



University of California
Cooperative Extension

Master Food Preserver

Pressure Canning Vegetables

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Presented by UCCE Master Food Preserver Program of Central Sierra

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<http://ucanr.edu/mfpcs>

UC Master Food Preserver Program Mission: To teach research-based practices of safe home food preservation to the residents of California.

Resource Websites:

- National Center for Home Food Preservation: <http://nchfp.uga.edu>
- UC ANR Publications: <http://anrcatalog.ucanr.edu>
- Ball: <http://freshpreserving.com>

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Section 1: The Kitchen

- Food Safety Basics
- pH Values of Foods
- Temperature Gauge for Food Preservation
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Food Safety Basics

The quality of food is judged by wholesomeness, its nutritional value, and our expectations of its color, flavor, odor, and texture. The quality of preserved food varies greatly and depends mostly on the quality of the fresh food and preservation methods. High quality preserved foods are free from microbial spoilage and toxins, are pleasing to eat, and are reasonably nutritious.

Causes of Food Spoilage & Deterioration

Food spoilage is the process of food becoming unsafe or unacceptable for human consumption. There are five general causes of food deterioration:

Microbial Spoilage

The most common cause of food spoilage is the growth of bacteria, molds, or yeast that are naturally occurring microscopic organisms. Thousands of species exist in nature and are widely found in the soil, water, and air.

- **Bacteria:** There is a full spectrum of bacteria from desirable to deadly. *Lactobacillus* is a desirable bacteria involved in fermentation processes to produce cheese, pickles, and sauerkraut. An example of a “bad” or pathogenic bacteria is *Clostridium botulinum*, which under the right circumstances causes botulism poisoning, a very serious and sometimes deadly illness. Proper canning of low-acid foods (vegetables, fish, meat) by using a pressure canner is required to kill this odorless, tasteless, and colorless toxin.
- **Molds:** Molds grow on most foods and are easily recognized by their masses of fuzzy growth in a variety of colors. The roots of mold can spread invisibly through soft foods, thus removing the surface mold does not eliminate mold from the food. Molds grow best at room temperature, but some can grow (slowly) at refrigerator temperatures. They are relatively tolerant of common inhibitors, acid and salt. Molds require oxygen, so wrapping food tightly will reduce the opportunity for mold growth. Molds are easily killed by heat. Most begin to die at about 140°F and almost all are dead when food temperatures reach 190°F.
- **Yeasts:** Yeasts can grow with or without air and require more water than molds. Their masses in or on food appear as slime, scum, or murkiness. Yeast fermentation in food is recognized by gas bubbles, froth, or foam which result from the fermentation activity and the production of carbon dioxide gas. Depending on the specific growth conditions, yeast produce acids (vinegar), alcohol (beer and wines), or carbon dioxide (raised bread) during fermentation. This can be desirable or result in spoiled food. Yeast grow best at room temperatures and are destroyed by heating foods to temperatures of 140°F to 190°F. They grow slowly on refrigerated foods. Yeasts grow best on or in acidified foods and fruits. Yeast growth in these foods can raise the pH, changing the conditions to be more favorable for bacterial growth.

Enzyme Action

The activity of enzymes naturally present in foods results in changes in appearance, texture and flavor, and loss of vitamins. Enzymes are easily inactivated by quickly heating raw food to temperatures of 170°F to 190°F in boiling water, in steam, or with a microwave oven. This is the purpose of blanching vegetables before freezing or drying.

Oxygen

The presence of oxygen causes oxidation, which causes many color and flavor changes, including rancidity of fats. Oxygen can also increase activity of many chemical substances in food. Good airtight packaging, careful wrapping of food to exclude oxygen and vacuum packaging machines are all good ways to exclude oxygen and improve the shelf life of stored food.

Insect Infestation

Some unavoidable insect eggs are contained in freshly harvested foods. If they are not controlled, the eggs will hatch and become larvae that will burrow through these foods to eat. Inspect food carefully, use good sanitation practices, and store food in covered containers. If insects are found, locate and discard all infested foods and clean storage areas thoroughly.

Moisture Loss

Loss of moisture changes food quality. Moisture loss proceeds more rapidly at higher temperatures. Refrigeration and proper packaging of fresh food keep these changes to a minimum.

Methods of Food Preservation

Food preservation is the maintenance of safe and nutritious food for an extended period of time. The primary methods of preserving food include the following:

Refrigeration

- Retards growth of microorganisms
- Slows action of enzymes

Freezing

- Prevents growth of microorganisms, but does not necessarily kill them.
- Kills insect eggs and larvae.
- Slows, but does not stop enzymatic activity. Therefore, enzymes present in most fresh vegetables must be inactivated by blanching before freezing.
- For highest quality, lower the food temperature to 0°F as rapidly as possible and maintain a 0°F food temperature.
- Freeze only the amount you can use before its shelf life expires.
- Use packaging that is moisture proof, sealable, and oxygen impermeable to retain quality.

Canning

- With proper canning practices, air is forced from the jars, leaving a vacuum. Processing heat destroys the most heat-resistant microorganisms capable of growing in food stored at room temperature.
- The amount and method of heat processing used depends mainly on the acidity in food. Acidity may be natural, as in most fruits, or added, as in pickled food. Low-acid canned foods contain too little acidity to prevent the growth of heat-resistant bacteria. Acid foods contain enough acidity to block their growth or destroy them more rapidly when heated.

- Molds and some yeast are unable to grow in a vacuum. However, there is a very healthy growth environment for some bacteria in sealed, low-acid home-canned foods. Such foods must be heat processed until a commercially sterile product is achieved, or they must have salts, sugars, acids, or other preservatives added.
- Yeasts and molds are destroyed when food temperatures reach about 190°F, whereas most bacterial vegetative cells are destroyed in foods heated to a boiling temperature. Bacterial spores are able to survive for a long period at the temperature of boiling water.
- Pressure enables the processing of canned foods at temperatures higher than boiling water, where kill rates of bacteria are greatly increased. Pressure canning is required to safely process low-acid foods that may support the growth of bacterial spores.
- It is the scientific study and research of these food spoilers that has resulted in different canning methods (boiling water, atmospheric steam canning, and pressure canning) that allow the home canner to safely process and store foods. A list of approved sources that base their recipes and preservation methods on research findings is included on page 4 of this document and should be the exclusive reference for all home canners.

Dehydrating

- Removes water and prevents growth of microorganisms.
- Microorganisms require water for growth. Removal or reduction of water from a food prevents growth of microorganisms and controls enzyme activity.
- Dried foods must be packaged in oxygen and moisture proof containers to prevent oxidation of flavors and moisture gain.

Pickling and Fermenting

- These methods (and others, like canning naturally acidic fruits, jams and jellies) use either naturally produced or added acids to inhibit or prevent the growth of many microorganisms. Foods that contain enough acid to inhibit the growth of *Clostridium botulinum* are called high acid foods (pH lower than 4.6). The presence of acids in foods, however, does not kill organisms.
- Fermenting uses bacteria to produce lactic acid and lower the pH in products such as fermented pickles and sauerkraut.
- Pickling adds vinegar (acetic acid) to lower pH in fresh pack pickles and other acidified products.

Salting

- Chemically bonds water, inhibiting growth of some bacteria.

Sweetening and Acidifying Jellies and Jams

- Adds sugar and acids that tie up free water and lower the pH.

On Guard Against Spoilage

Don't taste or use canned foods that show any sign of spoilage! Look closely at all jars before opening them. A bulging lid or leaking jar is a sign of spoilage. When you open the jar, look for other signs, such as, spurting liquid, an off-odor or mold. Spoiled canned foods should be discarded in a place where they will not be eaten by humans or pets.

Don't taste or use improperly canned, low-acid foods! Low acid foods include vegetables, meat, seafood and tomatoes. Improperly canned, low-acid foods can contain the toxin that causes botulism **without showing signs of spoilage.** Jars of foods that have not been properly processed must be discarded, even if there are no signs of spoilage, or if they are unsealed, open or leaking they must be

detoxified and discarded as directed below. Low-acid foods are considered improperly canned if any of the following are true:

- The food was not processed in a pressure canner.
- The gauge of the canner was inaccurate.
- Up-to-date researched processing times and pressures were not used for the size of the jar, style of pack or kind of food processed.
- Proportions of ingredients were changed from the original approved recipe.
- The processing time and pressure were not correct for the altitude at which the food was canned.

How to Detoxify Canned, Low-Acid Foods

Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Be extremely careful not to splash or come in contact with the suspect food or liquid. Wear disposable rubber or heavy plastic gloves. Wear clothes and aprons that can be bleached or thrown out if contaminated.

Step-by-Step Instructions for Detoxification:

- Carefully place the jars, with their lids, on their sides in an 8-quart, or larger pot or canner.
- Wash your gloved hands thoroughly.
- Carefully, without splashing, add enough hot water to the pot to completely cover the jars with at least 1 inch of water above the containers.
- Place a lid on the pot and heat the water to boiling.
- Boil for 30 minutes to make sure the food and containers are detoxified.
- Cool and discard the containers, their lids and food in the trash or dispose in a nearby landfill.

How to Clean Up Contaminated Surfaces:

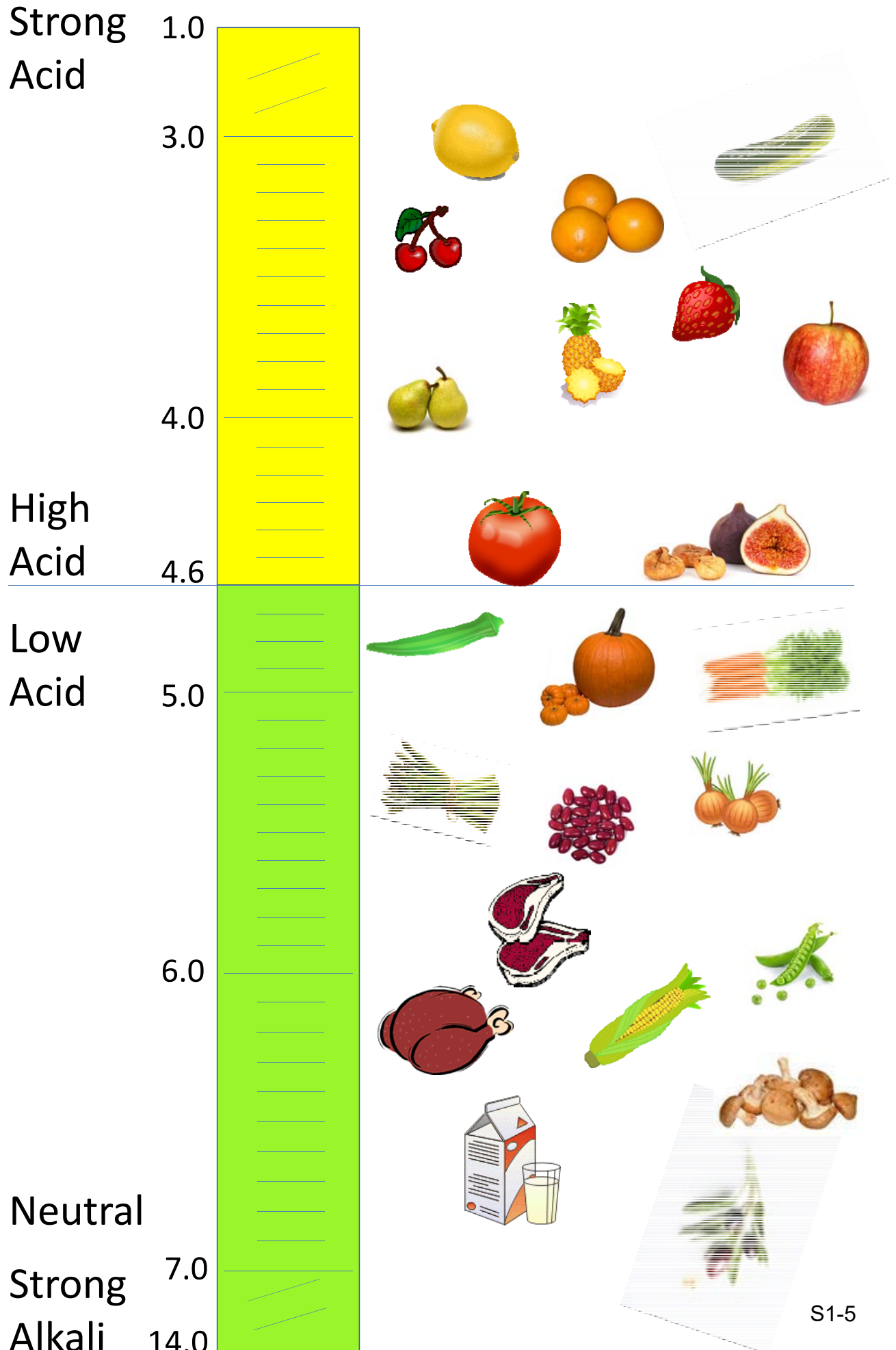
- Wear rubber or heavy plastic gloves to clean up contaminated work surfaces and equipment, including can openers and clothing that may have come in contact with suspect foods or liquids.
- Use a fresh solution of 1 part unscented, liquid, household, chlorine bleach (5 to 6% sodium hypochlorite) to 5 parts clean water.
- Spray or wet contaminated surfaces with the bleach solution and let stand for 30 minutes. Avoid inhaling bleach or contact with skin.
- Wipe treated spills with paper towels and place paper towels in a plastic bag before putting them in the trash.
- Apply the bleach solution to all surfaces and equipment again, and let stand for 30 minutes and rinse.
- Wash all detoxified counters, containers, equipment, clothing, etc.
- Discard gloves when cleaning process is complete.

