What to Do Before Breaking Ground on Your New Brewery

WHITE PAPER

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MECHANICAL INC

Contents

Introduction

Whether you are expanding production at your current facility or building a new brewery, there are critical decisions to be made early in the project which will lay the groundwork for the future. This guide provides many of the considerations which are fundamental to the brewery construction, and which will set you up to succeed.

This proactive guide will help your team:

- save money during construction
- reduce costly change orders
- meet your target timeline
- lower your operating expenses such as labor, utilities, and maintenance
- lay the infrastructure for future expansion

Build Your Team

The design and construction of a new brewery is a complex undertaking. To do the best job possible, everyone involved must work to create the most efficient and reliable system while working within the constraints of budgets and timelines. With the pace of change today, versatility and adaptability are crucial features in a new brewing system. The same must apply to the physical plant which will be built or renovated to house the brewing system. The goal is to make the most of today's best technologies, while simultaneously anticipating tomorrow's innovations.

Each stakeholder in your project has different perspectives and goals and they each speak a unique language. Some stakeholders may not understand the brewing process which makes it important to thoroughly explain what you need, why you need it, and how you envision your brewery coming together. This context will reduce assumptions and mistakes and make your team more efficient, and effective.

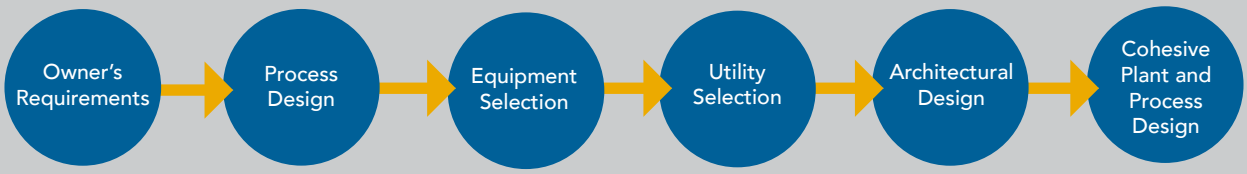
Solve Problems Upfront

The further you get into the construction process, the more expensive it is to make a change. A new buildout or expansion provides the opportunity to design your facility in anticipation of change and growth in the future.

Early engagement of the key team members ensures a deeper understanding of the owner's goals, budget, time frames and constraints, speeds up decision-making and reduces implementation time. The brewing process design impacts the equipment and utilities selection. The process, equipment, and utilities all impact the building design. Each process is unique, and each element of the process has a direct impact on the building design specifications, space for maintenance, storage, access, and growth.

View your brewery and the brewing process system as a cohesive unit, and design them as such.

Interconnected Decisions



Interconnected Decisions

It is important to select an experienced process design firm and it is equally important to select an architect and general contractor (GC) with demonstrated brewery experience. Your initial team should consist of:

Intercompany Team	Consulting Team
Owner	Architect
Financial Officer	General Contractor
Operations Manager (Brewmaster)	Process Design Engineer
Maintenance Manager	Subcontracted Engineers (Structural, Electrical)
Sales Manager	Alcohol Beverage and Legal Compliance Firm

It may not seem obvious but each of these team members have different perspectives which can impact the design of the brewery, the building, and expansion plans. For example, the Sales Manager may predict growth trends, seasonal trends, and branding efforts all of which can impact everything from bulk ingredients to packaging equipment.

Site Location

The site location is a key early decision which will drive many factors of the brewery design. If you have not selected a location and you plan to buy the land you will want to consider:

- Can the site accommodate the unloading of bulk materials and the shipping of your product?
- Are there special constraints, ordinances, or rules specific to your location?
- Will the zoning classification of your project be permitted in your proposed location?
- Is there adequate parking and storage space?

Site Utilities

Is the site located near the utilities you will need? Consider your needs for:

- Electrical (primary panel capacity, voltage and phase, configuration and expandability)
- Potable water (line size, pressure, availability and limits)
- Internet/Communication(s) (connection types and bandwidth)
- Municipal sewer or treatment/discharge system (ponds, rural)

In addition to the considerations above, if you are renting or refurbishing an existing building, you will want to consider:

- The TI budget/agreement with the landlord
- Rules, regulations and constraints imposed by the landlord
- Height or other spatial requirements in an existing facility

Brands and Strategy

The number of brands, packaging types, and product mix are critical to downstream decisions about the use of space as well as the need for equipment. It's important to consider your plans regarding contract brewing or co-packing operations if those are to be considered in the space. Related considerations are:

- Are you planning to make products other than beer? If so, what?
- Do any of your products require dedicated equipment such as tanks, hoses, pasteurizers or fillers?
- Will you have any products which have flammable ingredients or flavors?
- NFPA storage and handling
- What is your anticipated product mix (i.e., % by brand)?
- Does the brewhouse need special accommodation(s) for kettle souring, coffee products, or other non-beer?

