# To The Point
## High Pressure Pasteurization for the Food Industry

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High pressure pasteurization (HPP) is becoming more and more popular for extending the shelf life of food in the industry. HPP holds the promise of helping to ensure pathogen-free food while retaining taste, texture, and nutritional value while extending product shelf life. While this may sound like a panacea, it comes at a cost and is not devoid of risk. This innovative process uses high pressures upwards of 87,000 psi (6,000 atmospheres)[1] in a flooded chamber as a "kill step" to inactivate pathogens without heat or radiation. These pathogens include listeria, E. coli, salmonella, lactic acid bacteria, yeast, and mold, which are responsible for Foodborne Illness Outbreaks (FBIOs), product recalls, and product liability.

Aside from food safety, other key benefits include lack of change to taste or texture, retaining the food's nutritional value, and extending product shelf life.

Certain foods are ideal for HPP, such as foods with intermediate to high moisture content or "water activity" of .85 or greater (1.0 being pure water). These foods include ready-to-eat refrigerated salads containing high protein meats or seafood and avocado-based foods such as guacamole and hummus. Essentially any low-acid food with significant water content and a desire to retain its original properties are potential candidates for HPP.

### How Does HPP Work?

HPP process description:

1. Food is placed in semi-rigid, liquid-proof packaging.
2. The food is loaded into the HPP unit, a cold isostatic press (CIP), on a "per batch" basis.
3. The CIP unit is sealed and filled with isostatic liquid (including pure, clean water).
4. Pressure is allowed to build in the chamber containing the food until it reaches the required pressure.
5. The food then stays under pressure for a validated and verified time to achieve the necessary kill step (e.g., 3-5 minutes under desired pressure)[1] as a

crucial process-oriented "preventive control" (PC).
6. The pressure is then relieved, and the CIP unit is drained.
7. The product is then removed and ready for further packing and distribution.

Because force is applied uniformly, the packaging doesn't rupture or get "squished" by the HPP CIP press. According to the National Provisioner / Independent Processor, while HPP adoption is limited, it is anticipated to grow as a unique kill step by over 22% or $640M in service revenue by 2022.[2]

## Risk Engineering Considerations

CIPs are capital investments and can cost upwards of $2-4M for an installed and commissioned unit. An initial decision needs to be made regarding purchasing a CIP unit or engaging third-party contract manufacturing organizations (CMOs/co-mans) to perform this service on your behalf. Production quantities are often a telltale way to determine the cost/benefit of whether to own or sub out the HPP process.

### Inspectional and Operational Considerations:

Strong maintenance practices dictate routine, predictive inspections, and subsequent documentation. For example:

- Having an overall adherence to American Society of Mechanical Engineers (ASME) code section 8 Division 3.
- Obtaining cycle tracking data.
  - Current cycle count
  - Design cycle life (per Original Equipment Manufacturer (OEM) and ASME)
  - Average number of cycles per day
  - Remaining life based on cycle count and average cycles per day
- Obtaining a copy of the nameplate and ASME data report.
- Understanding and appreciating the operating pressure vs. design pressure.
- Documenting any history of repairs or alterations.
- Inspecting containers for any scratches or defects. Some scratches may be able to be polished out; in other cases, the container will need to be replaced.
- Proving (in writing or electronically) daily, weekly, and monthly OEM vessel inspection/Maintenance requirements. In addition, documenting:
  - A copy of the annual quick closer and safety interlock inspections by the OEM or OEM representative
- Obtaining a copy of the annual NDE inspections by an OEM or OEM representative.
- Conducting vessel pressure controls testing and collecting calibration records, including frequency of calibration activities.

### Business Contingency Considerations:

If a CIP vessel is purchased, it is important to understand its finite cycle life. Moreover, a great deal of care and maintenance are associated with these units. Some considerations include:

- Does the existing maintenance team have the necessary training and skills to inspect, maintain, and service this equipment? If not, what needs to be accomplished regarding staff hiring, training, and providing the necessary financial resources to operate and maintain this equipment?
- What warranties come with the CIP unit? What is covered and what isn't? What is considered a "consumable part," and what is defined as "wear and tear"?
- Has a service contract been purchased on the CIP system? If yes, what is the vendor's response time if the unit experiences a problem? In high-production food facilities, hours can equate to thousands of dollars.
- Has the HPP process been formally documented and incorporated into your organization's regulatory preventive controls (PC) food safety program?
- How have you consistently validated and verified the pressure and time requirements to inactivate pathogens?
- Does your organization have a formal Business Contingency Program? If yes, has a formal risk assessment been carried out on the HPP process? For example, if the HPP system goes down, do you have a backup (pre-validated and verified) kill step that can be used instead of the HPP system until it is back up and running? If there are no available alternative kill steps, are contracts/agreements in place with third-party co-mans who can perform HPP on your behalf?

Accountability must be considered in equipment breakdown due to the high pressures produced.

### Subcontractor Considerations:

If food processors opt to subcontract HPP to third parties, consider the following:

- Have you documented current third-party co-mans in your preventitive controls (PC) food safety plan?
- In your BCP, do you include supply chain interdependencies with third-party vendors (ingredients, packaging, transportation/logistics, onsite service/maintenance/sanitation contractors, etc.)?
- Are the co-mans geographically local to your operation? Do you have formal contracts or agreements with them?
- If capacity is significantly reduced, how will you prioritize which customers will receive your product? How will you modify refrigerated transportation and storage arrangements to safely allow this shift in HPP vendors, especially if your alternate HPP vendor is not local?

- How much inventory do you keep on hand in case of a process upset? Many food processing organizations have opted for "JIT" (just in time) manufacturing, thus leaving little margin for error.

## Resources


1. **The Ohio State University, Food Safety Engineering Laboratory,** u.osu.edu/foodsafetyeng/research-focus/high-pressure-processing/frequently-asked-questions/
2. **The National Provisioner,** www.provisioneronline.com/articles/107538-high-pressure-processing-outsourcing-vs-in-house


## Learn More & Connect

For more information on protecting your business, contact your local risk engineer, visit the Chubb Risk Consulting Library, or check out www.chubb.com/engineering.

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