A good rule to follow is: When in doubt, throw it out! If food looks or smells strange, don't take a chance by tasting it and don't give it to your pets or other animals. Throw it out!

Research-Based Sources

- National Center for Home Food Preservation (<http://nchfp.uga.edu/>)
- USDA Guide to Home Canning, 2015
- So Easy to Preserve 6th Edition, September 2014 (University of Georgia)
- Ball Complete Book of Home Preserving, 2006 and 2012
- University of California Publications
- Cooperative Extension Offices (all 50 states)
- Package inserts included with name-brand pectins

pH Value of Various Foods



Temperatures for Food Preservation

Canning temperature for low acid foods in a pressure canner



Temperature needed to destroy *Clostridium Botulinum* spores.

240°F

Canning temperature for high acid foods in either a boiling water canner or atmospheric steam canner



Water boils at 212°F at sea level and at lower temperature as altitude increases. Water simmers at around 180°F. Boiling destroys most bacteria, yeasts and molds. Time needed to kill these increases as temperature decreases.

212°F

180°F

165°F

Temperature range for drying foods in a dehydrator



Warming temperatures prevent growth but may allow survival of some microorganisms.

140°F

DANGER ZONE: Temperatures in this zone allow rapid growth of bacteria, yeasts, molds and production of toxins by some bacteria and molds.

80°F

60°F

50°F

40°F

Best storage temperatures for canned and dried foods



32°F

Cold temperatures permit slow growth of some bacteria, yeasts and molds.

Water Freezes



Best storage temperatures for frozen foods

0°F

Freezing temperatures stop growth of microorganisms, but may allow some to survive.

-10°F

Cleaning & Sanitizing the Kitchen

Using inexpensive household food-safe products

TAKE A LOOK INSIDE

P2 *Common Household Products that are Effective Sanitizers on Hard Surfaces.*

P3 *Steps for Using Vinegar OR Hydrogen Peroxide to Sanitize.*

P4 *What About “Green” Sanitizers?*



Consumers can protect themselves by preventing the spread of germs by both cleaning and sanitizing surfaces where food is prepared.

Cleaning definition: removing dirt from food preparation surfaces in the kitchen. Surfaces can be counters, cutting boards, dishes, knives, utensils, pots and pans.

Cleaning steps:

1. Wash surface with soap and warm water.
2. Rinse with clean water.
3. Air dry OR dry with a clean paper towel.

Sanitizing definition: the reduction of germs to a safe level so illness is unlikely to occur. The most commonly known germs causing illness are *Salmonella*, *Campylobacter*, and *Norovirus*. Toxin-producing *E. coli* and *Listeria monocytogenes* are less common in the kitchen, but cause very serious, if not deadly, illnesses.

Sanitizing steps: (See the table on page two)

1. Spray surface with sanitizer of choice.
2. Leave sanitizer on the surface for the suggested amount of time.
3. Allow to air dry OR dry with a clean paper towel.

Effective cleaning involves both cleaning and sanitizing surfaces BEFORE and AFTER use.

Common household products effective as sanitizers on food preparation surfaces:

ITEM	CONCENTRATION	TEMPERATURE	CONTACT TIME	<i>LISTERIA MONOCYTOGENES</i>	<i>E. COLI</i>	<i>SALMONELLA</i>
Chlorine Bleach (6%)	1 scant teaspoon to 1 quart water	Room Temperature (77°F or 25°C)	1 minute	✓	✓	✓
Hydrogen Peroxide (3%)	Undiluted	130°F or 55°C	1 minute	✓	✓	✓
Hydrogen Peroxide (3%)	Undiluted	Room Temperature (77°F or 25°C)	10 minutes		✓	✓
White Distilled Vinegar (5%)	Undiluted	130°F or 55°C	1 minute	✓	✓	✓
White Distilled Vinegar (5%)	Undiluted	Room Temperature (77°F or 25°C)	10 minutes			✓
Baking Soda	Not an effective sanitizer at any temperature or time, even after 10 minutes of contact time					

✓ means that the product was effective at reducing the presence of the pathogen with more than 99.999% reduction.

Source: Yang, H., Kendall, P., Medeiros, L., Sofos, J. (2009) Inactivation of *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella* Typhimurium with compounds available in households. *J. Food Prot.* 72(6); 1201-1208

Points to remember when using household chlorine bleach:

- tip** • Diluted chlorine bleach is a **very effective sanitizer**. The amount needed is very small and no chlorine residue will be left behind using a concentration of 1 scant teaspoon of chlorine bleach to 1 quart of water.
- Chlorine reacts quickly and becomes inactive quickly. Detergents and dirt inactivate chlorine; surfaces must be cleaned first to ensure effective sanitation.

- Chlorine solutions need to be made at least weekly and must be stored in a dark place.
- Do not use chlorine with added fragrance - this is not food-safe.



Steps for using vinegar OR hydrogen peroxide to sanitize:

Both products when heated will produce an odor. This odor is not harmful to you. Test sanitizer in an unseen place to be sure hydrogen peroxide will not discolor or fade the surface.

tip Option 1:

1. Heat either 4 oz (1/2 C) white distilled vinegar **OR** hydrogen peroxide in a sauce pan to 150°F or 66°C. (Handle **CAREFULLY** when heating as the liquids will be warm but not hot.)
2. Using a funnel pour the **warm** solution into a spray bottle.
3. Immediately spray on kitchen surfaces, counter tops, sink, refrigerator interior, faucets.
4. Let sit for 1 minute then wipe with a clean paper towel.

tip Option 2: *(if warming the solution is not an option)*

1. Use either 4 oz (1/2 C) white distilled vinegar **OR** hydrogen peroxide
2. Using a funnel, pour **room temperature** solution into spray bottle.
3. Spray onto kitchen surfaces, counter tops, refrigerator interior, and faucets.
4. To be effective solution **MUST sit for 10 minutes** then wipe with a clean paper towel.

WARNING: NEVER MIX HYDROGEN PEROXIDE OR VINEGAR TOGETHER.

How often should you sanitize?

Sanitizers kill living organisms, which is why they are so important in controlling harmful pathogens. How often should the kitchen be sanitized is best determined by your personal situation. Some questions to think about when trying to decide how often the kitchen should be sanitized are:

1. Do you have elderly people living with you?
2. Do you have someone in your house that is severely ill or immune-compromised?
3. Do you have children under the age of 5 in your home?
4. Do you have indoor or outdoor pets?

You can sanitize daily. Think about your situation and decide what is right for you.



What about “GREEN” sanitizers?

“Green” is a commonly used term by the public or the media to convey a product is “safe” for the environment. Over the past 10 years there has been an increase in the number of cleaning products labeled; “environmentally friendly”, “eco-safe”, and “environmentally safe” as a result of consumer demand. These terms suggest that the product is not going to cause harm to the environment; however, there is no standard or regulation for when or how these statements can be used. The Environmental Protection Agency (EPA) has started a

program to help the consumer purchase environmentally safe products. Industries may submit their products to be reviewed by an EPA approved scientific team. Each ingredient in the product is reviewed for chemicals that are the least concern for their class; e.g. low concern to humans, biodegrades easily, degraded by-products will not produce pollutants, etc. If you would like more information about the EPA’s Design for the Environment (DfE) program, please go to the website:

http://www.epa.gov/oppt/dfe/product_label_consumer.html.



Look for the label!

The household products suggested for use as sanitizers at the recommended dilutions are safe for home use and are safe for the environment. Vinegar and hydrogen peroxide will not be found on the DfE website although these two products do meet the DfE criteria.

WANT TO KNOW MORE?

Check out these additional resources...

Government Food Safety Information:

www.foodsafety.gov

Centers for Disease Control and Prevention:

www.cdc.gov/foodsafety

Food Safety Information from OSU:

foodsafety.osu.edu

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Authors: Janet Buffer, Lydia Medeiros, Mary Schroeder, Patricia Kendall, Jeff LeJeune, and John Sofos

Sources:

1. Environmental Protection Agency (EPA) Design for the environment: An EPA partnership program. http://www.epa.gov/dfe/product_label_consumer.html, March 2010, Accessed May 27, 2010
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3. McGlynn, W. Guidelines for the use of chlorine bleach as a sanitizer in food processing operations, Oklahoma Cooperative Extension Service, Division of

Agricultural Science and Natural Resources. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-963/FAPC-116web.pdf> Accessed May 27, 2010

4. National Restaurant Association Solutions™, ServSafe Coursebook 5th edition.
5. Office of Pollution Prevention and Toxic, Chemicals in the environment: Chlorine (CAS NO. 7782-50-5) USEPA http://www.epa.gov/chemfact/f_chlori.txt, April 1994, Accessed May 27, 2010
6. Yang, H., Kendall, P., Medeiros, L., Sofos, J. Inactivation of *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Salmonella* Typhimurium with compounds available in households. *J. Food Prot* 72(6); 1201-1208

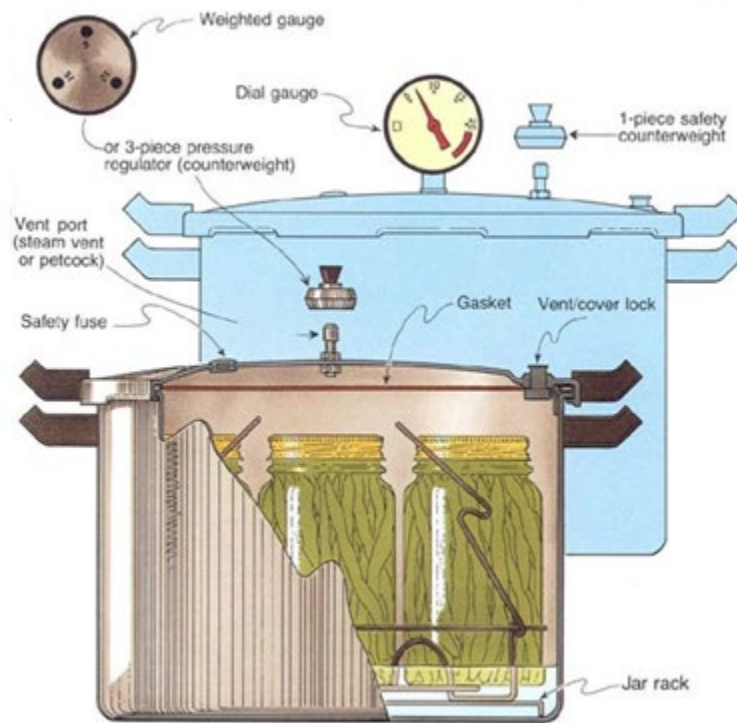


Photography by Abigail Saxton.
Design by Margaux Baldrige, The Office of Technology and Enhanced Learning, The College of Education and Human Ecology, The Ohio State University.

