

Laboratory Safety Committee



Northern Illinois
University

Laboratory Pressure Vessel Policy

Purpose

Laboratory pressure vessels are also referred to as sample preparation bombs, acid digestion bombs, hydrothermal or chemical digestion autoclaves. The heating of chemicals inside a closed vessel can result in some of the highest gas or super critical fluid pressures encountered in a laboratory. Failure of a vessel can be the result of improper maintenance and operation or design flaw. This policy will help ensure the safety of NIU staff and students.

Policy

Definition

A pressure vessel is defined as any closed container which is operated at an internal pressure greater than 15 PSIG.

Specifications

1. All vessels are to comply with the ASME Boiler and Pressure Vessel Code or similar codes. Notably, each pressure vessel shall be equipped with a pressure release device. A pressure gauge is also highly preferred. Special procedures are necessary for those pressure vessels (small size sealed tubes) where the pressure release device or pressure gauge could not be installed.
2. Any NIU Machine Shop is not currently permitted to produce “homebuilt” pressure vessels.

Training

All pressure vessel operators are to be trained on the safe and proper operation of the device by the owner (defined as the Principal Investigator) or a designee of the owner. Documentation of the training shall be kept within the lab as part of the Laboratory Safety Plan.

Responsibility

The Principle Investigator (PI) is responsible for maintaining the operational condition of the vessel in accordance with the manufacturer’s specifications. A review of student written standard operating procedures shall be made by the PI and Office of Research Compliance, Integrity and Safety before work is begun.

Inspection

The pressure vessel system, pressure release device, and pressure gauge shall be inspected each time of use for defects, possible fractures or other deformities which may reduce safety. In addition, any inspections required by the manufacturer will be provided in accordance with manufacturer’s specifications.

Operating Procedure

A detailed standard operating procedure, including intended operating pressures and temperatures, shall be written as part of the Laboratory Safety Plan kept in the laboratory. Novice users must be directly supervised in experimental design, vessel assembly, and heating mode selection until they exhibit full understanding

and proficiency. Any conditions that increase hazards must be well understood to prevent dangerous ruptures or explosions.

1. Except for rare and well justified cases, all laboratory pressure vessels shall be equipped with a form of overpressure relief to protect the vessel from the hazards of unexpected or dangerously high internal pressures. Appropriate overpressure relief through a safety rupture disk or safety relief valve must be part of the laboratory pressure vessel design. All manufacturer instructions regarding safety must be followed.
2. A detailed Standard Operating Procedure must accompany the use of the vessel. The PI should provide all of the documents to justify that their pressure vessels meet the required safety standard of the NIU Laboratory Safety Committee and OSHA.
3. Justification and special operating procedures are required for those devices without a safety relief device. The justification and special operating procedures must be reviewed and approved by the LSC.
4. The proper operation of the device shall not be restricted or defeated by any means such as a cap, tie down, removal, paint, etc.
5. Manufacturer's literature and documentation of maximum pressure and temperature must be readily available when pressure vessel is in use, assembled, or maintained.
6. Pressure vessels should be located in appropriate enclosure away from general laboratory activities. When using toxic chemicals and reaction gases appropriate venting has to be assured.
7. Review procedures to ensure that temperature and loading limits are not exceeded past manufacturer's specifications. Overloading of a pressure vessel is a significant hazard. Identify the load limits for each chemical and vessel size combination in the manufacture's literature.
8. DO NOT use explosive materials inside a pressure vessel. Do not use chemicals which may react with the pressure vessel container.
9. Dangerous overheating can be caused by defective temperature controls or operator inattention:
 - a. Use heating devices equipped with excess temperature limits which prevent overheating beyond experimental needs.
 - b. Heat pressure vessels using heating devices appropriate for the investigated chemicals and the container material of the pressure vessel.
 - c. Heat pressure vessels behind a blast shield or suitable barrier.

- d. Post caution signs and entry requirements when heating pressure vessels, which are unattended.
10. Pressure vessels equipped with a pressure release device shall be opened **only** at room temperature and atmospheric pressure. They shall be opened behind a blast shield or suitable barrier. Pressure vessels without the pressure release device shall be opened only under special precautions preventing explosions and injury.
 11. If a vessel is designed and constructed as part of a research project the vessel construction, design and operation must be certified by a neutral party to ensure that the vessel complies with all safety regulations.

Annual Review

The Laboratory Safety Committee will review and revise this policy on an annual basis to reflect operational and procedural changes internal to the University as well as changes to applicable rule, and regulations and consensus standards.

Date	Reviewed by	Changes
1/29/2018	Lab Safety Committee	Annual review
3/8/2021	Lab Safety Manager	Annual review
2/7/2022	Lab Safety Manager	Annual review

Reference

American Society for Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, 2021
<https://www.asme.org/>