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High Acid Canning Basics

Using Boiling Water and Steam Canners



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Basic Food Safety & Sanitation

When preparing food for preservation, cleanliness is essential in preventing food-borne illness, especially when handling raw fish, meat and other foods that won't be cooked (including fruits and vegetables).

Step 1: Clean Your Work Area

Wash your sink and countertops with soap and warm water, rinse well, and dry with clean cloths or paper towels. Then apply a sanitizing solution such as bleach (1 scant teaspoon of liquid unscented bleach to 1 quart of water). Spray well and allow to air dry, or let sit for 30 seconds and wipe dry with clean cloths or paper towels. If using commercial sanitizers, be sure to follow the manufacturer's directions. Not all commercial sanitizers are food safe. Wash and sanitize both before and after preparing food.

Step 2: Wash Your Hands

Wet your hands, apply soap, lather and then scrub for at least 20 seconds. Rinse well and dry with paper towels or a clean cloth. If using gloves, first wash your hands and then wash the gloves following these same procedures. Wash your hands again when switching tasks.



Image Source: FDA

Step 3: Avoid Cross-Contamination

Be sure to use clean cutting boards and kitchen utensils, and wash them thoroughly before switching from one food type to another, or use separate boards and utensils for different types of foods (e.g., use one board for raw fish or meat and another board for vegetables, herbs, etc.). Wipe up spills promptly, and re-clean your work area as often as necessary.



Image Source: Partnership for Food Safety Information

Basic Food Safety & Sanitation – cont.

QUICK TIPS

- use paper towels or a fresh clean dish towel to clean surfaces
- wipe up spills immediately with paper towels or a clean dish towel (and then put that towel straight into the laundry basket)
- change dish cloths and towels **every day**
- sanitize sponges between uses by using one of these 3 methods:
 - moisten the sponge and heat in a microwave for one minute
 - wash in a dishwasher with a drying cycle
 - soak in a bleach solution for one minute
- replace sponges frequently

Step 4: Prepare Your Food

Do not wash raw seafood, meat and poultry – doing so can spread pathogens and potentially cross-contaminate other foods. Wash **all** fresh produce, even if the skin or rinds won't be eaten. To wash produce, rinse under cool running water in a clean sink – do not soak.

QUICK TIPS

- clean produce right before using
- gently rub soft fruits and vegetables (such as tomatoes) with your hands under running water to remove dirt
- scrub firm fruits and vegetables (such as potatoes, carrots, and melons) with a vegetable brush (don't forget to clean the brush!)
- remove outer leaves of lettuce and cabbage before washing
- rinse herbs and sprouts, then shake to remove excess water
- use a kitchen sink sprayer to rinse berries in a colander, gently turning and shaking the colander to remove dirt and excess water

For more information on cleaning and sanitizing the kitchen using inexpensive and food-safe household products, check out this publication:

<https://extension.colostate.edu/docs/pubs/foodnut/kitchen-sanitize.pdf>

When In Doubt, Throw It Out

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

For general information on food safety, here are some good websites to visit:

<http://nchfp.uga.edu>

www.foodsafety.gov

www.fightbac.org

<https://www.cdc.gov/foodsafety/cdc-and-food-safety.html>

Introduction to Canning and Canning Processes

Home canning is about more than creating a quality, shelf-stable product. When it really comes down to it, the home canning process is about making a *safe* product. That goal entails preventing foodborne illness by following canning procedures developed for the specific type of food being canned, whether it be a jam or a pickle or a jar of meat. Of greatest concern is preventing botulism, a very serious (and potentially deadly) disease caused by the bacteria *Clostridium botulinum*.

When canning, jars of food are heated to destroy pathogens, and to expel air and create a vacuum seal. This helps provide the shelf stability, but it also helps create the perfect environment in which *Clostridium botulinum* spores are able to germinate and produce the toxin that causes botulism. This environment includes:

- **moisture** (from the food being canned)
- a **temperature range that allows for growth** (40°F - 120°F)
- **lack of oxygen** (resulting from the air being driven out of the jar during heating)
- a **low acidity** level

When these four factors are present, then the conditions become favorable for *Clostridium botulinum* spores to produce toxin. The only way to destroy *Clostridium botulinum* bacteria is with high heat (240°F), which can only be achieved in a pressure canner. For this reason, low acid foods such as vegetables and meats *must* be processed in a pressure canner. Because *Clostridium botulinum* cannot grow in acidic environments, foods that are naturally high in acid (such as most fruits) or have had acid added to them (such as vinegar added to pickles) can be processed in a boiling water or atmospheric steam canner.