Section 2: The Tools

- Pressure Canning Parts
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 - Burning Issue: Canning in Electric Multi-Cookers
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Pressure Canner Parts



Sample Pressure Canner Models



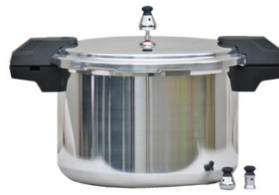
All American



*Presto
(induction
burner models
available)*



T-Fal



Mirro



*Fagor (induction
burner compatible)*

Pressure Canner Size

- Rated by volume of water they will hold, not the number of jars.
- Example: 16 quart model holds 16 quarts of water, not 16 quart jars.

Pressure Canner Parts:

- Flat rack in bottom.
- Pressure regulator or indicator.
 - Dial or weighted gauge.
 - Older: petcocks.
 - Vent pipe (port) for pressurizing.
- Safety valves or overpressure plugs.
- Safety locks when pressurized.
- Flexible gasket/sealing ring in lid **or** metal to metal seal.
- Optional stacking rack.

Weighted Gauge

- Regulates pressure inside the canner.
- Releases air/pressure from canner during process to keep pressure at maximum set by the number on the weighted gauge.
- Altitude adjustment requires increase of 5 psig pressure.
- One piece weighted gauge
 - Fitting for 5, 10 or 15 psig.
 - Do not use dead- or counter-weight from dial gauge canner or pressure cooker.
 - Mirro: “jiggles” 3 to 4 times per minute at correct pressure.
- Three piece weighted gauge
 - Number of pieces used determines 5, 10 or 15 psig.
 - Presto: rocks gently throughout entire process at correct pressure.
 - Mirro: “jiggles” 3 to 4 times per minute.

Dial Gauge

- Indicates pressure inside the canner.
- Must be checked for accuracy annually.
- More flexibility in altitude adjustments – small psig increments.
 - Has dead- or counter-weight to close open vent for pressurizing. Counter-weight not to be used for indicating pressure. Releases pressure at 15 psig.
- Read the manual! All American models are considered a weighted gauge canner; the dial is only used as a reference.

Pressure Canners vs. Cookers

- To be considered a combination pressure cooker/canner for USDA processes, the cooker must be big enough to hold at least **4** quart-size jars on a bottom rack.
- Pressure cookers with smaller volume capacities are not recommended for use in canning. Enough heat may not be delivered during the pressurizing and the cool-down periods.

Regular Maintenance

- Test dial gauges annually.
 - Pressure adjustments can be made if the gauge reads up to 2 pounds high or low.
 - Replace gauges that differ by more than 2 pounds.
 - Test replacement gauges upon arrival.
- Handle gaskets (sealing rings) carefully and clean according to manufacturer’s directions.
 - Keep clean and dry after using. Putting soapy water on a stiff new gasket helps installation.
 - Older models may require a light coat of vegetable oil annually.
 - Newer models are pre-lubricated and do not benefit from oiling.
 - Inspect; normally replace every 2 years.
- Rubber overpressure plugs: Keep clear.
 - Do not pick at or scratch during cleaning.
 - Replace every 2 years.
- Vent pipes; replace if clogged.
- Store canner with lid on loosely.
- To remove internal canner discoloration
 - Place 1 Tblsp cream of tartar per quart of water in canner.
 - Place lid on canner, boil water.
 - Bring to 5 pounds pressure, turn off heat, let pressure drop to zero.
 - Loosen lid, let sit on canner for 45-60 minutes.
 - Drain, rinse, dry.



Burning Issue: Canning in Pressure Cookers

What are the process times for canning in my pressure cooker?

USDA does not have recommended processes for canning in a small pressure cooker. The recommendation for using USDA pressure processes for low-acid foods is to use a canner that holds at least four (4) quart-size jars standing upright on the rack, with the lid in place. The research for USDA pressure processes for vegetable and meat products was conducted in pressure canners that are most similar to today's 16-quart or larger pressure canners.

Pressure cookers have less metal, are smaller in diameter, and will use less water than pressure canners. The result is that the time it takes a canner to come up to processing pressure (that is, the come-up time) and the time it takes the canner to cool naturally down to 0 pounds pressure at the end of the process (known as the cool-down time) will be less than for the standard pressure canner. The come-up and cool-down times are part of the total processing heat that was used to establish USDA process times for low-acid foods. If the heat from the come-up and cool-down periods is reduced because these times are shortened, then the heat from the process time at pressure alone may not be enough to destroy targeted microorganisms for safety. That is, the food may end up underprocessed. Underprocessed low-acid canned foods are unsafe and can result in foodborne illness, including botulism poisoning, if consumed.

During earlier years of canning research, pressure saucepans were considered an alternative for home canning and it was thought that adding 10 minutes to the process times for standard canners would keep food safe. That proved not to be the case for a general, across-the-board recommendation, as there are several sizes of pressure saucepans and they were not all adequately tested. In addition, the way heat transfers (penetrates) through food during the process is affected partly by the composition of the food and not all foods and styles of preparation were tested. Later research published in journals has not resulted in an absolute recommendation either. Therefore, in the late 1980s the USDA published its recommendation to not use pressure saucepans (small cookers) for home canning.

Some manufacturers may offer process directions for smaller pressure cookers. Consumers using this equipment will need to discuss processing recommendations with those manufacturers; the USDA and National Center for Home Food Preservation recommendation is to not use them for canning with our processes.

To be considered a pressure canner for USDA processes, the canner must be able to hold at least four quart-size jars, standing upright on the canner rack, with the lid in place. It is also important to realize the canner should have a way to follow recommended venting procedures to remove air from inside the canner before it is pressurized, and to indicate that the canner remains at least at the target pressure throughout the entire process time. (Also see: Using Pressure Canners)

We cannot convert processes intended for use with regular pressure canners to ensure safety when canning in other types of equipment.

September 2015

National Center for Home Food Preservation



Burning Issue: Canning in Electric Multi-Cookers

Should I can in my electric multi-cooker appliance?

Even if there are instructions for pressure canning in the manufacturer's directions, we do not support the use of the USDA canning processes in the electric, multi-cooker appliances now containing "canning" or "steam canning" buttons on their front panels. Our pressure process directions have not been developed for that type of appliance, and the canner being used does matter. Our recommendations were determined for stovetop pressure canners which hold four or more quart-size jars standing upright.

We do not know if proper thermal process development work has been done in order to justify the canning advice that is distributed with these pressure multi-cooker appliances. What we do know is that our canning processes are not recommended for use in electric pressure multicookers at this time.

Some of the major reasons we cannot recommend using electric multi-cookers for pressure canning:

1. Thermal process canning work relates the temperatures in the jars to the temperature inside the canner throughout the processing. No USDA thermal process work has been done with jars inside an electric pressure cooker, tracking the actual temperatures inside the jars throughout the process. It is ultimately the temperature and heat distribution inside the jars that matters for the destruction of microorganism in the food product. The position of jars in the canner and flow of steam around them also impacts the temperature in the jars. For example, there would be expected differences in jars piled together on their sides from those standing upright on the canner base.
2. What matters is temperature, not pressure. One manufacturer says its cooker reaches the pressure required for canning, that alone does not prove the food in the jars is heated throughout at the same rate as in the canner used for process development. A manufacturer should do process development work to document temperatures throughout the unit at a given pressure and throughout the whole process time. Just producing an interior pressure is not sufficient data for canning recommendations. For example, if air is mixed in the steam, the temperature is lower than the same pressure of pure steam. That's why a proper venting process is so important in pressure canning – to obtain a pure steam environment inside the canner. Also, one has to know how to make adjustments in pressure readings at higher altitudes. The same pressure and process time combination cannot be used at all altitudes.
3. In order to ensure the safety of the final product, the temperature in the canner must stay at minimum throughout the process time. Do power surges or drops with an electric canner cause the temperature to drop too low? How will you the user know if that happens with your cooker?
4. One of the big concerns is that the USDA low-acid pressure process times rely on a combination of heat from the time the canner is coming to pressure, during the actual process time, and then during the early stages of cooling the canner and jars. Even after the heat is turned off under the

canner, at the end of the recommended process time, the food remains at high enough temperatures for another period of time that can still contribute to killing of bacteria. This retained heat while the canner has to cool naturally to 0 pounds pressure before opening is used to advantage in calculating the total sterilizing value of the process to preserve some food quality. If anything is done to shorten the cooling period, including using a very small cooker, then the food could cool down more quickly, and be under-processed. (That is why we recommend using only pressure cookers that hold four or more quart-size jars.) Bacteria are not killed in the food only during the process time; the time it takes the canner to come up to pressure, the process time, and the cool-down time all matter. There is no way at this point in time to know exactly the percentage of contribution from cooling for each of the canning recommendations.

Please note: This statement about electric cookers does NOT include the Ball Automatic Home Canner for acid foods only, which is electric, but (1) is not a "multi-cooker", but a dedicated canner, (2) comes with its own instructions and pre-set canning options for specific food preparations, and (3) has had proper thermal process development done to support the recommendations with it. Jarden Home Brands also sells an electric boiling water canner, but it is not a pressurized appliance and for canning purposes operates similar to a traditional boiling water canner. Directions from the manufacturer for this Ball canner, as well as for the Weck non-pressurized electric boiling water canners, should be followed to get them assembled and for managing temperature settings to achieve a boiling process.

May 12, 2016

National Center for Home Food Preservation

nchfp.uga.edu



Burning Issue: Canning on Smooth Cooktops

Can I can on my smooth cooktop?

We have to say to follow manufacturer's advice because styles of smooth cooktops being manufactured differ in ways that influence suitability for canning. Some smooth cooktop manufacturers say do not can on them, while others who say it is okay still put stipulations on the diameter of the canner compared to the diameter of the burner. Boiling water or pressure canners may not be available that meet the maximum diameter pot they allow. There are several issues:

1. There can be damage to the cooktop from the excessive heat that reflects back down on the surface, especially if the canners used are too large of a diameter than is intended for the burner being used. The damage can range from discoloration of white tops to actual burner damage to cracking of the glass tops to fusion of the metal to the glass top.

