Hook Brewery
Indianapolis, Indiana

Ricky L. Stallman
Thesis 1980
Prof. Paul Laseau
Hook Brewery

This is a new brewery for a fictitious beer. It is designed to produce roughly 1.5 million barrels of beer annually. In general, breweries are composed of many functions combined into one. These functions include grain intake and handling, cooking grains in large kettles, and fermenting and aging beer in cooled tanks. Other functions include packaging beer into kegs, bottles, and cans, warehousing, laboratory work, and administration. Buildings other than the brewery itself may also be on site. These include truck maintenance, the powerhouse, and an administration building.
A Note To The Program

This building type is unique in that breweries have not been done for Thesis at this school. The difficulties were many. The major drawback was getting research for breweries since most architectural publications had few or no articles. To compound this, I found out that all brewing companies were very secretive in their process and buildings. Some brewers would not allow visits or send information. Breweries also use different brewing processes and equipment. Hence, there is no one guide or way to layout a brewery.

The net result of my program is details of a portion of the process from a certain brewer, combined with details of another part of the process from a different brewing process. So, most of this program is based on accurate assumptions and loose square footages. However, I believe I have included as much correct data and design as possible.
Contents

1. History of Beer 1
2. Brewing Ingredients 4
3. Brewing Process 5
4. Brewery Profiles 6
5. Site 26
6. Mechanical Rm. 48
7. Grain Intake 50
8. Brewhouse 61
9. Fermentation 80
10. Maturation Tanks 95
11. Packaging 101
12. Warehouse 122
13. Maintenance 126
14. Laboratory 130
15. Employee Locken & Canteen 138
16. Visitor 140
17. Preliminary Work 141
18. Final Drawings 159
19. Sources 171
HISTORY OF BEER

Beer, a beverage obtained by a process of alcoholic fermentation mainly using cereals (chiefly malted barley), hops and water. The history of beer extends over several thousand years. According to Dr. Bush, a beer made from malt or red barley is mentioned in Egyptian writings as early as the fourth dynasty. It was called heqa. Papyri of the time of Seti I (1300 B.C.) allude to a person inebriated from over-indulgence in beer. In the second book of Herodotus (450 B.C.) we are told that the Egyptians, being without vines, made wine from barley; but as the grape is mentioned so frequently in Scripture and elsewhere as being most abundant there, and no record exist of the vine being destroyed, we must conclude that the historian was only partially acquainted with the productions of that most fertile country. Pliny informs us that the Egyptians made wine from corn, and gives it the name of zythum, which, in the Greek, means drink from barley. The Greeks obtained their knowledge of the art of preparing beer from the Egyptians. The writings of Archilochus, the Parian poet and satirist who flourished about 540 B.C., contain evidence that the Greeks of his day were acquainted with the process of brewing. There is, in fact, little doubt that the discovery of beer and its use as an exhilarating beverage were nearly as early as those of the grape itself, though both the Greeks and the Romans despised it as a barbarian drink. Dioscorides mentions two kinds of beer, but he does not describe them sufficiently to enable us to distinguish them. Sophocles and other Greek writers, again, styled it Bovrov. In the time of Tacitus (1st century after Christ), according to him, beer was the usual drink of the Germans, and there can be little doubt that the method of malting barley was then known to them. Pliny mentions the use of beer in Spain under the name of celia; and elsewhere he says: "The natives who inhabit the west of Europe have a liquid with which they intoxicate themselves, made from corn and water. The manner of making this liquid is somewhat different in Gaul, Spain and other countries, and it is called by different names, but its nature and properties are everywhere the same. The people in Spain in particular brew this liquid so well that it will keep good a long time. So exquisite is the cunning of mankind in gratifying their vicious appetites that they have thus invented a method to make water itself produce intoxication."