Clostridium botulinum bacteria are naturally present all around us. They can be found in the dirt or on the surfaces of food, and spores can be carried by air currents. There's just no way to know if the bacteria is in that batch of food you're canning. For this reason, it's imperative to always choose recipes from reputable resources and follow processing recommendations precisely.

For further details on food safety in general, as well as information on a variety of food preservation topics, visit our Food Safety website, where you'll find free, downloadable publications and educational posters: https://ucanr.edu/sites/mfp_of_cs/Food_Safety/. You can also access the site by scanning this QR code with your smartphone or tablet.



Introduction to Canning and Canning Processes - cont.

To be sure your home-canned food is safe and of high quality, follow these guidelines.

USE A REPUTABLE RECIPE: Always choose an up-to-date, research-based canning recipe from a reputable source that follows the guidelines of the National Center for Home Food Preservation (NCHFP).

CHOOSE THE CORRECT CANNER: The method of processing depends on the type of food to be canned. For safety, *always* follow the method specified in the recipe. High-acid foods, such as most fruits and pickles, may be processed in a **boiling water canner**. Recipes that have been developed for boiling water canners may also be processed in an **atmospheric steam canner**, provided that the jar size is no larger than one quart and the processing time (including adjustments for altitude) are 45 minutes or less. Low-acid foods, such as meat, poultry and vegetables, are processed in a **pressure canner**. Some fruits have instructions for canning in a pressure canner. Some recipes have instructions for both boiling water/steam and pressure processing. In those cases you may choose either method. If only one option is given, you must use only that method.

UNSAFE CANNING PRACTICES: Some canning methods have been shown to be unsafe and are NOT recommended by the USDA or the NCHFP.

- the **open kettle** method (in which hot food is put into jars, lids are applied and the jars inverted, with no heat processing done)
- the **oven, dishwasher, microwave, or solar methods** (jars of hot food are heated in these ovens, which cannot properly sterilize the food)
- the **dry canning** method (where dry food is processed without liquid, either in a canner or in an oven)

Also **not recommended is inverting jars** when they are removed from the canner. This can allow food to get between the rim of the jar and the lid, resulting in a weakened seal.

High Acid Canning

High acid foods are those that are naturally high in acid (such as most fruits) or those to which acid has been added (such as pickles, relishes, salsas, etc.). Sauerkraut, which is a fermented food, is also considered an acidic food. In order to be safely canned in a boiling water or steam canner, the food must have a pH value of 4.6 or below.

Some foods are borderline in acidity (for example, tomatoes, figs, and Asian pears) and must have some added acid (citric acid, lemon juice or vinegar) in order to be safely canned. Note that while some tomato products may be canned in a boiling water or steam canner, other types of tomato products have low-acid ingredients, such as meat and/or vegetables, which lowers their acidity levels. The products must be processed in a pressure canner.

How do you know which products may be safely canned in a boiling water or steam canner? As noted on page 4, always choose an up-to-date, research-based canning recipe from a reputable source. Be wary of canning recipes circulating on the internet, and do not make up your own recipes.

Canning Basics

GET READY, BE PREPARED: A little preparation at the start of a canning session can help ensure success. Here's a few tips on getting started.

- Read the entire recipe thoroughly before you begin.
- Make sure you have all necessary ingredients on hand. Check expiration dates on items such as pectin, bottled lemon juice, etc., as well to make sure they're fresh.
- Measure out all ingredients. Do not change proportions of ingredients or add other ingredients not specified in the recipe unless an allowable exception is available (see *Make No Substitutions* below).
- Have all necessary utensils at hand.
- Inspect and wash jars, and keep them hot until ready to fill. Follow the lid manufacturer's directions for preparing lids. See *Jars and Lids Essentials* below for more information.