And by the way, even if a manufacturer says a burner/cooktop can be used for canning, people should also be aware the scratching can occur if the aluminum canner is slid or pulled across the cooktop. This often happens with large, heavy filled canners, so people need to be careful.

2. Many of these cooktops have automatic cut-offs on their burners when heat gets excessive. If that option is built in, and the burner under a canner shuts off during the process time, then the product will be underprocessed and cannot be salvaged as a canned food. The process time must be continuous at the intended temperature, or microorganisms may survive. Also, if the pressure drops quickly, most likely liquid and maybe even food will be lost from the jar (it will spill over from the area of higher pressure inside the jar to the lower pressure now in the canner around the jar).
3. Even if boiling water canning is approved by the manufacturer, it may be necessary to fashion your own canner out of a flat-bottomed stockpot with a bottom rack inserted. Many canners do not have flat enough bottoms to work well on a smooth cooktop to be able to maintain a full boil over the tops of the jars. The pot used as a canner must also be large enough to have lots of water boiling freely around the jars, and at least 1 inch over the tops of jars. If the canner is too small, then it starts boiling faster than expected and the total required heat the jars receive in the canner even before the process time begins can be too short.
4. Some manufacturers of pressure canners do not recommend using them on a smooth cooktop. Follow the advice of your canner manufacturer.

Our recommendation, therefore, is to contact or consult information from the manufacturer of your smooth cooktop and your pressure canner, if interested in pressure canning, before making your decision to can (or not) on it. They are the recommended sources of this information and may also have up-to-date alternatives or suggestions for equipment that you can use. We also caution that you might have to be sure they understand how large your boiling water or pressure canner is, how long it must be heated at high heat, how long the hot canner may stay on the burner until it cools after the process time, and that the canner is made from aluminum (if it is).

*Reviewed February 27, 2018
National Center for Home Food Preservation*



Burning Issue: Canning on Portable Burners

Can I can on portable gas or electric burners?

If you have a smooth cooktop and the manufacturer says not to can on it, then you might find yourself looking for an alternative. The alternatives for canning (if you have one of these no-canning recommended smooth cooktop ranges) are either to purchase and install a permanent set of electric coil or gas burners as a range top (without an oven) or to purchase a portable electric coil or gas burner.

And that is where important decisions come in to play. An installed range top requires the utilities to support it and can be quite expensive as a second range top. As for portable burners, they are not all alike and not all portable burners are appropriate for canning. First of all, check the burner manufacturer's specifications and directions or contact their customer service department for more specific information about the appropriate use of a particular burner for canning.

We cannot endorse a particular brand, but here are a few basic guidelines for you to keep in mind when selecting a portable burner for canning purposes:

- The burner must be level, sturdy, and secure. Look for enough height to allow air to flow under the burner, but not such that it will become unsteady with a full, heavy canner resting on it. One we have tested was about 4 inches high off the counter top, on short legs that allowed air circulation underneath but was plenty stable.
- Look for a burner diameter that is no more than 4 inches smaller than the diameter of your canner. In other words, the canner should not extend more than 2 inches from the burner on any side. This is a common recommendation, but also make sure this is the recommendation for your canner brand.
- For electric burners, you want the wattage to be about equal to that of a typical household range large burner. We have been successful bringing a boiling water canner to boiling with one that is 1500W/120V, but household range burners are more typically 1750W or higher and this kind of wattage may actually be a better choice if you can find it. We have not yet tried using a pressure canner on a portable electric burner.
- You want the burner to have housing that will hold up to the high heat under the canner for long heating periods, and not damage counter tops with reflected heat. We contacted a foodservice supply store to help us identify one like this; it cost us about \$155. We used it successfully a few times to bring water to a boil, but have not used one repeatedly for canning.
- At least one pressure canner manufacturer advises not to can on any outdoor heat source. Your pressure canner can be damaged if the gas burner puts out too much heat. Higher BTU burners could also produce so much heat that the recommended come-up time for canning could be altered, potentially producing an unsafe final product.
- Again, *check manufacturer's directions and/or contact their customer service for more information about appropriate burners.* When you are asking manufacturers about canning, specify whether you are asking about pressure canning (much more heat concentration) or boiling water canning. If the manufacturer's directions have been followed, and canning problems occur, then you must take it up with the manufacturer.

November 7, 2014

National Center for Home Food Preservation

Section 3: The Process

- Pressure Canning Basics
 - Process Steps Checklist
- Avoiding Common (Major & Minor) Canning Mistakes

Pressure Canning Basics

Basic Food Safety

Wash Hands Frequently

- Personal cleanliness is a must. Wash your hands thoroughly and frequently. *E. coli* resides in the human nose and intestines. Wash your hands if you rub your nose, or if you wipe your face or skin.
- Bandage any cuts or burns on hands before handling food, or use disposable gloves.

Avoid Cross Contamination

- Rinse all fresh fruits and vegetables well under running water before preparing or eating them. Dry them with a clean cloth or paper towel.
- **ALWAYS** wash your hands, knives, cutting boards, and food preparation surfaces well with soapy water before and after any contact with raw meat, fish, or poultry.
- Use a disinfecting solution of 1½ teaspoon of chlorine bleach to 1 pint of water. Dispense with a spray bottle to disinfect countertops, cutting surfaces, sinks, etc. Let sit one minute then wipe. Make a new solution daily.

When In Doubt, Throw It Out

- Never taste food that looks or smells strange to see if it can still be used.
- Most bacteria that cause foodborne illness are odorless, colorless, and tasteless.

Canning Basics

Get Ready ... Be Prepared!

- Read the recipe thoroughly before you begin.
- Measure out all ingredients.
- Have all of your utensils at hand.
- Wash jars, lids and rings in hot soapy water and rinse well. Check jars for imperfections.
- Place clean jars into the boiling water canner and heat the jars.
- Prepare lids and rings according to the directions on the lid and ring packages. (Newer boxes of lids don't require pre-heating, older ones do. You may still pre-heat newer lids.)
- Do a "dry run" of the recipe to make sure you have all of your materials.

General Canning Supplies

- Reputable recipe that follows the USDA recommended canning procedures
- Standard canning jars, rings, self-sealing one-time use lids ; no paraffin wax as a sealing agent
- Funnel
- Headspace measurer
- De-bubbler
- Jar lifter
- Tray/towel for hot jars

Canning Processes

- Use an **atmospheric steam canner** or a **boiling water canner** for high acid foods: fruits, pickled and fermented products, jams and jellies.
- Use a **pressure canner** for low acid foods: meats, vegetables, and mixtures of high and low acid foods

Why two different processes? Low acid foods must be pressure canned because *Clostridium botulinum*, the bacteria that causes botulism, is a spore former. When conditions are not favorable for the organism to grow (high heat, dryness, etc.), the bacterial cell forms a protective structure called a spore. It takes a higher temperature than boiling to destroy the spores: 240° - 250°F. If you do not destroy the spores in low acid foods they will germinate and produce fatal toxins in the food when it is stored on the shelf. High acid foods have enough acidity to destroy spores.

The USDA does not recommend the open kettle method of canning because it does not prevent all risks of spoilage.

Raw-Pack vs. Hot-Pack Methods

Filling jars with raw, unheated food prior to heat processing is called the raw-pack method. The preferred method, filling jars with preheated, hot food prior to heat processing, is called the hot-pack method. Benefits include a tighter pack and, because food expels air when heated, less float.

Jars

Check jars, lids and bands for high quality. Wash jars, lids and bands in hot, soapy water. Rinse well. Dry bands. Heat home canning jars in hot water, not boiling, until ready for use. Fill a large saucepan or stockpot half-way with water. You may also place them in your canner. Place jars in water (filling jars with water from the saucepan will prevent flotation). Bring to a simmer over medium heat. Keep jars hot until ready for use. You may also use a dishwasher to wash and heat jars. Keeping jars hot prevents them from breaking when hot food is added. Leave lids and bands at room temperature for easy handling.

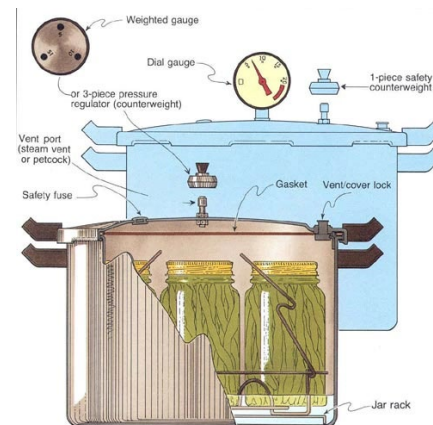
Headspace

Headspace is the completely empty space left in the jar underneath the lid and above the food. Headspace allows for food to expand during canning without being forced out from under the lid during processing. Recommended amounts also allow for good vacuums to be formed for holding lids in place and good food quality to be maintained during storage.

Pressure Canning Essentials

Pressure Canning Equipment

- Pressure canner with the following features:
 - Flat rack in bottom
 - Pressure regulator or indicator
 - ✓ Dial or weighted gauge
 - ✓ Vent pipe (port) for pressurizing
 - Safety valves or overpressure plugs
 - Safety locks when pressurized
 - Flexible gasket/sealing ring in lid or metal to metal seal
 - Optional: jar stacking rack
- Please note that a pressure cooker is NOT a pressure canner, but a pressure canner can be used as a pressure cooker. A pressure cooker must be able to hold **4 quart** jars on a rack to be considered a pressure canner.



Adjusting for Altitude: Pressure Canner

Processing times for all recipes are at sea level. At sea level to 2,000 feet, 11 pounds of steam pressure will produce 240°F. Above 2,000 feet you must increase the steam pressure to reach this temperature. At altitudes above sea level adjust the pressure according to the altitude chart.

Using a Pressure Canner

1. Clean lid gaskets and other parts according to the manufacturer's directions; make sure all vent pipes are clear.
2. Put 2 to 3 inches hot water (140°F) into the canner.
3. Place filled jars on the jar rack in the canner, using a jar lifter.
4. Fasten the canner lid securely. Leave the weight off the vent pipe or open the petcock.
5. Turn the heat setting to high; heat until the water boils and steams. **Always** vent for 10 minutes.
6. Place the counterweight or weighted gauge on the vent pipe, or close the petcock.
7. Start timing the process when the pressure reading on the dial gauge indicates that the recommended pressure has been reached, or, for canners without dial gauges, when the weighted gauge begins to jiggle or rock as the manufacturer describes.
8. Regulate the heat under the canner to maintain a steady pressure at, or slightly above, the correct gauge pressure. **IMPORTANT:** If at any time pressure goes below the recommended amount, bring the canner back to pressure and begin the timing of the process over, from the beginning using the total original process time. This is important for the safety of the food.
9. When the timed process is completed, turn off the heat, remove the canner from the heat (electric burner) if possible, and let the canner cool down naturally. **Do not force cool the canner.** Pints take about 30 minutes to cool; 45 minutes for quarts.
10. After the canner is completely depressurized, remove the weight from the vent pipe or open the petcock. **Wait 10** minutes; then unfasten the lid away from you to remove.
11. Remove the jars from the canner by lifting them upright and placing them on a rack or folded towel away from drafts.
12. Do not retighten the rings. Leave the ring bands on the jars until they have cooled thoroughly (approximately 24 hours). Do not try to dump or wipe up any water on the lids.
13. Dry the canner, lid and gasket. Take off removable petcocks and safety valves; wash and dry thoroughly. Follow maintenance and storage instructions that come from your canner manufacturer.