The knowledge of the preparation of a fermented beverage from cereals in early times was not confined to Europe. Thus, according to Dr. H. H. Mann, the Kaffir races of South Africa have made for ages - and still make - a kind of beer from millet, and similarly the natives of Nubia, Abyssinia and other parts of Africa prepare an intoxicating beverage from a variety of cereal grains. The Russian quass, made from barley and rye, the
Chinese samsku, made from rice, and the Japanese sake are all of ancient origin. Roman historians mention the fact that the Britons in the south of England at the time of the Roman invasion brewed a species of ale from barley and wheat. The Romans much improved the methods of brewing in vogue among the Britons, and the Saxons - among whom ale had long been a common beverage - in their turn profited much by the instruction given to the original inhabitants of Great Britain by the Romans. We are informed by William of Malmesbury that in the reign of Henry II, the English were greatly addicted to drinking, and by that time the monasteries were already famous, both in England and on the continent, for the excellence of their ales. The waters of Burton-on-Trent began to be famous in the 13th century. The secret of their being so especially adapted for brewing was first discovered by some monks, who held land in the adjacent neighbourhood of Wetmore. There is a document dated 1295 in which it is stated that Matilda, daughter of Nicholas de Shoben, had re-released to the abbot and convent of Burton-on-Trent certain tenements within and without the town; for which re-release they granted her, daily for life, two white loaves from the monastery, two gallons of conventional beer, and one penny, besides seven gallons of beer for the men. The abbots of Burton apparently made their own malt, for it was a common covenant in leases of mills belonging to the abbey that the malt of the lords of the manor, both spiritual and temporal, should be ground free of charge. Robert Plot, in his Natural History Of Staffordshire (1686), refers to the peculiar properties of the Burton waters, from which, he says, "by an art well known in this country good ale is made, in the management of which they have a knack of fining it in three days to that degree that it shall not only be potable, but is clear and palatable as we could desire any drink of this kind to be."

In 1630 Burton beer began to be known in London, being sold at "Ye Peacocke" in Gray's Inn Lane, and according to the Spectator was in great demand amongst the visitors in Vauxhall. Until tea and coffee were introduced, beer and ale were, practically speaking, the only popular beverages accessible to the general body of consumers. Since the advent of tea, coffee, cocoa and mineral waters, the character of British beers has undergone a gradual modification, the strongly alcoholic, heavily hopped liquids consumed by the previous generation slowly giving place to the lighter beverages in vogue at the present time. The old "stock bitter" has given way to the "light dinner ale", and "porter" (so called from the fact that it was the popular drink amongst the market porters of the 18th century) has been largely replaced by "mild ale." A certain quantity of strong beer - such as heavy stouts and "stock" and "Scotch" ales - is still brewed nowadays, but it is not an increasing one. The demand is almost entirely
for medium beers such as mild ale, light stout, and the better class of "bitter" beers, and light beers such as the light "family ales", "dinner ales" and lager.
BREWING INGREDIENTS

Malt Barley:

Barley is a very hardy cereal, maturing more quickly than wheat, rye or oats. There are numerous types of barley, all of which are classified by botanists as belonging to one branch of the grasses. It is preferred because it can be more easily malted for brewing purposes than any other cereal, and the solubles extracted from barley are a more desirable character and more complete than those extracted from other grains. The use of barley malt produces smoother performance in the brewhouse, such as quick conversion and good strain ing.

Adjuncts:

Virtually all brewers use additional cereal grains called adjuncts to supplement the malt in the brewing process. Grain adjuncts such as corn and rice, in the form of grits, can be interchangeably used, since it is the starch fraction of the cereal grain that is of importance to the brewer. Besides serving as a very economical source of starch extract, adjuncts also perform the even more important function of diluting the soluble nitrogen content of the beer, thus imparting a greater brilliance and also enhancing its physical stability.

Hops:

"Hops" is referring to the dried cones or flowers of the very unusual female hop plant. Hops provide the unique bitterness and typical hoppy flavor and aroma found only in beer. They are so effective that less than a quarter pound of dried hops is needed to flavor a whole barrel of beer. Dried hops are packed in 200 pound bales ready for the brewer.