USE THE BEST INGREDIENTS: Select produce that is fresh and of high quality. Discard any produce that is moldy or shows signs of decay or insect damage. Cut away bruises and blemishes from fruits and vegetables. Young and tender vegetables, processed within several hours of harvesting, produce the best results when canned. Fruit should be firm and ripe; however when making jams and jellies without added pectin, it's recommend to use $\frac{3}{4}$ ripe fruit and $\frac{1}{4}$ underripe fruit (underripe fruit has more natural pectin and will help the product to gel). *Do not can overripe fruit as an unsafe product may result.*

PREPARE AND PACK INGREDIENTS AS SPECIFIED: Recipe processing times are determined by not only the type of food being canned, but how it is prepared and packed into the jar. Heat must be able to penetrate throughout the food to the center of the jar. Dirt can harbor bacteria that remain even after washing and are difficult to destroy, so peeling is often required, especially for root crops, underground stem crops, and tomatoes. So, for example, if the recipe says to peel, then peel; if the recipe says to chop in 1" pieces, then the food should be cut in that manner; if the recipe calls for packing loosely or filling the jar only half-way with solids and the rest of the way with liquid, then heed those instructions.

MAKE NO SUBSTITUTIONS: Do not switch the type of pectin called for in jam/jelly recipes, or they may not gel correctly. Ingredients should not be substituted or amounts changed, with very limited exceptions (a list of safe changes and substitutions when canning can be found here: <https://www.ndsu.edu/agriculture/extension/publications/play-it-safe-safe-changes-and-substitutions-tested-canning-recipes>).

RESIZING JARS: Jars may be safely sized down and processed in *smaller* jars, however larger jars may only be used if a recipe specifically calls for it.

- When sizing jars down, process the smaller jars for the same amount of time as for the next largest size jar (e.g., if a recipe calls for 8-oz jars, process 4-oz jars for the same amount of time).
- When canning "in-between" jars, the process time is the same as the next largest allowable size jar (e.g., process 4-oz jars for half-pint times; 12-oz jars for pint times; and 24-oz jars for quart times).
- Use larger jar sizes only if a reputable recipe specifies them (e.g., if a recipe specifies half-pint or pint jars, you may use the larger pint jars, but you may not safely substitute larger quart jars).
- Jams may only be processed in pint jars if a reputable recipe allows for it; there are currently no approved generic instructions for increasing processing times for larger jars.

Canning Basics – cont.

STERILIZING JARS: Sterilizing jars for canning is essential only when processing times are less than 10 minutes. For processing times of 10 minutes or more, pre-sterilization is not required, as the jars become sterilized during processing. It is possible to increase the processing time to avoid sterilizing jars, however that may not always be preferable. For example, some jams and jellies have processing times of 5 minutes; if they are made from fruit low in pectin, the gel could be weakened from the increased processing time.

To sterilize jars in a boiling water canner:

- Fill canner with clean water to cover jars by at least 1".
- Place washed jars in an *upright position* on the rack in the canner.
- Cover the canner, turn heat to high and bring the water to a full rolling boil.
- Boil jars for 10 minutes at 0-1,000 feet above sea level, plus altitude adjustment if applicable (add 1 minute for each additional 1,000 feet of altitude).
- Reduce heat to keep jars warm until ready to fill.
- Remove jars one at a time, carefully pouring the hot water in the jars back into the boiling water canner.

To sterilize jars in an atmospheric steam canner:

- Place washed jars in an *inverted position* on the rack in the canner.
- Place cover on canner with vent hole(s) facing away from you.
- Turn heat to high and bring canner to the temperature of pure steam (212°F at sea level, as verified by a calibrated thermometer), just as you would when processing filled jars).
- Heat jars for 10 minutes at 0-1,000 feet above sea level, plus altitude adjustment if applicable (add 1 minute for each additional 1,000 feet of altitude).
- Reduce heat to keep jars warm until ready to fill.
- Take off cover directing steam away from you (hot steam is hot!); carefully remove jars one at a time.

HOT PACK VS. RAW PACK METHODS: There are two methods of packing food into jars for canning. In the *raw pack* method, raw unheated food is tightly packed into jars (except when liquid is added, which must be very hot). In the *hot pack* method, food is heated and loosely packed into jars. The hot pack method is preferred when canning in a boiling water or steam canner, because of several advantages: It removes more air; shrinks the food more (thus more food fits in a jar); helps keep food from floating; increases the vacuum seal; and it improves the shelf life, with better color and flavor retention during storage. The raw pack method is more suitable for processing vegetables in a pressure canner. When a recipe presents both options, you may choose either one, however note that the different pack methods may have different processing times, so be sure to follow the recipe carefully.