Altitude Chart	
Altitude in feet	Required Pressure
Sea Level – 2000ft.	11 lb.
2001 – 4000ft.	12 lb.
4001 – 6000ft.	13 lb.
6001 – 8000ft.	14 lb.
8001 – 10,000ft.	15 lb.

Finishing

Removing and Cooling Jars

Be careful when moving and lifting filled jars. Do not tilt. Do not be tempted to try to pour off the water on the top when lifting them out of the canner. The water on top of the hot jars will evaporate very rapidly. If the jars are tilted, food may become lodged between the glass rim and the sealing compound preventing proper sealing. Do not leave the jars in the hot water until cooled as the jars will fail to seal, which will result in spoilage.

The Next Day ...

- After cooling the jars for 12 to 24 hours, remove the screw bands.
- Check each jar for a seal; press the middle of the lid with your finger. If the lid springs up when you release your finger, the lid is unsealed.
- Clean the jars with a damp cloth. Thoroughly dry ring bands may be replaced on the jars, if desired.
- Label the jars with the product name, date, processing method (WB = Boiling Water/Water Bath, PC = pressure canner), and store in a cool, dark, dry area.
- If a jar did not seal, check the jar for flaws. Refrigerate and use the product within a few days, freeze the jar, or reprocess it within 24 hours using a new lid and if necessary, a new jar. Process by the method originally advised for the full length of time.



Resources

Research-Based Sources for Canning and Other Food Preservation:

- National Center for Home Food Preservation (<http://nchfp.uga.edu/>)
- USDA Guide to Home Canning, 2015
- So Easy to Preserve 6th Edition, September 2014 (University of Georgia)
- Ball Complete Book of Home Preserving, 2012
- University of California Publications (<http://anrcatalog.ucanr.edu>)
- Cooperative Extension Offices (all 50 states)
- For more links: <http://mfp.ucanr.edu>

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Pressure Canning Processing Steps

1. Use reputable, research-based recipe
2. Prep food & jars
3. Heat 2-3" canner water (*not boiling*)
Hot pack: 180°F, Raw pack: 140°F
4. Jars in canner
5. Lid on; weight off; high heat
6. **Vent** 10 minutes
7. Weight on
8. Pressurize; lower heat
9. Start timer
10. Process; adjust heat as needed
11. Ding! Timer off; heat off
12. **Wait** until pressure drops to 0
13. Weight off
14. Cool 10 minutes **more**
15. Lid off; jars out; cool 12-24 hours



Avoiding Common (Major and Minor) Canning Mistakes

Kathleen Riggs, Family and Consumer Sciences Agent, Iron County

Major Canning Mistakes – Potentially Deadly

***Making up your own canning recipe.** Without scientific testing, you will not know how long the product needs to be processed to be safe.

***Adding EXTRA starch, flour or other thickener to recipe.** This will slow the rate of heat penetration into the product and can result in undercooking.

***Adding EXTRA onions, chilies, bell peppers, or other vegetables to salsas.** The extra vegetables dilute the acidity and can result in botulism poisoning.

***Using an oven instead of water bath for processing.** The product will be under-processed since air is not as good a conductor of heat as water or steam. The jars also may break or explode.

***Not making altitude adjustments.** Since boiling temperatures are lower at higher altitudes, the products will be under-processed. Pressure canning requires adding more pounds of pressure while water-bath canning requires more processing time.

***Not venting pressure canner.** Lack of venting can result in air pockets (cold spots) which will not reach as high a temperature as is needed.

***Not having dial-type pressure canner gauges tested annually.** If the gauge is inaccurate, the food may be under-processed and therefore unsafe.

***Failure to acidify canned tomatoes.** Not all tomatoes have an adequate acid level (pH), especially if the vine is dead when tomatoes are harvested. This can result in botulism poisoning.

***Cooling pressure canner under running water.** Calculations as to processing time include the residual heat during the normal cool-down period as part of the canning process. Hurrying this process will result in under-processed food; siphoning of liquid from the jars and jar breakage may also occur.

***Letting food prepared for “hot pack” processing cool in the jars before placing them in the canner for processing.** The heat curves are based on the food being hot at the beginning of the processing. The product could be under-processed.

NOTE: Canned meat, vegetables, or salsa which is under-processed can cause botulism.

Minor Canning Mistakes – Economic Loss, But Results Not Deadly

***Use of mayonnaise jars.** The thinner walls of the glass may break, especially if used in a pressure canner, and it may be more difficult to obtain a good seal. However, if it seals, it is safe to use.

***Use of paraffin on jams & jellies.** Small air holes in the paraffin may allow mold to grow. Also, paraffin can catch on fire if overheated during preparation. If preserves do have mold growth, the recommendation is not to eat the product, but discard it.

***Cooling too slowly after removing from canner.** (Example: stacked jars close together.) There is a group of harmless organisms called thermophiles that can survive canning. If bottles are held hot for long periods, they can produce acid (fermentation). This results in the defect known as “flat-

sour.” This is harmless, but produces an undesirable flavor.

***Storing food longer than recommended.**

Keeping foods longer than recommended or storing them at temperatures above 70° F for an extended period of time will decrease the quality and the value of some nutrients, but the product will be safe to eat. A darkening of fruits and change in texture is often a result as well.

The general guidelines for safe food preservation really are not difficult to follow. Just make certain to always use an up-to-date, scientifically-tested recipe, follow it exactly and make the altitude adjustments for time or pressure. If you have specific questions, contact your local USU Extension office. If you cannot find your local office listed in the phone directory under USU, look under the county government listings.

Cautions Issued for Specific Foods

- **Butter** — For now, canning butter using any method is not recommended. Some methods are dangerous at best; others are not backed by science.
- **Hydrated wheat kernels (berries)** — Starch in wheat may interfere with the heat penetration during canning. Insufficient processing can result in botulism food poisoning. Wheat should be stored dry until use or refrigerated up to several days if hydrated for use in the near future.
- **Quick Breads (e.g. , banana, zucchini, pumpkin)** — Baking quick breads in canning jars and then placing a lid and ring on the jar to create a vacuum seal as it cools does not kill botulism-forming organisms that grow in warm, moist, anaerobic conditions. These items should be either baked fresh and served or frozen.
- **Dried Beans (pinto, kidney, etc.)** — To safely can dried beans, they must be hydrated first (usually 12 to 18 hours) and then brought to a boil for 30 min. Hot beans are then placed into hot jars for processing.

General Rules

1. Always use up-to-date, scientifically tested canning recipes.
2. Only use approved, up-to-date canning methods (boiling water-bath or pressure).
3. Follow canning directions exactly.
4. Make altitude adjustments by adding more time to water bath canning or increasing pressure for pressure canned products.

5. Make certain canned products have a proper lid seal.

Note: Unless you are sure that the above general rules were followed, boil low acid foods for 10 minutes before eating them to inactivate botulism-causing organisms (*Clostridium botulinum*).

Exceptions to the General Rules

- **Changing salt level in anything except pickles.** Salt acts as a preservative and adds flavor and crispness to pickles. In other foods, it is mainly used as a flavoring agent and is *added as a personal preference*.
- **Changing sugar level in syrup used for canned fruit.** Sugar helps fruit retain a bright color and firm texture, but is not necessary for safety.
- **Add EXTRA vinegar or lemon juice.** Bottled acids help obtain required pH (acid levels) in tomatoes and pickles. If a more tart or sour flavor is desired, more vinegar, lemon or lime juice may be added.
- **Decrease any vegetable except tomatoes in salsas.** Salsa recipes have been tested to ensure that they contain enough acid to be safely processed in a boiling water-bath canner. This acid is provided by the correct amount of tomatoes. The addition of vegetables has also been calibrated to balance the acid level. While it is dangerous to add more vegetables to salsa recipes, fewer may be used for a milder flavor.
- **Substitute bell peppers, long green peppers or jalapeño peppers for each other in salsa recipes.** So long as the total amount of peppers remains the same (or fewer) as what is listed in the tested recipe, peppers may be interchanged.

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This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Noelle E. Cockett, Vice President for Extension and Agriculture, Utah State University.

Section 4: The Recipes

- Vegetables
 - Tomatoes
 - Meat
- Soups and Other Goodies

Table 1. Preparing and canning vegetables

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time (minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial])	
						Pint	Quart
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
asparagus	Use 4- to 6-inch long, tender, tight-tipped spears. Wash and cut off scales (bracts). Cut into 1-inch pieces or leave whole.						
	Hot pack: Cover asparagus with boiling water and boil for 2 to 3 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					30	40
	Raw pack: Pack asparagus tightly into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					30	40
beans: dried kidney, etc.	Use mature dry beans or peas. Sort and remove defective or discolored beans.						
	Hot pack: Soak in cold water for 12 to 18 hours in a cool place. Drain and add fresh water. Boil 30 minutes. Pack into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					75	90
beans: dried navy, etc., with tomato or molasses	Use mature dry beans. Sort and remove defective or discolored beans. Wash beans and boil 2 minutes (use 3 cups of water for 1 cup of beans). Remove from heat and soak for 1 hour. Drain and reheat to boiling using fresh water. Use this cooking liquid to make sauce.						
	Tomato sauce recipe 1: Mix 1 quart tomato juice, 3 tablespoons sugar, 2 teaspoons salt, 1 tablespoon chopped onion, and ¼ teaspoon each of ground cloves, allspice, mace, and cayenne. Add 3 cups of cooking liquid from beans. Heat to boiling.						
	Tomato sauce recipe 2: Mix 1 cup tomato catsup with 3 cups cooking liquid from beans (or plain water). Heat to boiling.						
	Molasses sauce: Mix 4 cups water or cooking liquid from beans, 3 tablespoons dark molasses, 1 tablespoon vinegar, 2 teaspoons salt, and ¾ teaspoon powdered dry mustard. Heat to boiling.						
	Hot pack: Fill hot jars three-quarters full with hot beans. Add one ¾-inch cube of pork, ham, or bacon to each jar if desired. Fill jars with heated sauce, leaving a 1-inch headspace. Remove air bubbles, wipe jar rims, adjust lids, seal, and process. Do not add any more meat or bacon than directed. Raw pack is not recommended.					65	75
beans: fresh green (snap, wax, string, or Italian)	Use tender, crisp pods. Discard diseased or rusty pods. Wash and trim ends. Cut into 1-inch pieces or leave whole.						
	Hot pack: Cover beans in boiling water and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. If beans are left whole, pack beans standing on ends. Remove air bubbles, wipe jar rims, adjust lids, and process.					20	25
	Raw pack: Pack beans tightly into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill jars with boiling water to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.					20	25
beans: fresh lima	Use young, tender, well-filled pods. Discard damaged beans. Shell and wash beans thoroughly.						
	Hot pack: Cover beans with boiling water and boil for 3 minutes. Pack loosely in hot jar, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
	Raw pack: Pack beans loosely in hot jars, leaving a 1-inch headspace for pints or 1½-inch (small beans) or 1¾-inch (large beans) headspace for quarts. Add salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002

Table 1. Preparing and canning vegetables, cont.

