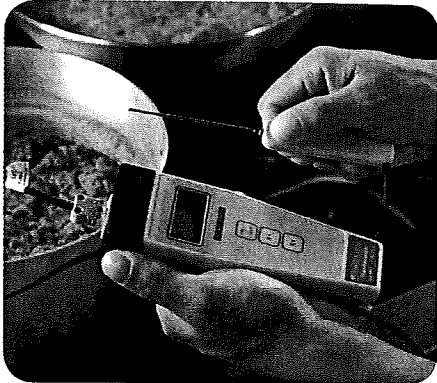
Calibration nut You can adjust the thermometer to make it accurate by using its calibration nut.

Easy-to-read markings Clear markings reduce the chance that someone will misread the thermometer. The thermometer must be scaled in at least two-degree increments.

Dimple The dimple is the mark on the stem that shows the end of the temperature-sensing area.

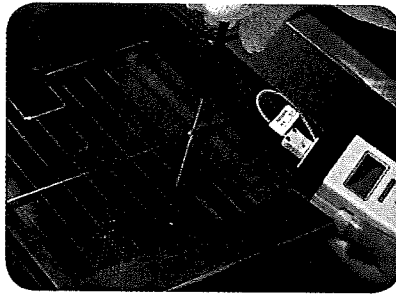


Thermocouples and Thermistors

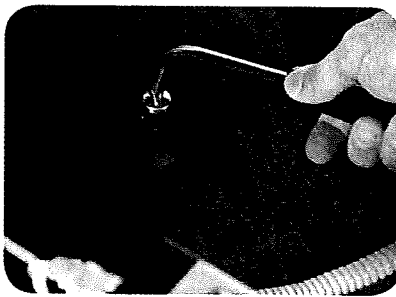


Thermocouples, such as the one in the photo at left, and thermistors are also common in operations. They measure temperatures through a metal probe. Temperatures are displayed digitally. The sensing area on thermocouples and thermistors is on the tip of their probe. This means you don't have to insert them into the food as far as bimetallic stemmed thermometers to get a correct reading. Thermocouples and thermistors are good for checking the temperature of both thick and thin food.

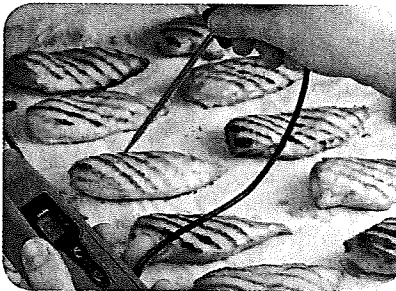
Thermocouples and thermistors come in several styles and sizes. Many come with different types of probes. The photos below show some basic types.



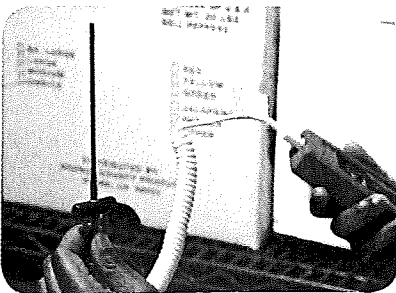
Immersion probes Use these to check the temperature of liquids. This could include soups, sauces, and frying oil.



Surface probes Use these to check the temperature of flat cooking equipment, such as griddles.



Penetration probes Use these to check the internal temperature of food. They are especially useful for checking the temperatures of thin food, such as hamburger patties or fish fillets.



Air probes Use these to check the temperature inside coolers and ovens.

Infrared (Laser) Thermometers



Infrared thermometers measure the temperatures of food and equipment surfaces. For example, the food handler in the photo at left is using one to measure the temperature of a grill top. These thermometers are quick and easy to use.

Infrared thermometers do not need to touch a surface to check its temperature. This means there is less chance for cross-contamination and damage to food. However, these thermometers cannot measure air temperature or the internal temperature of food.

Follow these guidelines for using infrared thermometers.

Distance Hold the thermometer as close to the food or equipment as you can without touching it.

Barriers Remove anything between the thermometer and the food, food package, or equipment. Do not take readings through metal, such as stainless steel or aluminum. Do not take readings through glass.

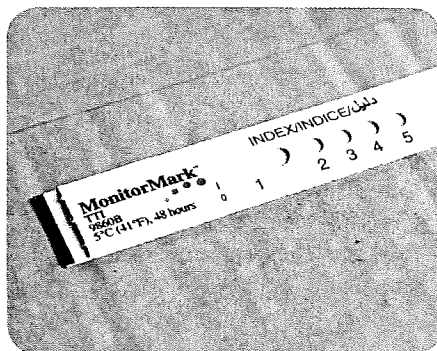
Manufacturer's directions Always follow the manufacturer's guidelines. This should give you the most accurate readings.

Other Temperature-Recording Devices

Other tools are available that can help you monitor temperature. A maximum registering thermometer is one type. This thermometer indicates the highest temperature reached during use and is used where temperature readings cannot be continuously observed. It works well for checking final rinse temperatures of dishwashing machines.