Your process designer will size and select filling equipment, other accessory equipment, and storage decisions based on:

- The number of products packaged into different formats
- Your split of draught versus packaged beer (by % or volume)

- Your shelf-life policy for each packaging type
- On-site cold storage versus storage in distribution

Process Flow

Mapping out your process flow is vital to your team's understanding. Here is a sample list of brewery process steps:

1. Grain handling and conveyance
2. Malt milling, grist conveyance, and grist storage
3. Brewhouse and wort production steps
4. Yeast handling, storage, propagation, and pitching
5. Fermentation and maturation
6. Dry hopping or adjunct addition
7. Separation and clarification
8. Flavor addition, blending and carbonation
9. Bright beer storage
10. Packaging
11. Shipping

Equipment Selection

The overall function(s) of the equipment should be versatile, easy to clean, and facilitate the ability to perform product/brand changeovers. The brewing design will specify the equipment required to support the process. Different types of systems and equipment call for different approaches and design considerations, and evaluating the various options is complex.

It is vital to partner with process designers who have extensive experience in material handling and processing of the specific ingredients used in brewing. There are different processes for each ingredient relative to equipment/lines, raw material and processing environment, and the versatility of the equipment to handle these differences is critical.

Existing Equipment

If you have existing equipment which you plan to use in the new or expanded brewery, you will want to provide all relevant technical documents to your process designer including:

- Equipment specifications
- Electrical loads (voltage, phase, and amperage)
- Physical dimensions and weight
- Utility requirements (compressed air, water, steam)

Piping and Connectivity

Most sanitary process equipment is connected by piping which runs over, under, and around the equipment. In some cases, catwalks and access platforms are required. The process designers will ensure the process design prevents piping traps, dead legs, and hard-to-clean-or-maintain areas.
To ensure the most efficient process, the building should be designed to accommodate the process and not the other way around.

Brewhouse Capacity

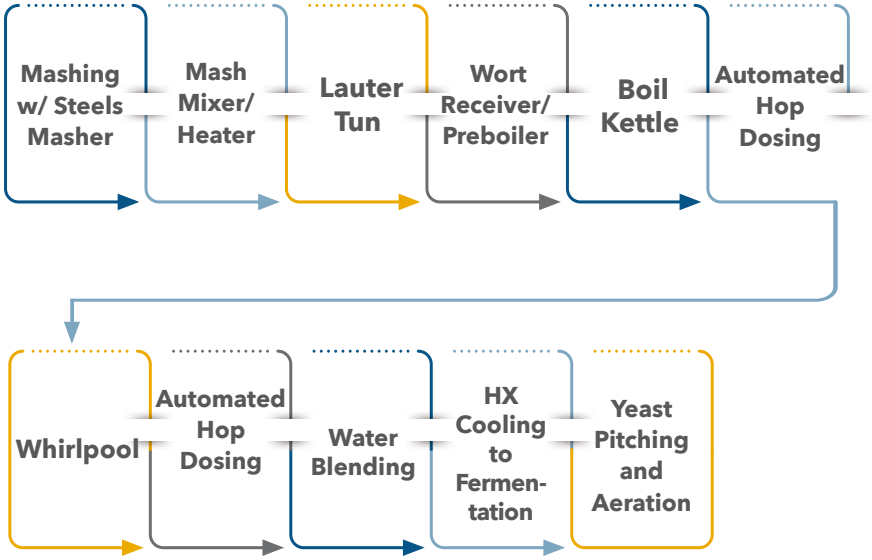
Capacity is a crucial design criterion, but it can be approached from different angles, such as expanding production of an existing brewery versus building a new brewery from scratch. Consider your desired production volume(s) and your growth plans. Your budget or other constrains might prevent you from initially building the brewery of your dreams but you will want to ensure your design can be expanded in the future to accommodate your success.