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time (minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial gauge]) [†]	
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
beets: sliced or cubed	Use beets with a diameter of 1 to 2 inches. Beets larger than 3 inches in diameter are often fibrous. Scrub well.						
	<p>Hot pack: Leave roots and 1 inch of stems on beets. Boil until skins slip off (about 15 to 25 minutes). Dip in cold water. Peel, trim root and stem, and slice. Discard woody beets. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					30	35
carrots	Select small carrots, preferably 1 to 1¼ inches in diameter. Wash, peel, and rewash carrots. Slice or dice.						
	<p>Hot pack: Cover carrots with water, bring to a boil, and simmer for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack: Tightly pack sliced or asparagus-style carrots, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling water to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p>					25	30
corn: cream style	Select slightly immature ears. Blanch ears 4 minutes in boiling water. Cut corn from the cob at the middle of the kernel. Scrape remaining corn from the cob with a table knife.						
	<p>Hot pack: Add 1 cup boiling water to 2 cups corn. Heat to boiling and simmer for 3 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add ½ teaspoon salt to pints if desired. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended.</p> <p>Raw pack is not recommended.</p>					85	Don't use
corn: whole kernel	Select slightly immature ears. Blanch ears 3 minutes in boiling water. Cut corn from cob at about three-quarters of the depth of the kernel. Do not scrape cob.						
	<p>Hot pack: Add 1 cup of boiling water to 4 cups corn. Heat to a boil and simmer for 5 minutes. Pack hot corn into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack: Pack corn into hot jars, leaving a 1-inch headspace. Add ½ teaspoon salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p>					55	85
mixed vegetables	Select your favorite mixture of vegetables, excluding greens, dried beans, cream style corn, winter squash, and sweet potatoes. Carrots, whole corn kernels, green and lima beans, crushed tomatoes, and zucchini make a good mix. Wash and prepare vegetables as described in this table.						
	<p>Hot pack: Combine all vegetables in a large pot and add enough water to cover. Boil 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					75	90
mushrooms	Use fresh, small to medium-sized domestic mushrooms. Mushrooms should have short stems, unopened caps, and no discoloration. Do not can wild mushrooms.						
	<p>Hot pack: Trim stems and soak in cold water for 10 minutes to remove dirt. Wash in clean water. Leave small mushrooms whole; cut larger ones into halves or quarters. Cover in water and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (¼ teaspoon to half-pints, ½ teaspoon to pints). For better color add ⅛ teaspoon (375 mg) ascorbic acid per pint. Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended.</p> <p>Mushrooms will be overcooked if processed long enough to be safe in quart jars.</p> <p>Raw pack is not recommended.</p>					45	Don't use
okra	Use young, tender pods. Discard diseased or rust-spotted pods.						
	<p>Hot pack: Wash and trim. Leave whole or cut into 1-inch pieces. Boil for 2 minutes and drain. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.</p> <p>Raw pack is not recommended.</p>					25	40

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002

Table 1. Preparing and canning vegetables, cont.

Canner type	0-1,000'	1,001-2,000'	2,001-4,000'	4,001-6,000'	over 6,000'	Processing time	
						(minutes in pressure canner at 10 psi [weighted gauge] or 11 psi [dial gauge]) [†]	
Dial gauge	11	11	12	13	14		
Weighted gauge	10	15	15	15	15		
Vegetable	How to prepare*					Pint	Quart
onions	Use onions that are 1 inch diameter or less. Wash and peel onions.						
	Hot pack: Cover onions in boiling water, bring to a boil, and boil for 5 minutes. Pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					40	40
peas: fresh green	Use well-filled pods containing young, tender peas. Shell and wash peas.						
	Hot pack: Cover with water and bring to a rolling boil for 2 minutes. Loosely pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	40
	Raw pack: Loosely pack peas into hot jars, leaving a 1-inch headspace. Add salt if desired. Fill jars with boiling water to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	40
peas: fresh black-eyed	Shell and wash peas. When packing the peas, do not shake the jar or press down on the contents.						
	Hot pack: Cover with boiling water and boil for 3 minutes. Loosely pack hot into hot jars, leaving a 1-inch headspace for pints, 1½-inches headspace for quarts. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
	Raw pack: Loosely pack peas into hot jars, leaving headspace as specified above. Add salt if desired. Fill jars with boiling water, leaving headspace as above. Remove air bubbles, wipe jar rims, adjust lids, and process.					40	50
peppers: bell, pimento, and chilies	Use firm peppers. Wash and drain. Peel peppers by heating in a gas flame, on the barbecue, or roasting under the broiler until the skins blister. Put peppers in a covered bowl for 5 to 10 minutes. Skins will easily slip off. Remove stem and seeds. Flatten whole chili peppers to remove air. For other peppers, cut into strips or other convenient pieces.						
	Hot pack: Pack loosely into hot jars, leaving a 1-inch headspace. Fill jars with boiling cooking liquid to 1 inch from the top. Add 1 tablespoon bottled lemon juice to each pint jar. Add ½ teaspoon salt to each pint jar if desired. Remove air bubbles, wipe jar rims, adjust lids, and process. Quart jars are not recommended. Raw pack is not recommended.					35	Don't use
potatoes: new	Use small to medium-sized mature potatoes. Potatoes stored below 45°F (7°C) may discolor when canned. For packing whole, choose potatoes that are 1 to 2 inches in diameter. Wash and peel potatoes.						
	Hot pack: Cut into ½-inch cubes if desired. Soak in a solution of 1 teaspoon (3 g) ascorbic acid in 1 gallon of water. Drain and place potatoes in hot water and boil (10 minutes for whole, 2 minutes for cubes). Drain and pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Raw pack is not recommended.					35	40
potatoes: sweet	Use small to medium-sized potatoes. Can within 1 to 2 months after harvest.						
	Hot pack: Wash and boil until partially soft (15 to 20 minutes), cool until you can remove skins. Peel, cut into pieces, and pack hot into hot jars, leaving a 1-inch headspace. Add salt if desired (½ teaspoon to pints, 1 teaspoon to quarts). Fill jars with boiling cooking liquid or sugar syrup (1 part sugar to 2 parts water) to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Do not mash or puree pieces. Raw pack is not recommended.					65	90
pumpkin or winter squash (acorn, banana, buttercup, butternut, or Hubbard): cubed	Use squash with hard rind and mature pulp. Small pumpkins are better for canning than large pumpkins.						
	Hot pack: Wash, remove seeds, and peel. Cut into 1-inch cubes. Add enough water to cover and boil for 2 minutes. Pack hot cubes into hot jars, leaving a 1-inch headspace. Fill jars with boiling cooking liquid to 1 inch from the top. Remove air bubbles, wipe jar rims, adjust lids, and process. Do not mash or puree. Spaghetti squash should be frozen because its flesh does not stay cubed on heating. Raw pack is not recommended.					55	90

Notes:

*Metric conversions: 1 teaspoon = 5 milliliters; 1 tablespoon = 15 milliliters; 1 cup = 0.24 liter; 1 pint = 0.47 liter; 1 quart = 0.95 liter; 1 gallon = 3.8 liters; 1 inch = 2.5 centimeters; 1 pound per square inch (psi) = 6.9 Pascals (Pa).

[†]Times are given for altitudes of 0 to 1,000 feet. For higher altitudes, see table 2.

Note: Research on food preservation is ongoing—recommendations may change. Make sure your food preservation information is always current. Always follow up-to-date, tested guidelines and recipes from reliable sources. 12/2002

Tomatoes

Contrary to popular belief, tomatoes are not a high acid food. They are borderline high acid with a pH of approximately 4.5. This is too close to the dividing line between high and low acid foods. As a result, you must acidify homemade tomato products by adding bottled lemon juice, citric acid or vinegar before they are heat processed in a boiling water, steam or pressure canner. For this reason, it is important to use a recipe from a reputable source and to acidify your tomato products correctly, for all heat processing methods. (*See below for acidification instructions.*) Note that the maximum amount of processing time in a steam canner is 45 minutes.

Today's tomato hybrids are developed to be less acidic. This is especially true for Roma-type tomatoes, which are popular for sauces. Once you add other vegetables, such as peppers, onions, celery and herbs, the acidity is lowered even further. Therefore, one needs to either follow a tested recipe from a safe source, or pressure can tomato sauces. Boiling water and steam canning is only used for high acid foods. If your tomato products are not correctly processed your product could be unsafe for consumption. Mold, *E. coli*, or botulism are real food hazards if the product is not processed correctly.

There are some tomato products in the USDA canning procedures that only have a pressure process listed (for example, tomatoes with okra or zucchini, spaghetti meat sauces, Mexican tomato sauce, etc.). If a pressure canning process is the only listed option, then it is the required processing method; do use a boiling water or steam canner if not specifically listed as a process option. These products made according to the stated recipes and procedures are low-acid food mixtures.

Acidifying Tomatoes

Most of today's tomatoes have been bred for sweetness versus acidity. For this reason, additional acid must be added to canned tomatoes, tomato puree, tomato sauce and tomato juice in the form of either bottled lemon juice, citric acid or vinegar that has an acidity of at least 5%. Most recipes call for the acidity product to be added directly to each jar.

Acidification Chart	
Bottled Lemon Juice	1 Tablespoon per Pint 2 Tablespoons per Quart
Citric Acid	¼ Teaspoon per Pint ½ Teaspoon per Quart
Vinegar, 5% acidity	2 Tablespoons per Pint 4 Tablespoons per Quart

Choosing Tomatoes

Use the best quality, vine ripened tomatoes whenever possible. Green (unripe) tomatoes are more acidic than ripe tomatoes and can be canned safely by the boiling water method. Do NOT use tomatoes from dead or frost-killed vines as the tomatoes may be lower in acid.

Sort tomatoes, picking out any that are spoiled or green. Rinse with cool water. To peel tomatoes, dip tomatoes in boiling water long enough to crack the skins (about 1 minute). Cutting a shallow X in the blossom end of the tomato speeds this process. Dip in cold water. Peel and remove cores. Save any juice to add to the hot liquid in which you boil the tomatoes. If using frozen tomatoes, run them under warm water and slip the skins off.

Both round and oblong tomatoes are suitable for canning. Oblong (plum or paste) tomatoes are meatier and less juicy than round tomatoes and often preferred by home canners as they create thicker sauces in a shorter period of time. Tomatillos may also be canned in a boiling water or steam canner but must be acidified the same as tomatoes.

The following chart shows the approximate yield by tomato type and preparation method.

Tomato Type	Purchase Unit	Purchase Weight	Preparation	Yield (Volume)
Round or Globe	3 medium	1 pound	Chopped	2-1/2 to 3 cups
	3 medium	1 pound	Peeled and crushed	1-1/2 cups
Oblong, Plum or Paste (Roma)	5 medium	1 pound	Chopped	2 cups
	5 medium	1 pound	Crushed or pureed	1-1/2 cups

Tomatoes that work well for canning

Amish	Jersey Devil	Polish Linguisa	Saucy
Amos Coli	Juliet	Pozzano	Sausage
Big Mama Paste	Mama Leone	Principe Borghese	Ten Fingers of Naples
Black Prince	Martinos Roma	Roma	Tiren
Gilberti	Opalka	Russian Big Roma	Verona
Granadero	Paisano	Salvaterres	Viva Italia
Italian Gold (Yellow)	Plum Regal	San Marzano	

Canning Tomatoes

Acidified tomatoes may be canned using either a boiling water/steam canner or a pressure canner. If only a pressure canner processing time is listed, pressure can the product.

Water levels in canners: Many tomato recipes have long boiling water processing times. You can use a steam canner only if the maximum processing time (including altitude adjustments) is no more than 45 minutes. The canner may boil dry if you process jars for longer periods of time. If using a boiling water canner, start with 2-inches of water above the jars if the processing time is 30 minutes or longer, to allow room for the boiling water to evaporate but still leave at least 1-inch of water above the jars during the entire processing time.