Brewing Water:

Water is that all important ingredient so common that is taken for granted. However, it must be of highest quality, for after all, water is the medium in which all brewing reactions take place and it represents about 90% of the volume of the final product.

Impurities in water such as off odors and colors, sediments and particularly chlorine are removed by treatment with activated carbon and filtration. Since most natural waters in the U.S. do not contain the desirable mineral balance required, these must also be added.

Brewers Yeast:

Yeast plays a most important and unusual role in the brewing process. Yeast is what converts the grain-derived sugars to alcohol and carbon dioxide in the fermenter. However, the yeast is removed from the beer and therefore it cannot rightly be called an ingredient.
BREWERY PROFILES

Form Follows Function - Brewery Functions Are In A Linear Form

1. Carlsberg
2. Sabinas
3. Warby

1. Powerhouse is located adjacent to brewhouse. Carlsberg's power is in the building, while Sabinas and Warby's is located outside of the building.

2. Warby Brewery uses this basic principle, but reverses direction of flow on a different floor level.

3. Expansion can happen without affecting or disturbing the other parts of the brewery.
Centralized - Brewery Functions Are "Wrapped Around" The Powerhouse.

1. Whitbread

2. Schaefer

1. Powerhouse "centrally located" in the process, so power, HVAC has to travel less.

2. The centralized form has a greater flexibility as to the placement of functions. This might be advantageous on a difficult or restricted site.

3. For expansion, one has to be careful not to lock in functions that could be expanded.
MECHANICAL ROOM
BREWHOUSE
FERMENTING CELLAR
KEGGING
BOTTLING
GENERAL STORAGE
LOADING AREA
CANTEEN
OFFICES
LABORATORIES
VISITORS' GALLERY
MATURATION OR STORAGE TANKS
BREWERY PROFILE: Carlsberg Brewery 1974

Location: Northampton, England

Architect: Knud Munk

Size: 70M x 197M = 13,790 sq. M or 148,380 sq. ft.

Cost: 15 Million

Output: 1 Million Hectolitres/Yr.

Chief Materials: Concrete, Steel, And Glass

Space: Highest hierarchy is: "Energy center", and brewhouse, followed by the space for the fermentation tanks. The lowest level is for the bottling plant, stores and workshops.

Structure: Re-inforced concrete which:
1. Requires less maintenance than a steel structure.
2. Has the advantage of being more fire-resistant.
   The roof is folded plate.
   The structure uses precast and prestressed elements.

Grid Layout: 5M or 16.4 ft.

Span: Common span of 20 or 65.6 ft.

Enclosure: Concrete finish of flank walls is fair-faced from resin-faced plywood forms built to cabinet-maker standards. The sand specified produced the desired warm reddish color.

Circulation: Visitor's entry is on the east side, with a stairs leading to a skylit corridor which runs parallel to the brewhouse and "energy center". The main circulation is a corridor that runs along the west wall and connects all the production areas.

Siting: The site is close to the town center, flanked by roads to the north and east and by the River Nene to the west and south. The building is on an industrial estate which plans the replacement of older plants by new buildings. Also, the strips along the river are to be converted into recreational areas. The building is on a north-south axis.

Primary Objectives: Express the function of the brewing process and to allow for future expansion and layout changes. Special functions - the malt silos, chimney, water tanks and storage tanks have been separated from the main structure to permit independent expansion if necessary.

The focal point of the complex is an 85 ft.
BREWERY PROFILE: Carlsberg Brewery, continued

x 231 ft. glass facade split into two sections by ventilation equipment, designed in Ziggurat fashion, which houses the mechanical room and brewhouse. This is the brewery's publicity sign by day, and by night with floodlights focusing on the boiler and machinery.
BREWERY PROFILE: Sabinas Brewery 1934

Location: San Antonio, Texas

Architect: Charles T. Aubin

Size: 30,000 sq. ft.