Your team will need to know:

- What size system (or systems) are being considered? How many vessels?
- What range of wort strength (SG or Plato) will you be brewing?
- Do you intend to produce short batches which are smaller than the rated capacity?

- Is the brewing system customizable or is it pre-engineered/pre-fabricated by the OEM?
- What level of automation is available or desired on the brewing system?
- Is there a firm shift schedule such as 2-4 shifts, no weekends, etc.?
- What are the process steps in your brewing system?

Example



Automated Control Systems, IT, and Factory Floor Networking

As you plan your process, you will want to evaluate the level of automation you want to include today and then imagine what you might want to automate tomorrow. Automation is a force multiplier and can help drive intelligent business decisions as you grow. At a base level, automation can limit your need for labor, increase quality, and reduce downtime. Considerations include:

- Electrical and communication network backbone and distribution points
- Wireless and local area network requirements
- Server storage (which requires climate-controlled rooms or enclosures)
- Determining peak electrical loads to ensure the building's electrical service is suitable for the application
- Is there a need for remote monitoring, alarm escalation, or data collection and visualization?
- Do you have an in-house or consultant IT person to help with networking and communications?
- Does the accounting and or logistics department need to track raw materials or processes digitally?
- Will you be using an Enterprise Resource Planning (ERP) software? If so, which one?

Utility Support Systems

Each type of utility system adds equipment and requires distribution and connection points. Here are a few considerations for planning utility support systems.

Brewery Heat Sources and Thermal Management

With a few exceptions, steam boilers and condensate recovery systems are the primary source of thermal power in breweries. Planning is essential to an efficient and well-designed steam and condensate return system and can dramatically reduce fuel and water costs. Due to regulatory constraints, local fuel costs, or environmental concerns, the primary source of heating might require a different system such as solar thermal, geothermal or direct fire kettles. In any case, the system should be laid out in a way which optimizes utility usage, reduces heat waste, and ensures operator safety.

The brewing process contains numerous steps which may appear to be at odds such as heating and cooling, hydrating and drying, and dilution and evaporation. Each of these process steps are highly energetic and can sometimes be balanced against each other.

Judicious use of heat exchangers, for example, can recover heat as well as water. Your team will need to consider the following:

- What is the primary heat source for wort production?
- Are there any auxiliary heat or hot water sources which can support the brewhouse?
- Will you be reclaiming heat from any process in the brewhouse such as the Wort HX?
- What is the heat source for other operations within the brewery such as:
  - Hot process water for cleaning
  - CIP skids
  - Packaging equipment
  - Clean steam or steam generators (Does your location have an ordinance or rule against high-pressure steam >15psi?)
  - Pasteurizers or thermal processors
  - Wastewater treatment such as anaerobic reactors

Compressed Air

Almost every brewing system requires compressed air, necessitating ample space for the air compressor(s). Compressors are noisy and many brewers store their compressors outside in protected spaces or in separate rooms, and pipe to multiple application points throughout the plant.

Compressed air is the most wasted utility in the U.S. and efficient design can save substantial money in operational costs. Compressed air can act as a motor gas for valves, pistons, and pumps but also has applications in aeration, evacuation and sparging. Key considerations are:

- What types of valves will be controlled using compressed air?
- Will your packaging equipment require compressed air?
- Will any AODD (diaphragm) pumps be used to move thick liquids in the brewery?
- Is there any contact, incidental or intentional, between compressed air and the product?
- Will the spent grain system need a high-flow air assist using compressed air?
- Do you need redundancy or isolation in the air system for maintenance or emergencies?
- Will compressed air be used for CO_2 evacuation in fermentation tanks?

Nitrogen and CO_2

Processes which require nitrogen or CO_2 will need either a generator or liquid storage tanks paired with an evaporator. The nitrogen or CO_2 generator requires indoor space near the compressed air receiver tank while a liquid supply and evaporator require a protective outdoor space on a concrete pad. Accommodation for bulk deliveries, including off-hours scheduling, should be considered.

Nitrogen as a partial substitute for CO_2 is growing in popularity due to the rising cost and limited supply. Nitrogen generators require a significant volume of compressed air which is clean and free of oil residues. If adding a nitrogen generator, your existing compressed air system should be sized for this added load or supplemented with a standalone compressed air system.