ADJUST FOR ALTITUDE: High-acid canning recipes are developed using sea level as the criteria for processing times. At sea level, water boils at 212°F. As elevation increases, water boils at a lower temperature. Thus, when canning in a boiling water or steam canner at any altitude higher than 1,000 feet above sea level, you must increase the processing time to ensure a safe product.

Follow the instructions for making altitude adjustments that are specified in the recipe's instructions. If none are given, follow the adjustments in the chart on the following page.

Canning Basics – cont.

ALTITUDE ADJUSTMENT CHART

Boiling Water/Steam Processing	
Altitude	Increase Processing Time
1,001 – 3,000 feet	5 minutes
3,001 – 6,000 feet	10 minutes
6,001 – 8,000 feet	15 minutes
8,001 – 10,000 feet	20 minutes

FILLING JARS: The general recommendation is to remove jars one at a time from wherever they're being kept hot. Fill each jar with product and apply the lid and screw band quickly. The band should be tightened just until it is finger-tip tight (unless otherwise directed by the manufacturer). Place the filled jar into the canner. Proceed until all jars are filled.

HEADSPACE: The empty space between the top of the food or liquid in the jar and the underside of the lid is known as *headspace*. This space allows for food to expand during canning without being forced out from under the lid, and it also allows for a good vacuum seal to be formed. Each recipe will specify the amount of headspace that should be left after filling the jar. It's important to follow the headspace amount to ensure that the food maintains good quality during storage. If too little headspace is allowed the food may expand and bubble out when air is being forced out from under the lid during processing. The bubbling food may leave a deposit on the rim of the jar or the seal of the lid and prevent the jar from sealing properly. If too much headspace is allowed, the food at the top is likely to discolor. Also, the jar may not seal properly because there will not be enough processing time to drive all the air out of the jar.

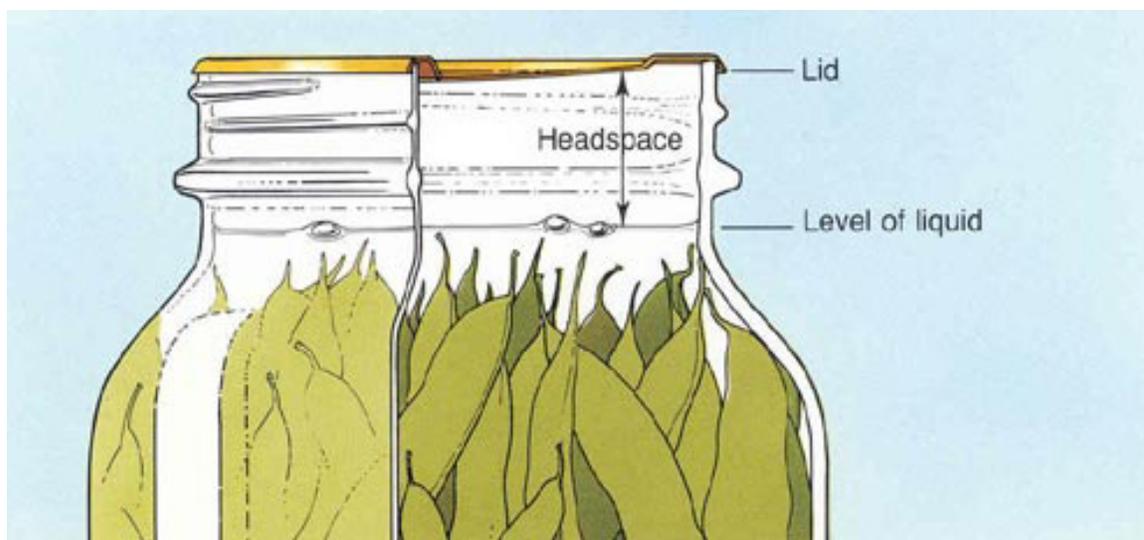


Image Source: U.S. Department of Agriculture

Canning Basics – cont.

In general, fruit spreads require ¼" headspace; tomatoes, pickles and other high-acid foods require ½" headspace; meat and vegetables need 1" headspace; and starchy vegetables need 1 ¼" to 1 ½" headspace. Again, check your recipe (from a reputable source) for the specified headspace level and measure correctly.