Cost: Unknown

Output: Unknown

Chief Materials: Unknown

Space: The brewhouse is 4 stories high and is the dominate feature of the building. It houses the malt process and brewing process up to the point of fermentation. The brewhouse is arranged vertically to use gravity in the beer process.

Directly behind the brewhouse, is the fermentation tank area, which is 2 stories high, and then the keg house, which is 1 story high. The bottling house is located across the 2 railroad tracks parallel to the main building.

Structure: Unknown

Grid Layout: None Shown

Enclosure: Brick and stone

Span: Brewhouse - 22', Fermentation Room - 22', Keg Room - 35', Bottling - 30'

Circulation: Entry at brewhouse. Main circulation in the brewhouse is vertical with a spiral stairs and elevator. The major circulation areas in the fermentation and kegging house are arranged between the fermentation and storage tanks, and are horizontal.

Siting: The site covers about 100,000 sq. ft. The brewhouse, fermentation and kegging house are separated by 2 lines of railroad tracks from the bottling house. There is an underground conduit for beer lines to the bottling house. The separation of the brewhouse and bottling house allows 1 railroad track for unloading grains and the 2nd track for shipment and return of bottles.

Primary Objectives: The architect has designed for further expansion of all functions of the brewery, without disturbing the railroad tracks.

The exterior of the brewery shows the functions of brewing by the downward progression of the facade. Carlsberg Brewery, 1974, uses the same concept.
BREWERY PROFILE: Whitbread Brewery 1968

Location: Luton, England

Architects: Peter Falconer & Partners

Size: App. 25,920 sq. M or 278,899 sq. ft.

Cost: 3 M

Output: 1.5M Bulk Barrels/Yr.

Chief Materials: Steel Frame, Concrete

Space: Construction is steel framed with light lattice trusses, galvanised, in the single story sections of the building. The multi-storied brewhouse is concrete encased. Roofing is insulated metal decking finished in 2 layer felt topped in granite chippings. Suspended floors in the brewhouse, are partly in situ concrete, partly prestressed precast slabs. Wall linings are thermalite, or engineering brick enclosure. External cladding is concrete panels which are textured by:

1. Exposing the dark flint aggregate.
2. Sandblasting to expose a permawhite aggregate.

Grid Layout: No apparent grid shown

Span: No spans shown

Circulation: Visitor's entry is located in the center of the front facade, where the multi-story block begins. At this point, the visitor takes an escalator to the 4th level where there is a reception area and service. Main entrance for worker is next to the visitor's entrance. There are 2 major interior circulation ways. The 1st leads from the entry, and serves both the fermentation area and the maturation tank room. The 2nd major circulation way serves the entire area of bottling, canning, and cask racking lines.

Siting: The brewery is located on 25 acres of land. This site is a ¼ of a mile from the company's original Chiswell Street London brewery.

Primary Objectives: This brewery is designed to produce a wide range of beers. One of the most important aspects of the brewery is that it is fully automated. It is controlled by a master brewer from a control panel located in the double story brew hall.
Although generally planned as a single storey envelope retaining flexibility to meet future requirements the brewhouse building has a multi-storey block 2 for the brewing processes housing plant, laboratories, offices and public relations area.

Construction is steel framed with light lattice trusses, galvanised in the single storey sections of the building and concrete encased for the multi-storey brewhouse block. Roofing is insulated metal decked finished with two layer felt topped in granite chippings. Suspended floors are partly in situ concrete, partly prestressed precast slabs. Wall linings are Thermalite or engineering brick.

External cladding has been treated boldly to read from the motorway: the main elevation is over 500ft long. Concrete panels have been used for this purpose and are textured either by exposing the dark fine aggregate or by sandblasting to expose a flint aggregate. The main entrance is approached through a sunken garden walled in rustic blue black brick.
BREWERY PROFILE: Schaefer Brewery 1974

Location: Fogelsville, Pennsylvania

Architects: The Eggers Partnership

Size: 600,000 sq. ft.

Cost: $60,000,000

Output: 800,000 Barrels/Yr.