Cryogenic gases such as liquid nitrogen and carbon dioxide require heating and evaporation prior to use within the brewery. Electric or atmospheric heat exchangers are the conventional means for evaporating cryogenic gases, but a third option is using the brewery's glycol system. By exchanging heat between liquid CO_2 and glycol, you can accomplish the evaporation step while simultaneously cooling the glycol. These types of glycol evaporators are sustainable and cost effective.

Hot Water

Processes requiring hot water will need either fuel for steam boilers or electric heaters. Electric heaters may be required in locations where a fuel source (natural gas, propane, fuel oil, etc.) cannot be routed, and they gen-

erally need to be positioned near where the hot water is needed. On-demand systems offer the benefit of saving space but they require a much larger utility supply.
When space comes at a premium and utilities (fuel or electricity) are ample, on-demand systems can be an excellent solution. Be aware that water quality, mineral hardness, and other water conditions, are a serious concern for these systems. Pre-treatment of the water and periodic maintenance will be required to prevent system failure.

Alternative hot water generation such as solar thermal heat is also available and becoming more attractive. Solar thermal systems can be used in locations with good sun exposure and roof structures which can handle the added weight load. (These solar piping systems are different from solar photovoltaic panels which are used to create electricity.) Systems with parabolic lenses or other means of amplification can generate near-boiling temperatures with the potential for good ROI. Given the seasonality of sun exposure, these systems are typically used in conjunction with another more conventional source of heating.

Chilling Systems

It is imperative to accurately design and size the chiller system to manage potential load fluctuations and future expansion. Smaller systems tend to be air-cooled whereas larger systems are often coupled to an evaporation tower. As the peak of beer production typically occurs in warmer months, chillers should always be sized with the worst-case ambient conditions (temperature and humidity) in mind.

In the event of power failure or loss, the chiller can cause fermentation to quickly get out of control and is a serious risk to product quality. Redundancy for the chiller system is highly recommended when possible. For the same reason, it is recommended to also have a backup generator which can maintain cold glycol during a power failure.

Locations with unstable power grids will find a short ROI on this equipment by preserving even a few batches of beer.

Cleaning and Clean-in-Place (CIP)

Cleaning and CIP functions are critical to safe production, and careful design will reduce labor costs, process downtime, water and chemical usage.

Each operation is unique and must be specified to best meet the needs of the process. For example, some CIP systems require a centrally located stationery CIP skid, or a mobile CIP tank which is rolled to where it is needed. Other operations may require multiple-tank and/or multi-circuit systems to clean multiple processes at once. Multiple-tank systems may be quite large and are often housed in separate rooms, away from the processing equipment.

Before selecting a CIP solution, you should consider the type and number of cleaning processes that need to happen concurrently. If a system is selected which can only clean one process at a time, scheduling conflicts may result, causing production delays.

Lastly, but most importantly, the CIP system should be designed in a way which does not expose operators to hazards such as contact burns, chemical burns, slips, or toxic atmospheres. Hoses and piping should be properly routed to prevent injury or accidental spills.

Flooring and Drainage

Other key design criterion are brewery floors and draining plans. Will you use the same drainage system everywhere in the plant, or break up the layout into smaller zones? Will you be catching the drained effluent in a sump pit or wastewater vault? Does your facility have special rules or prohibitions about solids, heat, or pH going down the drain? The flooring and drainage decisions may also tie into your downstream strategy for wastewater treatment.

Some breweries use uncoated concrete flooring while others use coated concrete or tiles.

There are different types of floor coating(s) which fit your requirements for durability, appearance, cost, and hygiene such as:

- Urethane-coated concrete
- Epoxy-coated concrete
- Brewery tile

Consider these questions before selecting your floor type and drainage plan:

- Will you be collecting and treating your facility's process waste prior to discharge?
- Will you be pouring a new slab or utilizing an existing?
- Will the slab, existing or new, be level or sloped. If sloped, what pitch? It is important to ensure the slope meets the Americans with Disabilities Act (ADA) compliance.

What type of catchment or drainage system are you considering?

- Area drains
- Slot drains
- Trench drains
- No drains

Incoming Water Quality and Treatment

The incoming water quality used for brewing, cleaning, and utility purposes will determine the requirements for pretreatments such as softeners, RO, GAC filtration or other treatment options. Your team will need a water quality report to determine which options may be required. In addition to pre-treatment, you will need to ensure you have an adequate inflow and pressure. If not, a holding tank and a pressure system may be required.