PROCESSING TIME: Always process food for the entire time specified in the recipe, starting from when the canner comes to a full rolling boil or full steam, depending on the canner you are using. **If at any time the water stops boiling, a full column of steam stops, or pressure falls, bring the canner back to the correct level and re-start the processing time from the beginning.** This is important to ensure that the food has been correctly processed and is safe to eat.

REMOVING AND COOLING JARS: After the processing time is up, carefully remove jars from the canner *without tilting*. Do not be tempted to pour off the water on the top when lifting jars from the canner, as tilting the jars can cause food to become lodged between the rim of the jar and the sealing compound on the lid, preventing proper sealing. The water will evaporate quickly and is of no concern. Jars should not be left in the canner to cool, as this could also result in improper sealing and food spoilage. The lid's gasket needs to dry on the jar lid, finishing the seal.

When removing the jars from the canner, set them on a heavy towel or a rack placed away from drafts. Leave at least 1" of space between jars during cooling. Don't put towels over the jars while they're cooling; the jars need to cool naturally in still, ambient air. Allow the jars to cool for 12 to 24 hours.

CHECK THE SEALS: After the jars have cooled, check to see that each one has sealed. To do so, remove the screw band and press the middle of the lid with your finger. If the lid springs up when you release your finger, the lid is unsealed. If you are unsure that a jar is sealed, carefully lift the jar by the lid after removing the screw band. If not properly sealed, the lid will come off. If using a reusable lid, follow the manufacturer's instructions for testing for seals.



Image Source: U.S. Department of Agriculture

Canning Basics – cont.

CLEAN, LABEL AND STORE: After the jars have cooled and the seals have been checked, remove the screw bands. Clean the jars with warm soapy water, rinse, and dry the jars. Wash and dry the screw bands. Thoroughly dry bands can be loosely placed back onto the jars, although it's generally recommended that this not be done when storing jars. Label the jars with the contents, processing date, and processing method (BW = boiling water; ST = steam canner; PC = pressure canner) and store in a cool, dark, dry place.

REPROCESSING: If a jar does not seal, refrigerate it and use the product within a few days, or freeze it for longer term storage. The jar can also be reprocessed within 24 hours. Use a new lid and check the jar for flaws (replace it if necessary). Reprocess using the method originally advised and for the full length of time.

General Canning Supplies

Most everything you need for successful canning you likely already have in your kitchen. Specialty tools, such as de-bubblers and headspace measurers, are very helpful but can be easily improvised. Here's the basics of what you'll need.

- a canner or stock pot with rack
- standard canning jars and two-piece metal lids (flat lids with sealing compound and screw bands [aka rings]).
- funnel
- headspace measurer
- bubble removing tool ("de-bubbler")
- jar lifter
- ladle and long-handled slotted spoon
- paper and/or clean cloth towels
- heavy cloth towel or rack for cooling jars
- reputable recipe that follows NCHFP guidelines



Jar and Lid Essentials

INSPECTING AND WASHING JARS: Whether used or fresh out of a new box, all jars should be inspected and washed. Check that there are no cracks, chips or large bubbles in the glass or debris inside the jar. Wash the jars with hot soapy water and rinse well (either by hand or in a dishwasher). Jars need to be sterilized only when the processing time is less than 10 minutes (*see Sterilizing Jars on page 6*). **Keep jars hot until ready to fill.**



Photo Credit: L. Crowley

Jar and Lid Essentials – cont.

LIDS: The most common home canning lids are two-piece metal lids, consisting of a flat lid with sealing compound around the outer edge and a metal screw band (aka ring). Inspect lids to make sure there are no buckles and that the sealing compound has no gaps. Follow the lid manufacturer's directions for preparing lids (most just need washing; some may still require heating after they have been washed). Check the screw bands for dents and rust. The flat metal lid may be used only once for canning; the screw bands may be used multiple times. There are other lid systems available that have reusable plastic or glass lids and rubber rings which are held in place with metal clamps or standard metal screw bands; check with the manufacturer for preparation and use instructions.



Image Source: U.S. Department of Agriculture

REMOVING AIR BUBBLES: After filling a jar to the required headspace, use a bubble-removing tool to release any air pockets that are trapped in the jar (*this is not necessary for jellies or completely liquid products*). De-bubbling is an important final step after filling jars, as trapped air can be expelled during heat processing and increase the amount of headspace beyond what you started with. Be sure to fill the jars to the correct level, de-bubble, and adjust the headspace by adding or removing product as necessary.