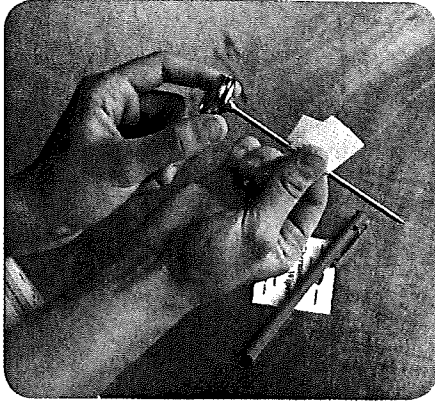
Some devices monitor both time and temperature. The time-temperature indicator (TTI), shown in the photo at left, is an example. These tags are attached to packaging by the supplier. A color change appears in the window if the food has been time-temperature abused during shipment or storage. This color change is not reversible, so you know if the food has been abused.

Some suppliers place temperature-recording devices inside their delivery trucks. These devices constantly check and record temperatures. You can check the device during receiving to make sure food was at safe temperatures while it was being shipped.



General Thermometer Guidelines

You should know how to use and care for each type of thermometer in your operation. In general, follow the guidelines below. However, you should always follow manufacturers' directions.

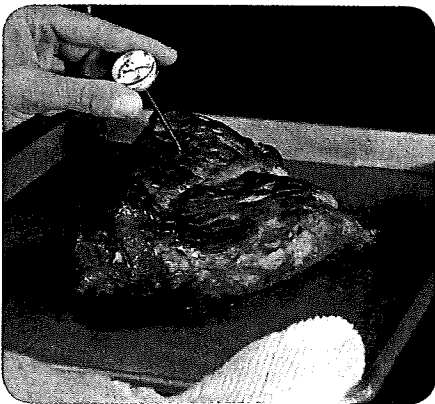


Cleaning and sanitizing Thermometers must be washed, rinsed, sanitized, as seen in the photo at left, and air-dried. Keep storage cases clean, too. Do these things before and after using thermometers to prevent cross-contamination. Be sure the sanitizing solution you use is for food-contact surfaces. Always have plenty of clean and sanitized thermometers on hand.

Calibration Thermometers can lose their accuracy when they are bumped or dropped. It can also happen when they go through severe temperature change. When this happens, the thermometer must be calibrated, or adjusted, to give a correct reading. Make sure your thermometers are accurate by calibrating them regularly. You should do this before each shift. You should also do this before the first delivery arrives. Some thermometers cannot be calibrated and must be replaced. Others will need to be sent back to the manufacturer for calibration. Follow the manufacturer's directions regarding calibration.

Accuracy Thermometers used to measure the temperature of food must be accurate to $\pm 2^{\circ}\text{F}$ or $\pm 1^{\circ}\text{C}$. Thermometers used to measure air temperature in food-storage equipment must be accurate to $\pm 3^{\circ}\text{F}$ or $\pm 1.5^{\circ}\text{C}$. A hanging thermometer in a walk-in cooler is an example.

Glass thermometers Glass thermometers, such as candy thermometers, can be a physical contaminant if they break. They can only be used when enclosed in a shatterproof casing.



Checking temperatures When checking the temperature of food, insert the probe into the thickest part of the food, as shown in the photo at left. This is usually in the center. Also, take another reading in a different spot. The temperature may vary in different areas.

Before recording a temperature, wait for the thermometer reading to steady. While digital thermometers are capable of displaying the temperature instantly, bimetallic stemmed thermometers will take more time. Allow at least 15 seconds after you insert the thermometer stem into the food.

Apply Your Knowledge**Pick the Correct Thermometer**

For each situation, choose the best thermometer or thermometers. Some thermometers may be chosen more than once. Write the letter or letters in the space provided.

- | | |
|--|---------------------------------------|
| ① _____ Internal temperature of a chicken breast | Ⓐ Bimetallic stemmed thermometer |
| ② _____ Internal temperature of a roast | Ⓑ Thermocouple with immersion probe |
| ③ _____ Internal temperature of a large stockpot of soup | Ⓒ Thermocouple with surface probe |
| ④ _____ Surface temperature of a grill | Ⓓ Thermocouple with penetration probe |
| ⑤ _____ Air temperature of a cooler | Ⓔ Thermocouple with air probe |
| | Ⓕ Infrared thermometer |

For answers, please turn to page 4.14.

Summary

- The flow of food is the path food takes in your operation from purchasing to service. Many things can happen to food in its flow through the operation. Two major concerns are cross-contamination and time-temperature abuse.
- To prevent cross-contamination, use separate equipment for each type of food. Also, you must clean and sanitize all work surfaces, equipment, and utensils after each task. Prepping ready-to-eat food before raw meat, poultry, and fish is one way to minimize the chance for cross-contamination. Similarly, you can buy food items that don't require much preparation or handling.
- Time-temperature abuse happens any time food remains between 41°F and 135°F (5°C and 57°C). This range is called the temperature danger zone. You must try to keep food out of this range.
- A thermometer is the most important tool you can use to prevent time-temperature abuse. You should regularly record food temperatures and the times they were taken.
- Always put the thermometer stem or probe into the thickest part of the food. A bimetallic stemmed thermometer should be put into food from the tip to the end of the sensing area. Before you record the temperature, wait for the thermometer reading to steady. Never use glass thermometers with food items unless they are enclosed in a shatterproof casing.
- Thermometers should be calibrated regularly. Most important, they must be cleaned and sanitized before and after each use.