Wastewater Management

Consumers are becoming more environmentally aware and will likely research your company reputation. Water is a precious resource, and most processes require wastewater management and or treatment. This will depend on your location, capacity, and sewer fee structure. In other cases, municipal treatment is not an option at all. The options vary from filtration methodologies to anaerobic digestion. Most solutions entail specialized equipment, dedicated piping and storage tanks which can be installed indoors or out, and even settling ponds.

Your process engineers will help you identify water/sewer municipality requirements, find the most suitable treatment system, and the appropriate piping for process waste. Brewers often shy away from wastewater treatment solutions because of their complexity, but with help from your process engineers the solutions can be manageable and cost effective.

Biosolids Management (Yeast, Hops, Trub)

Brewing facilities produce a high volume of waste. Biosolids and their disposal are highly regulated and many brewers are employing specialized solutions such as biorefinery to reduce the associated storage, transportation, and energy costs. Some brewers are proactively using their biosolids to produce other products such as fertilizer, compost, or animal feed. These innovative solutions are environmentally sustainable and can be integrated into plant operations with planning at the early stages of process design.

Yeast, hops, and trub are very concentrated forms of solid effluent which can be expensive to treat and discharging them to the sewer may be prohibited. The best and least expensive way to manage them is to side-stream these materials and separate them from your other waste streams. Here is a list of considerations to discuss with your system designer.

- Will these materials be accepted by your spent grain hauler?
- Are you located nearby a municipal water treatment facility?
- Are you located nearby an industrial composting facility?

- Will you be using a centrifuge to separate yeast and other solids from your beer?
- Will your facility be operating a wastewater treatment system of any kind?

Energy Recovery

Energy recovery is vital to reducing utility costs. In addition to selecting high-efficiency equipment, brewers are recapturing heat in closed-loop systems and using it to heat water for processes such as CIP. There are numerous techniques for energy recovery involving heat exchange and product-to-product regeneration. Each of these techniques requires equipment and space, the cost of which will vary with complexity. In all thermal systems such as boilers, chillers, compressors, CIP and brewhouse tanks, there exists an opportunity to recover heat and reduce operating costs.

Employing micro turbines, combined heat and power (CHP), and solar arrays can provide sustainable electricity and significantly reduce costs. As with wastewater and biosolids management, these solutions must be built into the process design and the architectural design of the plant, or space should be set aside for future integration.

Storage

The primary requirement for storage in brewery environments is for raw materials. Within the broad category of raw materials, are brewing ingredients and dry goods such as packaging materials. In both cases, the layout of the storage area needs to allow for ease of inventorying and counting these goods, as well as ensuring proper first in first out (FIFO) protocol. It may be tempting to constrict access isles and forklift lanes to maximize storage space, but care should be taken to leave isles uncluttered. An organized warehouse will be less likely to create breakage, foster hazards to employees, and attract pests such as rodents and insects.

All process piping in proximity to dry storage must be 100% free of leaks and should not have any junctions which can fail and cause leaks or spills onto goods in the warehouse. It is of the upmost importance to insulate all cold piping which can condensate, drip, or develop mold. Ventilation and segregation should also be used to ensure that nearby odors from the processing area of the brewery cannot contaminate ingredients such as malt.

Cold Storage and Distribution

Most breweries use cold storage and require cold distribution methods. The storage and distribution methods must be carefully sized and specified to meet your needs.

- Do you require on-site cold storage for raw materials or finished goods?
- What quantity of materials – or square footage of space – will be required?
- What temperature will be maintained in the coldbox(s)?
- Will the coldbox have a stand-alone compressor?
- Will the coldbox structure be free-standing, partially supported by ceiling/walls, or fully supported?
- Will you utilize a glycol system?

If you intend to utilize the brewery glycol system to cool your coldboxes, care should be taken to adequately size the chiller and supply headers to accommodate existing and future loads. Consider the need for chiller redundancy as a system failure will potentially compromise all the stored product unless the problem is addressed immediately. The biggest chilling load in the coldbox tends to be from outside air entering the box and automated doors can drastically reduce unnecessary load on the chiller or coldbox compressor.

