

GUIDE TO BREWERY DESIGN

PART II: DESIGNING FOR HEDONISM

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Overview

The production and retail sale of alcohol has a long history in the United States, interrupted only by Prohibition in the 20th century. Because of this, those who provide services to the alcohol industry have historical data to assess the risks and benefits of engaging in the alcohol industry. However, public taste and demand inevitably change, which results in changes and disruptions in historical patterns.

The explosive growth in craft breweries has not only changed the types of beers that Americans drink, but it has also changed where Americans drink their beer. The craft beer craze has even reached into architecture – Donut Island Brewing and Hiisi Brewing Company in Finland have created a limited edition pale ale celebrating the collaborative nature of architectural work - Revision Cloud Architectural Pale Ale.

Small breweries are centers of innovation and revitalization of the alcohol industry, and their business contributions to the overall economy are significant and invaluable. The demand for craft beers has resulted in a comparable growth in commercial space being utilized for brewing, along with space for pubs and restaurants.

The regulation and requirements for a craft brewery, however, are often different than those of a larger commercial brewery. The same general building, management and commercial construction principles apply, but to understand the design requirements for the smaller brewery, design professionals need to consider issues of utilizing space efficiently; of public safety; and of the risk of potential contamination and product liability. This paper addresses design issues and considerations for a design professional who is considering working on a craft brewery.

Special Design Issues of Breweries and Distilleries

Breweries and distilleries have been built in the United States since its founding, resulting in common regulatory standards and code provisions for such businesses. However, the applicability of various code requirements can vary, depending on whether there is brewing on-site; the physical layout of the brewery; and how manufacturing materials are stored.

Premises Design. An efficient and safe design of brewery space is crucial. The brewery itself is the cornerstone of the commercial space and it needs to be laid out to allow for materials to come in one

way and for beer to go out the other way. Proper flow of materials allows for efficiency and cost savings, so careful determination of the interior dimensions in the layout of the brewing facility will ensure its efficient operation. In addition, brewery equipment has significant issues of height and width which must be addressed from the very start of the design process. Ceiling heights of 12' to 15' in the brewhouse and cellar areas are standard for smaller systems of 5 to 10 barrels. Microbreweries and production breweries will require additional ceiling heights due to the larger vessel sizes.

Any design for a brewery should also be designed to efficiently locate all pieces of equipment as well as accommodate the equipment needed to move materials, such as a forklift. There must be an entryway into the building to accommodate the largest vessels. When the layout does not permit adequate placement of equipment or inventory storage, efficient operation and transportation are hampered.

Anchoring platform posts and tank legs are another commonly overlooked design requirement. Municipal inspectors will frequently insist on additional, enhanced anchoring of brewing equipment and those needs are best addressed early in the design process.

Brewing issues. The biggest ingredient in beer can be the biggest problem in making the beer. A clean, reliable water source is a must, and, given the increasing number of water challenges faced by communities across the U.S., one that should not be taken for granted. When determining water supply requirements for a particular location, pressure, flow rate, and pipe capacity are three primary factors that should be addressed.

Of course, advertising has made us all aware that water quality is crucial to the brewing process ["brewed with pure water"], but operating design considerations should also emphasize reducing water usage wherever possible. The amount of water necessary to brew beer is roughly 3.5 to 1. Given its fundamental importance as a core ingredient in beer, water supply is a critical utility for any brewery, brewpub, or restaurant. The less water that is needed to be treated, the less pumping and energy use and the lower the cost. Aggressively reducing water will lower the impact on effluent flow, thus reducing the cost of discharging the water and lessening the impact on the local water treatment facility.

The design must also ensure there is uniform water pressure to the brewhouse. The water pressure should not be affected by water demand elsewhere in the building, so that necessary rinses and mashing can be achieved. A filtration treatment system is also typically designed to achieve a desired consistency and purity of water as well as for clarity of the beer.