Boiling Water Canner Essentials

Boiling water canners are generally made from enamel-coated steel, stainless steel, or aluminum and come with removable perforated racks and fitted lids. There are also electric canners available, which are generally more expensive. The canner must be deep enough so that at least 1" of water (2" if the processing time is longer than 30 minutes) covers the tops of the jars. There also must be enough airspace to allow for 1" to 2" of vigorously boiling water. If you don't have a dedicated canner, a large deep pot with a lid can be used. Canning racks can be purchased separately, or a perforated pizza pan, cake rack, silicone trivet, etc. can be substituted. Pressure canners can also function as boiling water canners, however, the lid should not be applied tightly.

Boiling Water Canner Essentials – cont.

Filled canners can be heavy and they generate a lot of heat. Before canning on a smooth top range, check with the manufacturer as to whether it is suitable for canning and for any canner size limits. On smooth top and electric burners, use only pots with flat bottoms (canners with flat, ridged, or concave bottoms can all be used on gas burners). In general, to ensure uniform processing when canning on an electric range, the canner should be no more than 4" wider in diameter (2" on each side) than the burner element used to heat the canner. Just as with smooth top ranges, some types of portable burners are okay for canning and others are not, so first check the manual. Lastly, keep in mind the height of your range hood; if there's insufficient clearance between it and the top of the canner, it will be difficult to add or remove jars if you're using a vessel that is fairly tall.

See page 14 for step-by-step boiling water canner processing.

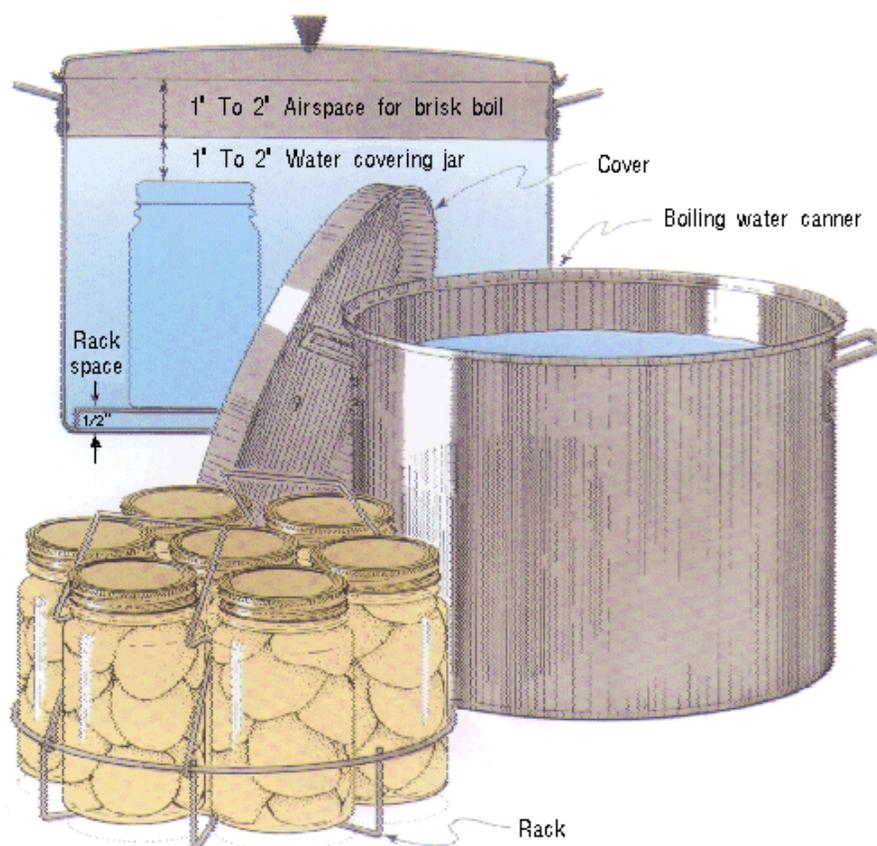


Image Source: U.S. Department of Agriculture

Steam Canner Essentials

Steam canners consist of a shallow pan, a perforated rack, and a tall vented dome cover. These canners are lightweight and use much less water than boiling water canners, so they heat up quickly and use less energy.