Chief Materials: Concrete, Red Brick, and Glass.

Space: The most prominent elements are the grain silos, and the 40 ft. high brewhouse windows which display 2 stainless steel kettles.

Structure: Concrete

Grid Layout: Different for major spaces.

Span: Same as grid layout.

Enclosure: 40 ft. high windows in brewhouse. The walls are red brick, and are visually relieved by brick recess details.

Circulation: Entry for visitors is denoted by an extension and recess in the building.

Siting: The brewery is on a rural 160 acre site, near a highway.

Primary Objectives: The building has been designed to hug the site, and yet to stand out. This was the client's wish to make the public aware and to want to tour the brewery. The silos and brewhouse not only show their function, but their form also blends well with nearby structures. The lower parts of the building, such as the exterior wall corners, also reflect the rounded shapes of the silos.

A strong emphasis was on quality control which resulted in a large testing laboratory. Also, there were extreme cleanliness requirements, and a high degree of automation.

The form of the building was designed around the mechanical facilities, instead of placing them in the building form.
A congenial neighbor can be a highway billboard

This 600,000-square-foot Fogelsville, Pennsylvania facility has been designed to hug a rural 160-acre site and stand out at the same time. Certain elements have been chosen for visual emphasis, in line with the client's desire that the public be not only aware of, but induced to tour the full plant. The most prominent element contains the grain storage silos and two stainless steel kettles behind the 40-foot-high brewhouse windows (photo, upper right). The functions are clearly revealed and at the same time, the forms are reminiscent of the adjacent agricultural structures, here translated into red brick, concrete and glass. The walls of the lower parts of the building are visually relieved by brick recess details reflecting the rounded shapes of storage tanks (photo, opposite page, center) within. The rounding of exterior wall corners is derived from the silo shapes.

A happy collaboration between architects The Finger Partnership and corporate production planners produced a plant closely related to the production process. One of the first design steps was preparation of a model of the facility's association around which the rest of the building was determined.

Schacter's contribution to its Lehigh Valley location is multifaceted. The plant provides up to 400 jobs and produces 800,000 barrels a year under extremely efficient manufacturing conditions and with a high degree of automation. The receiving consumer and worker alike. A strong emphasis on quality control produced the requirement for a large testing laboratory. Little bit of gas oil, for cultural oil consumption. Used grains and hops become feed for farm animals and other by-products are similarly employed. Construction costs were $60,000,000.
Brewery at Värby, Sweden.
0 Lastwagenrampe zum Keller / Rampe d'accès du sous-sol pour camions / Truck access ramp to the cellar
1 Bohlenhalle / Réservoirs d'eau chaude / Boiler hall
2 Oltenks / Soutes à mazout / Oil tanks
3 Hof / Cour / Court
4 Wartehof für den Unterhalt der Lastwagen / Cour de travail, entretien des camions / Truck maintenance
5 Lift für die Beförderung des Maltes / Monte-charges (malt) / Volt supply lifts
6 Brauerei / Boulangerie / Brewery
7 Lager für gefüllte Flaschen / Dépot de bouteilles pleines / Store for filled bottles
8 Flaschenhalle / Halle des bouteilles / Bottle hall
9 Lager für leere Flaschen / Dépot de bouteilles vides / Store for empty bottles
10 Empfang für Besucher und Verkaufsabteilung / Réception des visiteurs et bureaux de vente / Reception and sales department
11 Haupteingang / Entrée principale / Main entrance
12 Abwartewohnung / Appartement du concierge / Porter's lodge
13 Angestelltenrestaurant und Umkleidekabinen / Canine et vestiaires / Employees restaurant and changing lockers
14 Verwaltung / Administration
The Site

The site is currently farmland with a manmade lake. Since brewing water is purified to h2o, the lake is just considered as an esthetic part of the site. Two important features of the site are the railroad line on the west border, and the Interstate on the east border. A service road at the northeast corner of the site connects it with the Interstate, thus allowing trucks to distribute beer to wholesalers throughout the nearby states. Other truck traffic includes supply and maintenance trucks, coal trucks, and local Farm Bureau trucks taking spent grains to be used as farm feed.