When brewing beer, temperature is a vital component of the process. The ability to achieve temperature consistency must also be integrated into the brewery design. The components must be heated to exact temperatures and those temperatures must be maintained for set timeframes.

Contamination. Contamination during the brewing process is one of the most prevalent problems so that generally, design professionals should specify high quality stainless steel, because it makes cleaning easier.

Proper handling of the discharge from a brewing operation is also a common issue. The municipality in which the brewery is located should be consulted to achieve the required acceptable quality and volume of the discharge. The consultation should also include a determination of whether the municipality might require the brewery to treat discharge water.

Drains are required in the brewhouse, in the fermentation area, in the walk-in cooler (if applicable), the boiler room, and any other area where water and spillage may occur (e.g. keggering and bottling). Floors should have a recommended pitch of ¼" per foot towards drains. Floors that are not sloped properly or which fail to contain the necessary number and placement of drains will quickly result in a slipping zone for employees and brewery tour guests. Channel drains with stainless steel or fiberglass grating are typically recommended as the drains need to be able to withstand the high temperatures associated with the brewing and cleaning liquids which are typically acidic. Reports are that industrial tile is a functional covering for flooring. Sizing is also important, as the drains typically need to handle 4-6 barrels of effluent for every one barrel of beer produced.

Cleanliness and discharge flow are not the only parameter to consider; the biological oxygen demand (BOD), total suspended solids (TSS), and other components also need to be accounted for. Wastewater treatment and discharge costs can be expensive. Therefore, it is critical to reduce the discharge flow as much as possible, to avoid high wastewater charges and ensure that present and future production needs can be achieved.

Insulation. A brewery has high density heating and cooling processes and equipment, and the space may need different layers of insulation for various areas that a restaurant that will not. Some brewery production areas can be incredibly hot and uncomfortable for brewers and visitors alike. If the brewery is planning on having patrons, appropriate equipment will be needed to provide a comfortable environment for its customers, so how to manage the heat being emitted by the vessels must be considered when designing the space's HVAC and ventilation.

Future expansion. Given the success of craft breweries, design professionals should take into consideration that success will result in possible expansion of the premises. When designing the equipment, design professionals are caught in a quandary when sizing the equipment. Installing too much equipment will impact operating cost, but failing to consider the possibility of expansion may result in unnecessary costs to the client. A good choice would be to install pads, piping tie-ins, and future space for electrical equipment to accommodate new units when the load increases.

Safety. A safety concern that might appear to fall within the cleanliness consideration but which also has a significant component is the risks of fire and explosion. One must remember that the fermentation process uses grains, and the dust from that product is highly combustible. Controlling combustible dust

through proper ventilation and other means is key to avoiding what could turn into a spectacular disaster. Spark repression is also crucial in the design of a brewery.

Patrons visiting brew pubs love to see the brewing process. Care should be used in selecting a combination of artificial light, windows, and skylights which greatly affect a brewery's overall ambiance. Important questions include how much of the brewing process will be visible to patrons and how to divide the brewery and the taproom. Code requirements must be carefully coordinated with local authorities, as the type of operation may result in an F-2 Low Hazard facility which would require a two-hour firewall separating the taproom from the brewery.

Finally, one must remember that the end product is frequently a flammable liquid. For example, whiskey is classified as a flammable liquid. When storing harder liquors, the design professional must meet Fire Codes and NFPA standards for flammable liquids.

Common Risk Problems

A design professional providing services in the construction of a brewery, distillery or grow facility must be aware of a wide variety of risks not necessarily seen in typical construction. These include the following:

1. Threat of Explosion and Fire

Even with ventilation and NFPA protections, the risk of explosion is great enough that the National Brewer's Association recommends cleaning up immediately whenever a dust layer of 1/32-inch thickness (thickness of a paper clip) accumulates over a surface area of at least 5% of the floor area of the facility or any given room, not to exceed 1,000 square feet. It also highlights that one should use only non-sparking equipment such as dustpan and broom, or an explosion proof vacuum, when performing cleaning operations.

