

MBAA Safety Toolbox Talk



Pressurized Vessels & Equipment in the Brewery

Overview

Pressurized containers exist throughout the brewery including fermentation tanks and compressed gas cylinders, but there are many other pressurized sources throughout the brewing environment. When exposed to pressure greater than their engineered design, these vessels can fail catastrophically, causing serious and potentially fatal injuries. Even partial vessel ruptures can potentially expel hazardous materials such as chemicals and hot liquids into the work area. In addition to over-pressure situations, effective vacuum relief is needed to guard against implosions during negative pressure conditions.

Pressurized Containers in the Brewery

- Piping and hoses
 - Compressed air, CO₂, N₂, etc.
 - Steam
 - Liquids (water, beer, chemicals, etc.)
- Vessels
 - Fermentation vessels, bright beer tank (BBTs)
 - Kegs
 - Compressed gas cylinders & reservoirs
 - Boilers
 - Cryogenic/liquid gas reservoirs

Safety Equipment

- Operator training/awareness
- Pressure relief devices
 - Pressure relief valves (PRVs)
 - Single-use rupture discs
 - Vacuum relief devices
- Pressure gauges
- Gas regulators (single- or dual-stage)
- Preventative maintenance programs

Design & Engineering Considerations

- Pressure vessels will have a maximum operational pressure rating listed on the manufacturing blueprint and should be stamped onto the vessel.
 - Brewery vessels such as fermentation vessels & BBTs are typically only rated to 15 psig. Without documentation confirming that a given vessel can handle higher pressures, operational conditions should not exceed 15 psig.
- Pressurized systems need to have a method for safely releasing excess pressure in order to remain within their rated capacity and prevent a catastrophic failure. Pressure relief valves (PRVs) are designed to open when pressures reach a certain level. Spring-actuated valves are commonly used as a primary device, bleeding off pressure as long as the spring is depressed and then resealing again. The release point is generally preset by the manufacturer, but it may be adjustable. Single-use rupture discs are frangible devices designed to break when exposed to pressure above a set level, providing an open vent. In addition to being single-use, they are relatively fragile and can break when handled, making them more suitable as a secondary safety device.
- Vacuum relief: Although brewery vessels are designed to handle outward pressure, they have limited capacity to handle negative pressure conditions. Vessels need to have adequate ventilation to allow for pressure equalization. Common causes of vacuum in a brewery:
 - Rapid cooling during a CIP cycle;
 - Chemical incompatibility, such as introducing a caustic solution into a high CO₂ environment;

- Transferring beer without a balance line or adequate head pressure on the source tank.
- When adding/modifying equipment, conduct a safety review and identify any changes to the existing risk assessment. Factors should include:
 - Have working pressures or pressure sources changed?
 - Have control devices like valves been added or removed?
 - Will any of the changes require employees to perform tasks differently and are employees adequately trained on those changes?

Recommended Practices

- Training and operator awareness: Employees should know the sources of pressure in the brewery and what levels are safe for each vessel type. Assume everything is pressurized until proven otherwise.
- Repair or replace compromised equipment.
 - Test PRVs to verify pressure release at the listed setpoint(s).
 - Calibrate vessels' pressure gauges, regulators, and other equipment against a master gauge or pneumatic testing rig to verify accuracy.
 - Vibrations can cause loose connections and support hangers, leading to potential points of failure; monitor piping and supports for excessive movement.
 - Temperature fluctuations and chemicals can affect pipe connections, hose fittings, and other soft parts. This is particularly dangerous when corrosive chemicals or cryogenic gases are involved. Regular inspection and proper installation are important.
- Compressed gas cylinders must be effectively secured to prevent damage. A broken cylinder can effectively turn into a missile.
 - Cylinders must be strapped or chained to a stable wall-mount or post. The strap should be midway up the cylinder to prevent it from tipping over or slipping out beneath the strap.
 - Cylinder caps must be screwed on when the tank is not in use.
- Control valves should not be installed in between a PRV and the pressure vessel: the risk of accidentally closing the valve and blocking the PRV is too high.
- PRVs, single-use rupture discs, and vacuum-relief devices mounted on the tops of vessels should be periodically inspected to confirm that they are being cleaned effectively and are not compromised by soil, corrosion, or beerstone.
- Pressure regulation: Limit the amount of available pressure at the point-of-use to the minimum necessary to accomplish a task, even when a vessel is rated for higher pressures.
 - When draining partially filled kegs, install a limiting regulator to reduce compressed air pressure to 30–40 psig or lower.

Learn more!

Resources and Regulatory References

OSHA Standard 29 CFR 1910.101

<https://www.osha.gov/SLTC/pressurevessels/index.html>

<https://www.osha.gov/SLTC/pressurevessels/standards.html>

FOR MORE INFORMATION ON BREWERY SAFETY, PLEASE VISIT THE MBAA BREWERY SAFETY WEBSITE AT:
<http://www.mbaa.com/brewresources/brewsafety>

ASME Boiler and Pressure Vessel Code
Compressed Gas Association Standards