Selecting, Preparing and Canning Tomatoes Crushed Tomatoes (with no added liquid)

Quantity: An average of 22 pounds is needed per canner load of 7 quarts; an average of 14 fresh pounds is needed per canner load of 9 pints. A bushel weighs 53 pounds and yields 17 to 20 quarts of crushed tomatoes-an average of 2¾ pounds per quart.

Procedure:

1. Wash tomatoes and dip in boiling water for 30 to 60 seconds or until skins split. Dip in cold water, slip off skins, and remove cores. Trim off any bruised or discolored portions and quarter. Heat one-sixth of the quarters quickly in a large pot, crushing them with a wooden mallet or spoon as they are added to the pot. This will exude juice. Continue heating the tomatoes, stirring to prevent burning. Once the tomatoes are boiling, gradually add remaining quartered tomatoes, stirring constantly. The remaining tomatoes do not need to be crushed, they will soften with heating and stirring. Continue until all tomatoes are added. Boil gently 5 minutes.
2. **Add bottled lemon juice or citric acid to jars:** 2 tablespoons of bottled lemon juice or 1/2 teaspoon of citric acid per **quart** of tomatoes. For **pints**, use 1 tablespoon bottled lemon juice or 1/4 teaspoon citric acid.
3. Add 1 teaspoon of salt per quart to the jars, if desired. Fill jars immediately with hot tomatoes, leaving ½-inch headspace. Adjust lids. Recommended process times are given below. Acidification is still required for the pressure canning options.

Process Time in a Boiling-Water or Atmospheric Steam Canner at Altitudes of					
Style of Pack	Jar Size	0 - 1,000 ft	1,001 - 3,000 ft	3,001 - 6,000 ft	Above 6,000 ft
Hot	Pints	35 min	40	45	50
	Quarts	45	50	55	60

Weighted-Gauge Pressure Canner Pressure (PSI) at Altitudes of				
Style of Pack	Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Hot	Pints or Quarts	20 min	5 lb	10 lb
		15	10	15
		10	15	Not Recommended

Dial-Gauge Pressure Canner Pressure (PSI) at Altitudes of						
Style of Pack	Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft
Hot	Pints or Quarts	20 min	6 lb	7 lb	8 lb	9 lb
		15	11	12	13	14

Source: USDA "Complete Guide to Home Canning," revised 2015

Processing Meat, Poultry and Seafood

Recommended process times in a dial-gauge pressure canner.

	Style of Pack	Jar Size	Process Time	Canner Pressure (PSI) at Altitudes of			
				0-2K	2001-4K	4001-6K	6001-8K
Chicken or rabbit without bones:	Hot & Raw	Pints	75 min	11 lb	12 lb	13 lb	14 lb
		Quarts	90 min	11 lb	12 lb	13 lb	14 lb
Chicken or rabbit with bones:	Hot & Raw	Pints	65 min	11 lb	12 lb	13 lb	14 lb
		Quarts	75 min	11 lb	12 lb	13 lb	14 lb
Ground or Chopped Meat	Hot	Pints	75 min	11 lb	12 lb	13 lb	14 lb
		Quarts	90 min	11 lb	12 lb	13 lb	14 lb
Strips, Cubes or Chunks	Hot & Raw	Pints	75 min	11 lb	12 lb	13 lb	14 lb
		Quarts	90 min	11 lb	12 lb	13 lb	14 lb
Meat Stock, (Broth)	Hot	Pints	20 min	11 lb	12 lb	13 lb	14 lb
		Quarts	25 min	11 lb	12 lb	13 lb	14 lb
Fish	Raw	Pints	100 min	11 lb	12 lb	13 lb	14 lb
Soups*	Hot	Pints	60 min*	11 lb	12 lb	13 lb	14 lb
		Quarts	75 min*	11 lb	12 lb	13 lb	14 lb

*Caution. Process 100 minutes if soup contains seafood.

Recommended process times in a weighted-gauge pressure canner.

	Style of Pack	Jar Size	Process Time	Canner Pressure (PSI) at Altitudes of	
				0-2K	2001-4K
Chicken or rabbit without bones:	Hot & Raw	Pints	75 min	10 lb	15 lb
		Quarts	90 min	10 lb	15 lb
Chicken or rabbit with bones:	Hot & Raw	Pints	65 min	10 lb	15 lb
		Quarts	75 min	10 lb	15 lb
Ground or Chopped Meat	Hot	Pints	75 min	10 lb	15 lb
		Quarts	90 min	10 lb	15 lb
Strips, Cubes or Chunks	Hot & Raw	Pints	75 min	10 lb	15 lb
		Quarts	90 min	10 lb	15 lb
Meat Stock, (Broth)	Hot	Pints	20 min	10 lb	15 lb
		Quarts	25 min	10 lb	15 lb
Fish	Raw	Pints	100 min	10 lb	15 lb
Soups*	Hot	Pints	60 min*	10 lb	15 lb
		Quarts	75 min*	10 lb	15 lb

*Caution: Process 100 minutes if soup contains seafood.

Source: Based on "Complete Guide to Home Canning" Agriculture Information Bulletin 539, 2015 revision

Canning Soup

No Reputable Canning Recipe?

Prep Food:

1. Select, wash, and prepare vegetables, meat and seafood.
2. Cover meat with water, cook until tender. Cool meat, remove bones.
3. Cook vegetables as described for a hot pack.
4. For each cup of dried beans or peas, add 3 cups of water, boil 2 minutes, remove from heat, soak 1 hour, heat to boil and drain.

Heat Soup:

1. Combine solid ingredients; cover with broth, tomatoes, or water.
2. Do not add thickening agents before canning (noodles or other pasta, rice, flour, cream, milk, etc.) Do not puree.
3. Boil 5 minutes. Salt to taste, if desired.

Process Soup:

1. Fill jars with half solid mixture and half soup liquid, leaving 1-inch headspace.
2. Place lids and rings on jars and process, adjust for altitude.

<i>Soups in a dial-gauge pressure canner at altitudes of:</i>						
Style of Pack	Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft
Hot	Pints	60* min	11 lb	12 lb	13 lb	14 lb
	Quarts	75*	11	12	13	14

<i>Soups in a weighted-gauge pressure canner at altitudes of:</i>				
Style of Pack	Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Hot	Pints	60* min	10 lb	15 lb
	Quarts	75*	10	15

** Contains seafood? Process 100 minutes, adjust for altitude.*



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Pressure Canning Recipes

Baked Beans

- ¾ pounds beans per quart
- 3 tablespoons molasses
- 1 tablespoon vinegar
- 2 teaspoon tablespoons salt
- ¾ teaspoon powdered dry mustard
- 7 pieces of pork, ham or bacon (¾-inch pieces)

Preparation:

- Beans:** Sort and wash dry beans. Add 3 cups of water for each cup of dried beans. Boil 2 minutes, remove from heat and soak 1 hour and drain. Heat to boiling in fresh water, and save liquid for making sauce.
- Molasses Sauce:** Mix 4 cups water or cooking liquid from beans, 3 tablespoons dark molasses, 1 tablespoon vinegar, 2 teaspoons salt, and ¾ teaspoon powdered dry mustard. Heat to boiling.
- Baked Beans:** Place seven ¾-inch pieces of pork, ham, or bacon in an earthenware crock, a large casserole, or a pan. Add beans and enough molasses sauce to cover beans. Cover and bake 4 to 5 hours at 350°F. Add water as needed—about every hour.

Canning Processing:

- Fill jars, leaving 1-inch headspace. Remove air bubbles.
- Wipe rim with white vinegar. Place lids and rings on jars, tighten rings finger tight.
- Process in a pressure canner: pints 65 minutes, quarts 75 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000'

Source: National Center for Home Food Preservation, 2020

Chicken

Cut the chicken into suitable sizes for canning. Can with or without bones. The hot pack is preferred for best liquid cover and quality during storage. Natural poultry fat and juices are usually not enough to cover the meat in raw packs.

- **Hot pack** – Boil, steam or bake meat until about two-thirds done. Add 1 teaspoon salt per quart to the jar, if desired. Fill jars with pieces and hot broth, leaving 1-1/4 inch headspace. Remove air bubbles.
- **Raw pack** – Add 1 teaspoon salt per quart, if desired. Fill jars loosely with raw meat pieces, leaving 1-1/4 inch headspace. Do not add liquid.

Processing for Both Methods:

- Wipe rim with white vinegar. Place lids and rings on jars, tighten rings finger tight.
- Process in a pressure canner:
 - **Without bones:** pints 75 minutes, quarts 90 minutes; **with bones:** pints 65 minutes, quarts 75 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000'

Source: National Center for Home Food Preservation, 2020

Stewed Tomatoes

Yield: About 7 pints or 3 quarts

4 quarts tomatoes, cored, peeled, chopped (about 24 large)
 1 cup celery, chopped
 ½ cup onion, chopped
 ¼ cup green peppers, chopped

2 teaspoons salt
 Bottled Lemon Juice: 1 tablespoon per pint or 2
 tablespoons per quart, **or** Citric Acid: ¼ teaspoon
 per pint or ½ teaspoon per quart

- Combine all ingredients in a large non-reactive kettle.
- Cover and cook 10 minutes, stirring occasionally to prevent sticking.
- Ladle hot mixture into jars, leaving 1-inch headspace. Remove air bubbles. Wipe jar rims clean. Place lids and rings on jars, tighten rings finger tight.
- Process in a pressure canner: pints 15 minutes, quarts 20 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000', 15 lbs at 8,001-10,000'

Note: When you see the tomato product recommendations in USDA canning directions that offer both boiling water and pressure canning options, those pressure processes are still only the same amount of heat treatment as the boiling water option. (Higher temperature=shorter process time.) Those pressure processes are not the amount of heat and time that would be required for canning a low-acid food to control for botulism. There has not been a properly researched process for pressure canning of low-acid tomatoes without added acid, so the available process times still require the addition of acid as if they are being processed in boiling water.