2. Worker Safety

According to a Reuters news article in 2013, state inspectors and OSHA found 547 violations of safety rules at craft breweries from 2003 through 2011.¹ Included in that number were 250 serious violations, according to the Reuters' analysis of the data. Violations ranged from failing to enclose sprockets and chains to not ensuring machinery was disabled when an employee was inside. By comparison, large brewers, such as Anheuser-Busch and Coors, had 151 violations, including 69 serious ones, during the same period.

3. Product Liability

One of the biggest risks to a craft beer business is the contamination of one of its batches. The cost of recalling the product, the loss of a substantial portion of its product and revenue, the cost of remediating the problem and the negative publicity can be crippling to a small business such as a brewery.

One can easily envision that liability for the contamination would be imposed against the design professional under either a direct cause of action or a claim for contribution. Indeed, in recent years, the heightened concern for providing the innocent plaintiff with adequate compensation have combined to deny the design professional the traditional defenses. Moreover, under the influence of product liability litigation, courts in some circumstances have recognized a right of action against design professionals predicated on the theory of implied warranty and strict liability. Privity and 'acceptance rule' defenses, in some instances, are slowly being eroded. Thus, design professionals should take extreme care in designing breweries to ensure the integrity of the brewing process.

CONCLUSION

As noted earlier, building, management, and commercial construction principles apply to the construction of craft breweries, and there are existing guidelines and standards of practice which can be adapted to their design. However, the business of designing a craft brewery is a unique experience. Careful, considered planning and design work will reduce many of the potential risks and problems. Site selection and careful evaluation of major utilities are key first steps in a successful design. Operating systems must be carefully evaluated to ensure that the needs of the brewing process are met, while planning for future expansion. Patron and worker safety are paramount in any design, particularly given the risk of dust explosion and the large amount of water involved in the brewing process that creates slip risks. One of the largest considerations must be given to ensuring that there is no contamination of the product during the brewing process.

Design professionals are well advised to take two steps to reduce potential liability. One is to avoid overlooked design issues by having another engineer or colleague review the design before it is submitted. Second, craft breweries have a reputation for being difficult clients who get frustrated with the process of designing and building the brewery. Whether an issue of design or communication, the design professional should take immediate steps to resolve any confrontation or discord.

¹ Reuters, *Insight: Fast-growing U.S. craft brewers struggle with worker safety*, July 12, 2013.

Appendix A. **Brewery and Distillery Code Provisions**

Building Code and municipal entity groups have recognized the unique qualities inherent in breweries and distilleries. Thus, NFPA and code provisions have been developed and constantly updated to ensure the safety of the manufacturing process.

Standards that most commonly apply to distilleries and breweries:

NFPA 10 – Portable fire extinguishers

NFPA 13 – Standard for Installation of Sprinkler systems

NFPA 30 – Flammable and Combustible Liquids

NFPA 61 – Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities

NFPA 69 – Standard on Explosion Prevention Systems

NFPA 72 – National fire Alarm & Signaling

NFPA 497 – Recommended Practice for classification of Flammable liquids, Gases or Vapors and of Hazardous (Classified) Locations for Electrical Installation in Chemical Process Areas

NFPA 499 - Recommended Practice for classification of Combustible Dusts and of Hazardous Locations for Electrical Installation in Chemical Process Areas

NFPA 780 – Standard for the Installation of Lightning Protections Systems

The Most Common Occupancy Classifications for Distilleries are:

Assembly – A-2 Food and/or Drink consumption

Factory - F-1 Moderate Hazard (although breweries are frequently designated F-2 Low Hazard)

High-Hazard- H-2 Accelerated Burning, Combustible Dust exceeding qtys in open storage >15PSi; or

H-3 Materials that readily support combustion or pose a physical hazard <15PSi

Storage - S-2 Moderate Hazard Storage