

## pH of Brine For Canned Food Testing

For brine of canned acid foods, the equilibrium pH value must be 4.6 or below to inhibit the growth of *Clostridium botulinum*, the most heat resistant of the food pathogen microorganisms.



### Introduction

The anaerobic bacterium *Clostridium botulinum* produced in improperly canned foods has caused illness and death. The vacuum seal on cans provides an oxygen-free environment that will allow *C. botulinum* spores to grow and produce deadly toxin, if the canning process is not carried out properly. Fortunately, the *C. botulinum* spores will not grow in high-acid foods (pH ≤ 4.6). For low-acid foods (pH > 4.6), these spores, that are resistant to boiling water temperature, must be killed during the canning process.

The appropriate pH in the cans is obtained by the use of brines with known acid concentrations or tablets of known acid compositions that are added to cans of specified volumes. The contents of the cans must be then conveniently stirred to ensure that the pH is below 4.6 in the center of all food particles. Acids used in canning to lower the pH to 4.6 are usually citric, lactic and malic, but also glucono-delta-lactone.

The LAQUAtwin pH meter can be used by food processors or home canners

to measure the pH of brine in canned foods. There are three (3) LAQUAtwin pH meter models available, namely pH 11, 22, and 33. These light, pocket-sized meters allow two to five calibration points using either NIST or USA pH buffers. The pH 33 meter has built-in temperature sensor that measures and displays temperature and automatic temperature compensation feature (ATC) that performs automatic calibration to the exact pH of the buffer at the measured temperature. Refer to the specifications of each meter model for more information.

### Method

Calibrate the LAQUAtwin pH meter using pH 4.01 and 7.00 (or 6.86) buffers according to manufacturer's instructions.

### Sample Measurement

Using the pipette that comes with the meter, take an aliquot of the brine sample and place some drops into the sensor. Record the pH and temperature once stabilized. After testing each brine sample, rinse the sensor with water and blot dry with soft tissue.

To obtain accurate results, a uniform temperature should be maintained for the standard buffer solutions and brine samples. The test should be made at a temperature between 20-30°C, the optimum is 25°C.

Table 1: Some pH Values of Common Foods

Food	pH
Vinegar	2.5
Lemon Juice	2.6
Jelly	3.1
Ketchup	3.6
Mayonnaise	3.7
Canned peaches	3.9
Canned Tomatoes	4.0
Canned Green Beans	5.0
Canned Hominy	6.8

(Source: John E. Rushing, Ph.D., Formulating Dressings, Sauces, and Marinades. Food Safety)

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## Results and Benefits

Food acidity is important in preventing botulism, a foodborne illness that comes from eating contaminated food with toxins produced by *C. botulinum*. This fact is used in canning acid foods. Aside from following tested recipes and proper canning methods to ensure that *C. botulinum* is killed and does not grow in canned food, performing accurate pH measurement using a reliable instrument is also necessary to ensure that the correct pH value of 4.6 or below is attained for food safety and regulatory compliance. The final equilibrium pH (the pH of a food product after the food acid is distributed equally throughout the product) must be checked, controlled and documented after the product has completed the thermal processing step.

### References

1. Sun, Da-Wen. Thermal Food Processing New Technologies and Quality Issues. 2nd ed. USA: CRC Press, 2012.
2. Numer, Brian. Food Acidity and Safety. FN/Food Safety/2008-01. Utah University. August 2008.
3. Pickle Bill Factsheet. Dairy and Food Inspection Division. Minnesota Department of Agriculture REV 0, 12 AUGUST 2015

Table 2: Acidity and Canning Requirements

Acid (pH)	Type	Botulism Potential	Canning Method
≤ 4.6	Acid Food	No	Hot fill* (~190°F) or Boiling Water Canner (~212°F)
> 4.6	Low Acid Food	Yes	Pressure required (~250°F)

\*Hot fill processing is only recommended for licensed food processors. Home canners should use the boiling water canning process. (Source: Numer, Brian. Food Acidity and Safety, FN/Food Safety/2008-01)

### pH Meters Lineup

#### pH 11 Meter



#### pH 22 Meter



#### pH 33 Meter



### Features

Flat pH sensor with temperature compensation offers a reliable and quick direct measurement of micro-samples from 100 µL.

### Applications include

Fresh water testing; aquarium; affluent treatment; soil & food testing; research laboratories; QC education, etc.

Model	pH 11	pH 22	pH 33
Measurement principle	Glass electrode method		
Minimum sample volume	0.1 mL (0.05 mL with sampling sheet B)		
Measurement range pH / mV	0 to 14 pH / ± 650 mV		
Resolution	0.1 pH	0.01 pH	
Calibration	Two-point	Three-point	Five-point
Accuracy	± 0.1 pH	± 0.01 pH	
Calibration curves	USA / NIST		
Functions	Temperature compensation • IP67 Water/Dust Proof • Auto Hold • Auto Stable • Automatic power off (30 minutes)		
Display	Custom (monochrome) digital LCD		
Operating temperature/humidity	5 to 40°C, 85% or less in relative humidity (no condensation)		
Battery life	Approx. 400 hours in continuous use with x2 CR 2032 batteries		
Main Material	ABS epoxy		
Dimensions/Mass	164 mm x 29 mm x 20 mm (excluding projections) / Approx. 50 g (meter only, without batteries, approx. 45 g)		
Accessories included	2 CR2032 batteries • 1 Pipette • Instruction manual • Quick manual • Storage case • 14 mL Standard solutions (pH 4 & pH 7)		
Ordering Code	3999960122	3999960123	3999960124

### LAQUAtwin Pocket Ion Meters Lineup



pH      COND      Na+      K+      NO3-      Ca2+      Salt EC



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