

Choosing a Hot-Fill-Hold Process for Acidified Foods

A thermal process is required for most foods after container filling to ensure safety and shelf stability. For **acidified canned foods**, thermal processing is most often either placement in boiling water/pure steam (canning) or using a hot-fill-hold process. The type of thermal process that you select is based on the type of food, properties of the food, and your container/closure system.

A general guide to processing via immersion in **boiling water** can be found here: www.nchfp.uga.edu

Many foods lend themselves to a **hot-fill-hold process**. Sauces, salsa and other foods with a smooth consistency and a pre-cook process can often be effectively hot-filled.

- 1) food is heated (very hot),
- 2) hot food is placed into containers (often pre-warmed),
- 3) a closure or lid is applied. The sealed container is most often inverted to ensure pasteurization of the container headspace.

After inversion for a short period of time, the container is turned right side up and allowed to cool prior to labelling.

Research conducted by the scientists working at North Carolina State University provides **minimum** hot-fill hold conditions required to ensure destruction of pathogens and spoilage organisms. Higher temperatures or longer hold times may be necessary to ensure safety and seal integrity.

Minimum hot-fill hold times for acidified foods with an equilibrium pH of 4.1 or below (partial table; for a full listing see here: http://foodsafety.wisc.edu/business_food/files/Lethality_TimeTemp.pdf)

Temp(°F)	Time(min.)	Temp(°F)	Time(min.)	Temp(°F)	Time(min.)	Temp(°F)	Time (min.)
140	12.7	150	3.9	160	1.2	170	0.4
142	10.1	152	3.1	162	0.9	172	0.3
144	7.9	154	2.4	164	0.7	174	0.2
146	6.3	156	1.9	166	0.6	176	0.2
148	4.9	158	1.5	168	0.5	178	0.1

Reference: F. Breidt, K.P. Sandeep, and F.M. Arritt. 2010. Use of linear models for thermal processing of acidified foods. *Food Protection Trends* 30:268-272. [z value of 19.5]

Using this information, the heating step in a scheduled process step for spaghetti sauce, pH 3.8, can be described as follows:

1. Fill jars with hot sauce, minimum fill temperature 180°F, target temperature is 200°F, set headspace at ½" and cover with properly prepared closure/lid.
2. Invert jar and hold, 180°F or higher for 1 minute or longer. Turn jar right side up and allow to air cool. The hold time is, at a minimum 6 seconds (0.1 minutes) at 178°F. The processor chooses to hold the product longer, and at a higher temperature, to ensure safety and that a strong seal is achieved on the container. Minimum hot-fill hold times for higher pH foods, pH 4.1-4.6, are below.

Minimum hot-fill hold times for acidified foods with an equilibrium pH of 4.1 - 4.6 (partial table; for a full listing see here: http://foodsafety.wisc.edu/business_food/files/4.1_4.6ThermalProcessing.pdf)

Temp(°F)	Time(min.)	Temp(°F)	Time(min.)	Temp(°F)	Time(min.)	Temp(°F)	Time (min.)
		150	22.4	160	5.6	170	1.4
142	67.7	152	17.0	162	4.3	172	1.1
144	51.4	154	12.9	164	3.2	174	0.8
146	39.0	156	9.8	166	2.5	176	0.6
148	29.6	158	7.4	168	1.9	178	0.5

Reference: F. Breidt, K. Kay, J. Osborne, B. Ingham, and F. Arritt. 2014. Thermal processing of acidified foods with pH 4.1 to 4.6. *Food Protection Trends* 34:132-138. [z value of 17.1]