Some models have a temperature sensor/gauge on the dome. The sensors on steam canners cannot be tested, so they should be used only as a guide.

Steam Canner Essentials – cont.

Dome-top atmospheric steam canners have been approved for use with reputable recipes that have been developed for boiling water or atmospheric steam canning (meaning high-acid foods such as most fruits, pickles, and other acidified foods) in half-pint, pint, and quart jars. Follow these guidelines when using steam canners:

- use only standard glass canning jars with 2-piece metal lids
- jars must be no larger than quart size
- **the processing time must be 45 minutes or less, including any adjustments for altitude**
- during processing, do not lift the dome cover to add more water (doing so immediately lowers the heat and thus processing will need to start over from the beginning)
- regulate the heat so that the canner maintains a temperature of 212°F (**a canner that boils too vigorously can boil dry within 20 minutes**)
- *helpful hint:* put a quarter or some marbles in the bottom of the canner; they will begin to rattle if the water gets too low

See page 15 for step-by-step atmospheric steam canner processing.



Resources

National Center for Home Food Preservation <http://nchfp.uga.edu>

USDA Complete Guide to Home Canning

online (pdf) <https://nchfp.uga.edu/resources/category/usda-guide#gsc.tab=0>

print https://mdc.itap.purdue.edu/item.asp?Item_Number=AIG-539

So Easy to Preserve <https://www.fcs.uga.edu/extension/so-easy-to-preserve>

Ball Blue Book Guide to Preserving. 2020.

Ball Complete Book of Home Preserving. 2006/2012.

Boiling Water Processing

Be sure to read Boiling Water Canner Essentials beginning on page 11 before following these processing steps.

1. Fill canner with enough water to cover the tops of the jars by at least 1" (2" if processing time is longer than 30 minutes).
2. Heat water in canner to 140°F for raw pack or 180°F for hot pack.
3. Placed filled jars on the canner rack.
4. Place lid on canner. Bring the water to a full rolling boil.
5. Begin to count processing time when the water comes to a full boil. Reduce the heat to maintain a gentle boil.
 - If the water ceases to boil at any point during processing, bring it back to a full boil and re-start the processing time from the beginning.
6. Process for the time indicated in the recipe, plus any altitude adjustments.
7. When the time is up, remove the lid and wait 5 minutes.
8. Carefully remove the jars to a cooling rack or heavy cloth towel.
 - Straight up – Straight Over – Straight Down
 - Do not invert jars!
9. Allow jars to cool in still, ambient air away from drafts for 12-24 hours.
10. Test jars for seals.
 - If a jar did not seal, refrigerate it and use within a few days, or reprocess it within 24 hours using a new lid.
11. Clean and dry jars and screw bands.
12. Label jars and store in a cool, dry, dark place.

Atmospheric Steam Processing

Be sure to read Atmospheric Steam Canner Essentials beginning on page 12 before following these processing steps.

1. Add enough water to the base of the canner to cover the rack (follow the manufacturer's specific recommendations).
2. Heat water in canner to 140°F for raw pack or 180°F for hot pack.
3. Placed filled jars on the canner rack. Place lid on the canner base.
4. Turn heat to high until a steady column of steam (6-8") appears from the vent hole(s) in the canner lid.
5. Begin to count processing time only after a steady stream of steam is visible from the vent hole(s) and the temperature inside the canner reaches that of pure steam (210°F – 212°F at sea level) as determined by inserting a calibrated thermometer into the vent port (note that steam vent size or intensity does not accurately indicate the steam temperature). If using a canner with a temperature sensor, use the temperature gauge only as a guide.
 - If there is any interruption in the full column of steam during the processing period, bring the canner back to full steam and re-start the processing time from the beginning.
6. When the time is up, turn off the heat and wait 2-3 minutes, then remove the lid, tilting it away from you.
7. Carefully remove the jars to a cooling rack or heavy cloth towel: Straight up – Straight Over – Straight Down; Do not invert jars!
8. Allow jars to cool in still, ambient air away from drafts for 12-24 hours.
9. Test jars for seals. If a jar did not seal, refrigerate it and use within a few days, or reprocess it within 24 hours using a new lid.
10. Clean and dry jars and screw bands.
11. Label jars and store in a cool, dry, dark place.