Chemical Storage and Distribution

Your chemical storage and distribution processes can have a significant impact on your process layout and the design of your plant. Chemicals can be stored in large tanks and piped to their use points, or they can be stored in drums and manually distributed to their usage locations. Chemical storage rooms may have unique requirements due to corrosives and the potential need for secondary containment.

Your plan should specify which chemicals and materials should be separated from your production area.

Where will hazardous materials be stored (compressed gas cylinders, lab solvents, CIP chemicals)? Will CIP chemicals be dispensed manually or via an automated CIP skid? In any case, chemical storage and distribution should be built into the process and architectural design.

Bulk Ingredient and Material Handling

Buying bulk ingredients is very attractive due to storage efficiency, ease of handling, and lower cost. Bulk ingredients often require specialized equipment and automation to achieve their full potential. The most common bulk ingredients are malt and CO_2 gas, both of which have unique storage and handling systems designed to limit hazards. For example, malt silos and conveyance systems must be thoroughly grounded and electrically bonded to prevent dust explosions and cryogenic CO_2 systems house dangerously cold gases which can also displace oxygen and cause suffocation. Atmospheric monitoring and forced ventilation systems are now required in many areas.

Ingredient storage has its own set of considerations. Here are a few which should be built into your plan.

- Do you require separate hop storage which is refrigerated or frozen? What is your desired temp?
- Do you require CO_2?
- Will you reclaim CO_2?
- Will you generate and store nitrogen onsite?
- Is your source of brewing oxygen in the form of sterile air or high pressure O_2 cylinders?
- Will your facility be certified Organic by the USDA?

Fermentation and Maturation

Product mix and recipe design will dictate the maximum theoretical capacity required for fermentation tanks and brite tanks. Generally, the ratio of brands to bright tanks should always be near 1:1. Tanks should be procured with similar glycol jacket designs as tanks with different glycol pressure requirements will not cool easily or efficiently.

Your process designer will need to know:

- Will you require tanks with an ASME rating for greater than 15psi? (Nitrogenated beers)
- What is the shortest, longest, and average fermentation cycle of your brands?
- What is the lowest, highest, and average wort gravity (SG or Plato) of your recipes?
- What method of dry hopping (if any) will be used during fermentation?
- Are hops or other adjuncts used in the bright tanks?
- Do you plan to use a pinpoint carbonator and, if so, where in the process flow?
- Do you intend to do high-gravity brewing, followed by dilution/blending with de-aerated water?
- Will you ever need to brew a batch of beer which does not fill the fermenter? How full?
- How many zones of control do you want in your fermentation tanks?
- Will bright tanks be purged with CO_2 or nitrogen?

Filtration and Separation

Filtration and separation require special equipment and processes and create waste streams such as biosolids, filtration medium, yeast, hops, beer and clarifying agents.

There are several types of clarification strategies such as:

- Enzyme clarification
- Finings/settlement
- Filtration
- Centrifugation
- Colloid stabilization

The growing popularity of centrifugation has been beneficial to brewers and process designers alike. The placement of this equipment, if selected, should address the following criteria:

- Noise mitigation (if greater than 85db, an enclosed room may be necessary)
- Forklift access or lifting gantry for periodic bowl maintenance.
- Proximity to solids holding tank (for storage of discharged solids)
- Supply pump in proximity to green beer cellar

Yeast Strains, Storage, and Propagation

Yeast management may require very little process equipment or quite a lot depending on the following factors and considerations:

- How many full-time yeast strains will be used in the brewery? How many seasonal/limited strains?
- Will propagation be performed in-house, or purchased as full pitchable quantities?
- How will yeast be collected, stored, and quantified for production brewing? (By Mass, Weight, or Specialty Equipment such as ABER Meter/Coulter Counter)
- Will yeast brinks be on load cells?
- Will you use portable storage tanks?
- Will your tanks be agitated or aerated?
- At what temperature and pressure will you store the yeast?
- Where and how is yeast pitched in the process?
- Do you use any strains of the variety diastaticus and is special handling required?
- How is waste yeast, trub, and hop material removed from the tank and where does it go?
- What temperature crashing profile and holding temperature will you use?