Source: Ball Blue Book

Split Pea Soup

Yield: About 5 pints or 2 quarts

2 cups dried split peas
 8 cups water
 1½ cups sliced carrots
 1 cup chopped onion
 1 cup diced cooked ham
 1 bay leaf
 ¼ teaspoon ground allspice
 Salt and freshly ground black pepper

- In a large stainless steel saucepan, combine peas and water. Bring to a boil over medium-high heat.
- Reduce heat, cover and boil gently for about 1 hour or until peas are tender.
- If a smooth soup is desired, working in batches, puree peas and liquid in a food mill or a food processor fitted with a metal blade. Return puree to saucepan. (Or just use a stick blender in the pot.)
- Add carrots, onion, ham, bay leaf and allspice to saucepan. Bring to a boil over medium-high heat. Reduce heat and boil gently for 30 minutes. If soup is too thick, thin with boiling water. Season with salt and pepper to taste. Remove bay leaf.
- Ladle hot soup into hot jars, leaving 1-inch headspace. Remove air bubbles and adjust headspace, if necessary, by adding hot soup. Wipe rim with a paper towel moistened with vinegar.
- Process in a pressure canner: pints 75 minutes, quarts 90 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000', 15 lbs at 8,001-10,000'

Source: Ball Complete Book of Home Preserving, 2012

Chicken Stock

Yield: About 4 quarts or 8 pints

One 3 to 4 pounds chicken, cut into pieces	2 medium onions, quartered	2 bay leaves
16 cups water	1 tablespoon salt	
2 stalks celery	10 peppercorns	

- Combine chicken and water in a large sauce pot. Bring to a boil. Add remaining ingredients. Return to a boil.
- Reduce heat and simmer 2 hours or until chicken is tender. Remove from heat. Skim off foam. Remove chicken from stock, reserving chicken for another use.
- Strain stock through a sieve or several layers of cheese cloth. Allow stock to cool until fat solidifies.
- Skim off fat. Heat stock to a boil. Ladle hot stock into hot jars leaving 1-inch headspace.
- Wipe rim with a paper towel moistened with vinegar. Place lids and rings on jars, tightening rings finger tight.
- Process in a pressure canner: pints 20 minutes, quarts 25 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000', 15 lbs at 8,001-10,000'

Source: *Ball Complete Book of Home Preserving, 2012*

Beef Stew with Vegetables

Yield: About 14 pints or 7 quarts

4 to 5 pounds beef stew meat	8 cups carrots, peeled and sliced	4½ teaspoons salt
1 tablespoon oil	3 cups celery, chopped	1 teaspoon dried thyme
12 cups potatoes, peeled and cubed	3 cups chopped onions	½ teaspoon pepper

- Cut meat into 1 ½-inch cubes; brown in oil.
- In a large kettle, combine meat, vegetables, and seasonings. Cover with boiling water. Bring stew to a boil.
- Ladle into hot jars, leaving 1-inch headspace.
- Wipe rim with a paper towel moistened with vinegar. Remove bubbles.
- Place lids and rings on jars, tightening rings finger tight.
- Process in a pressure canner: pints 75 minutes, quarts 90 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000', 15 lbs at 8,001-10,000'

Source: *Ball Complete Book of Home Preserving, 2012*

Vegetable Stock

Yield: About 8 pints or 4 quarts

1 pound carrots, 1-inch pieces	2 large tomatoes, cored, seeded,	3 bay leaves
6 stalks celery, 1-inch pieces	chopped	1 teaspoon crushed dried thyme
3 medium onions, quartered	2 medium turnips, chopped	8 whole peppercorns
2 red bell peppers, 1-inch pieces	3 cloves garlic, crushed	28 cups water

- Bring all ingredients to a boil over medium-high heat. Reduce heat, cover and boil gently for 2 hours. Uncover and boil gently for 2 hours. Strain stock through a fine sieve or cheesecloth-lined strainer. Discard vegetables and seasoning. Return stock to a boil. Ladle into hot jars, leaving 1-inch headspace. Adjust lids and rings.
- Process in a pressure canner: pints 30 minutes, quarts 35 minutes
 - Weighted gauge: 10 lbs at 0-1000', 15 lbs above 1000'
 - Dial gauge: 11 lbs at 0-2000', 12 lbs at 2001-4000', 13 lbs at 4001-6000', 14 lbs at 6001-8000', 15 lbs at 8,001-10,000'

Source: *Ball Complete Book of Home Preserving, 2012*

Recipe: Crushed Tomatoes (with no added liquid)

Quantity: An average of 22 pounds is needed per canner load of 7 quarts; an average of 14 pounds is needed per canner load of 9 pints. A bushel weighs 53 pounds and yields 17 to 20 quarts of crushed tomatoes – an average of 2-3/4 pounds per quart.

Procedure:

1. Prepare canner, jars and lids.
2. Wash tomatoes and dip in boiling water for 30 to 60 seconds or until skins split. Then dip in cold water, slip off skins, and remove cores. Trim off any bruised or discolored portions and quarter. *(Save the skins and dry them with your favorite spice mix for tomato chips!)*
3. Heat one-sixth of the quarters quickly in a large pot, crushing them with a wooden mallet or spoon as they are added to the pot. This will exude juice. Continue heating the tomatoes, stirring to prevent burning.
4. Once the tomatoes are boiling, gradually add remaining quartered tomatoes, stirring constantly. These remaining tomatoes do not need to be crushed; they will soften with heating and stirring. Continue until all tomatoes are added. Boil gently 5 minutes.
5. Put bottled lemon juice or citric acid in each empty, hot jar. Add 2 tablespoons of bottled lemon juice or 1/2 teaspoon of citric acid in each quart jar. For pints, use 1 tablespoons bottled lemon juice or 1/4 teaspoon citric acid per pint jar.
6. Add 1 teaspoon of salt per quart to the jars, if desired.
7. Fill hot jars immediately with hot tomatoes, leaving 1/2-inch headspace. Remove air bubbles and adjust headspace if needed. Wipe rims of jars with a dampened clean paper towel. Adjust lids and process as follows:

- Crushed Tomatoes in a **boiling-water canner**: Process Time at Altitudes of:

Jar Size	0 - 1,000 ft	1,001 - 3,000 ft	3,001 - 6,000 ft	Above 6,000 ft
Pints	35 minutes	40 minutes	45 minutes	50 minutes
Quarts	45 minutes	50 minutes	55 minutes	60 minutes

- Crushed Tomatoes in a **weighted gauge pressure canner**: Process Time and Pressure at Altitudes of:

Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Pints or Quarts	20 minutes	5 lb	10 lb
	15 minutes	10 lb	15 lb
	10 minutes	15 lb	Not recommended

- Crushed Tomatoes in a **dial-gauge pressure canner**: Process Time and Pressure at Altitudes of:

Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft
Pints or Quarts	20 minutes	6 lb	7 lb	8 lb	9 lb
	15 minutes	11 lb	12 lb	13 lb	14 lb

Source: USDA Complete Guide to Home Canning, 2018

Recipe: Spaghetti Sauce with Meat

Yield: about 9 pints or 5 quarts

Ingredients:

- 30 pounds tomatoes
- 2-1/2 pounds ground beef or sausage
- 5 cloves garlic, minced
- 1 cup chopped onions
- 1 cup chopped seeded green bell pepper or celery
- 1 pound mushrooms, sliced (optional)
- 4 tablespoons chopped fresh parsley
- 1/4 cup lightly packed brown sugar
- 2 tablespoons dried oregano
- 4 teaspoons salt
- 2 teaspoons freshly ground black pepper

Procedure:

1. Wash tomatoes, removing stems and any bruised or discolored portions. Core and quarter 6 tomatoes and place in a large stainless steel saucepan. Bring to a boil over high heat. Using a potato masher, crush tomatoes to release juices, stirring constantly. While maintaining a boil and stirring to prevent scorching, core and quarter additional tomatoes, adding them to the saucepan as you work. Make sure the mixture continues to boil vigorously while you add, stir and crush the remaining tomatoes. When all tomatoes have been added, reduce heat and boil gently until tomatoes are soft, about 10 minutes.
2. Working in batches, press tomato mixture through a fine sieve or food mill. Discard peels and seeds. Set puree aside.
3. Prepare pressure canner, jars and lids.
4. In a large stainless steel skillet, over medium heat, brown ground beef, breaking it up with a fork, until no longer pink. Drain off excess fat. Add garlic, onions, green pepper and mushrooms, if using. Sauté until vegetables are tender, about 3 minutes.
5. In a large stainless steel saucepan, combine reserved tomato puree, meat mixture, parsley, brown sugar, oregano, salt and pepper. Add water to make a thinner sauce, if desired. Bring to a boil over medium-high heat and boil, stirring occasionally, for 5 minutes, until heated through.
6. Ladle hot sauce into hot jars, leaving 1-inch headspace. Remove air bubbles and adjust headspace, if necessary, by adding hot sauce. Wipe rim with vinegar. Apply lids.
7. Place jars in pressure canner. Adjust water level to 2 or 3 inches, lock lid and bring to a boil over medium-high heat. Vent steam for 10 minutes, then close vent. Continue heating to achieve 10 pounds pressure for altitudes below 1,000 feet. Increase pressure for higher altitudes according altitude chart above.
8. Process jars as follows.

- **Weighted gauge pressure canner:** Process Time and Pressure at Altitudes of:

Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Pints	60 minutes	10 lb	15 lb
Quarts	70 minutes	10 lb	15 lb

- **Dial-gauge pressure canner:** Process Time and Pressure at Altitudes of:

Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft	8,001 - 10,000 ft
Pints	60 min	11 lb	12 lb	13 lb	14 lb	15 lb
Quarts	70 min	11 lb	12 lb	13 lb	14 lb	15 lb

9. Turn off heat. Let pressure return to zero naturally. Wait 2 minutes longer, then open vent. Wait 10 minutes. Remove canner lid, then remove jars, cool and store.

Source: *Ball Complete Book of Home Preserving, 2012*

Soups

- Can vegetable, dried bean or pea, meat, poultry, or seafood soups. These foods are low-acid foods and must be pressure canned to ensure that they are free of *Clostridium botulinum* spores.
- **Caution:** Do not add noodles or other pasta, rice, flour, cream, milk or other thickening agents to home canned soups. The tested process time depends upon the product’s pH as well as the heat conductivity of the soup mixture. Thickening a soup changes the way the product heats; heat transfer is less efficient with thicker soups.
- If dried beans or peas are used, they must be fully rehydrated first. Otherwise they absorb liquid during the canning process, thickening the soup.
- If soups contain meat, the meat must be pre-cooked before canning.
- If soups contain any seafood, it must be processed for 100 minutes.
- Do not can pureed squash soups. Pureed squashes are so thick that the USDA does not have a reliable canning recipe to guarantee complete heat penetration.
- Do not puree soups before canning unless the recipe is from a reputable source that is known to test their recipes for safety.
- If canning a meat soup, use white vinegar to wipe the jar rim instead of water to remove any oils.
- *Not confident that you follow the USDA recommendations for canning soup correctly?*
 - *Boil soup 10 minutes at altitudes below 1,000 feet altitude; add 1 additional minute per 1,000 feet additional elevation. Boiling means you are able to see the liquid in the food actively forming large foamy bubbles that break all over the surface. This process should destroy any botulism toxins, but don’t use this technique to bypass proper processing and reputable recipes.*

Canning Soup Procedure:

- Select, wash, and prepare vegetables, meat and seafood as described below.
 - Cover meat with water and cook until tender. Cool meat and remove bones.
 - Cook vegetables.
 - If not soaking beans overnight: For each cup of dried beans or peas add 3 cups of water, boil 2 minutes, remove from heat, soak 1 hour, heat to boil and drain.
- Combine solid ingredients with meat broth, tomatoes, or water to cover. Boil 5 minutes. Salt to taste.
- Fill jars halfway with solid mixture. Add remaining liquid, leaving 1-inch headspace.
- Adjust lids and process following the recommendations below according to the type of pressure canner used.
- Vent canner for 10 minutes.

Recommended process time and pressure for soups in a dial-gauge pressure canner						
Style of Pack	Jar Size	Process Time	0 - 2,000 ft	2,001 - 4,000 ft	4,001 - 6,000 ft	6,001 - 8,000 ft
Hot	Pints	60* min	11 lbs.	12 lbs.	13 lbs.	14 lbs.
	Quarts	75*	11	12	13	14
* Caution: Process 100 minutes if soup contains seafood.						

Recommended process time and pressure for soups in a weighted-gauge pressure canner				
Style of Pack	Jar Size	Process Time	0 - 1,000 ft	Above 1,000 ft
Hot	Pints	60* min	10 lbs.	15 lbs.
	Quarts	75*	10	15
* Caution: Process 100 minutes if soup contains seafood.				

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