Spent Grain Handling

To avoid production issues, spent grain must be removed in a timely manner. Some brewers can offload the grains to farmers or compost facilities and others sell it as fuel or food additives. To ensure process efficiency, your designer will need to know:

- What will happen to your spent grain?
- How much water will be retained in the grain ("soupy" versus pressed dry from a mash filter)?
- How much spent grain will you generate per day or week? (Is it recipe dependent?)
- How frequently will your hauler be able to reliably pick up your spent grain?
- What type of vehicle will be used to receive and transport the grain? Is the vehicle reasonably water-tight?
- Will any other waste item be mixed with the spent grain such as yeast or trub?
- Do you have an outdoor storage area available, or will spent grain be stored indoors?

Specialty Rooms/Activities (Barrel Aging, Sour, R&D)

Brewery architects and builders routinely devise creative solutions for meeting floor-space and ceiling-height demands and the earlier they can contribute their insight, the better-designed the plant. Some operations many require segregation. Your designer will need to know:

- Will you have a dedicated area for sour or "wild" beer production?

- Do you require any special cold-storage for barrels or aging tanks?
- Will your facility have a publicly viewed pilot brewery, showpiece brewing system, or R&D area?
- Does your facility require any accommodation for tours, catwalks or viewing windows?

Auxiliary Spaces

Your team will need to know if you require auxiliary spaces such as:

- Restrooms
- Employee break rooms
- Office space
- Landscaped spaces

Some breweries have showcase installations and allow public tours of the facility. Some even have restaurants, tasting rooms and beer gardens. Each of these spaces will need planning and may impact support utilities and wastewater management.

Powders and Dust

PPVP and other powders can sometimes have difficult flow characteristics which must be accommodated with an appropriate transfer system. Some organic powders create a higher safety risk due to their smaller particle size and the minimum energy required to ignite (MEI). These factors impact the process design and equipment selection as proper handling of combustible dust is critical to developing a safe and efficient process.

Allergens

Most breweries don't use ingredients which require separation but if your goal is to have zero allergen claims on your packaging, your brewhouse may require duplicated and segregated spaces to maintain allergen separation from raw materials to packaging. Some brewers are producing "gluten-reduced" formulas which may require special consideration and on the extreme end, if you plan on producing beer with oysters or any of the "Big 8"allergens, your system designer will need to know.

Transport and Operator Paths

Creating the most efficient and reliable system requires planning the paths in which people and materials are moved from point-to-point. Including the paths in your planning will ensure enough space and optimize your process design.

Maintenance and Inspection Access

Access points for maintenance and inspections are easy to overlook, but expensive to refurbish or create on the fly. Access points and maintenance paths must be designed into the process to ensure easy access for operators.

Growth and Expansion

Consider the ways your plant and its processes may expand or transform in the future. To prevent costly upgrades your process designer should size piping, utilities and electrical, networks, control systems, production, and storage space for your future needs. Your process designer can include future connection points in critical utilities like steam, glycol, air, water, and process. This small investment up front will make expansion less intrusive and reduce costs later.

The piping and instrumentation diagram (P&ID) depict the process but does not necessarily help the team envision the space requirements. For that, the process must be translated into a functional digital 3D model. The 3D model will reflect the space requirements for:

- Process equipment
- Utilities
- Automated control systems
- Bulk ingredient handling and storage

- Cross contamination prevention
- Piping and connectivity
- Transport paths
- Maintenance access
- Storage
- Cleaning and CIP
- Growth and expansion

All equipment and functions should be mapped and planned for maximum process efficiency. The layout should identify possibilities for future expansion of plant capacity.

Maximizing Process Efficiency

Assembling the right team before you break ground or embark on an expansion will protect your investment and ensure your production goals are achieved. Their collaboration is instrumental in delivering a brewery with maximum process efficiency today while accommodating for growth and flexibility in the decades to come. While you cannot know exactly what the future will bring, planning for greater possibilities can save you considerable time and money in the future.

Barnum Mechanical wishes you the best in your exciting new venture. Please don't hesitate to call on us if we can be of help.

For More Information

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Andy is BMI's Director of Business Development. He is an award-winning Brewmaster with experience in brewery design, sustainability, wastewater treatment, and process engineering. He holds a B.S. in Biochemistry from Cal Poly, San Luis Obispo, CA, and holds a Master Brewers' certification from the U.C. Davis Master Brewers extension program.

About Barnum Mechanical Inc.

Barnum Mechanical Inc. (BMI) is a forward-thinking design-build firm specializing in the food, beverage and specialty process industries. BMI is known for superior design, project management and installation services. BMI has operated throughout the United States since 1980.

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