The rail line brings the ingredients such as barley malt, rice, corn, and hops, from the far west. Also beer is transported in railroad cars to other parts of the country.
Goals

I have included the goals and objectives along with the site because they are closely related.

1. Efficient brewing operation
2. Good people spaces
3. Show off process

1. The brewing process begins with the arrival of the grains by rail on site. Therefore I have one point of entry for this and transporting beer out by rail.

2. These people spaces include: the dining area, lab., administration, and visitor area. I have placed these directly by the lake for these people to enjoy.

3. I wanted to show off the process to the people driving into and out of Indianapolis on Interstate 69. The elevation facing I-69, is the linear 1st. half of the process. The most dominate feature is the large glass opening, exposing the brew kettles, which I hope will invite people to stop and visit the brewery.
**INDIANAPOLIS**  
Elevation 792 Ft.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Degree Days</th>
<th>Rel. Hum</th>
<th>Precip.</th>
<th>Wind</th>
<th>Average Number of Days of Sunup/Sundown</th>
<th>Average Speed</th>
<th>Direction</th>
<th>% Poss. Sunlight</th>
<th>P. C.</th>
<th>Snow, 10&quot;</th>
<th>Thunder</th>
<th>Fog</th>
<th>Percent IFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>Extreme</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>Minimum</td>
<td>Monthly</td>
<td>Highest</td>
<td>Lowest</td>
<td>Heating</td>
<td>Cooling</td>
<td>1:00 P.M.</td>
<td>Total</td>
<td>Snow Total</td>
<td>Speed</td>
<td>Direction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>37</td>
<td>21</td>
<td>29</td>
<td>70</td>
<td>-18</td>
<td>1113</td>
<td>0</td>
<td>68</td>
<td>3</td>
<td>5</td>
<td>11</td>
<td>nw</td>
<td>41</td>
</tr>
<tr>
<td>F</td>
<td>39</td>
<td>23</td>
<td>31</td>
<td>67</td>
<td>-10</td>
<td>840</td>
<td>0</td>
<td>65</td>
<td>2</td>
<td>5</td>
<td>11</td>
<td>wnw</td>
<td>51</td>
</tr>
<tr>
<td>M</td>
<td>48</td>
<td>30</td>
<td>39</td>
<td>80</td>
<td>-6</td>
<td>800</td>
<td>0</td>
<td>62</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>wnw</td>
<td>52</td>
</tr>
<tr>
<td>A</td>
<td>61</td>
<td>40</td>
<td>51</td>
<td>89</td>
<td>20</td>
<td>432</td>
<td>2</td>
<td>56</td>
<td>4</td>
<td>4</td>
<td>11</td>
<td>sw</td>
<td>56</td>
</tr>
<tr>
<td>M</td>
<td>72</td>
<td>51</td>
<td>61</td>
<td>93</td>
<td>28</td>
<td>177</td>
<td>17</td>
<td>57</td>
<td>4</td>
<td>T</td>
<td>10</td>
<td>sw</td>
<td>62</td>
</tr>
<tr>
<td>J</td>
<td>82</td>
<td>60</td>
<td>71</td>
<td>96</td>
<td>42</td>
<td>39</td>
<td>324</td>
<td>57</td>
<td>5</td>
<td>0</td>
<td>9</td>
<td>sw</td>
<td>68</td>
</tr>
<tr>
<td>J</td>
<td>86</td>
<td>64</td>
<td>75</td>
<td>99</td>
<td>48</td>
<td>0</td>
<td>237</td>
<td>00</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>sw</td>
<td>70</td>
</tr>
<tr>
<td>A</td>
<td>85</td>
<td>63</td>
<td>74</td>
<td>97</td>
<td>41</td>
<td>0</td>
<td>202</td>
<td>50</td>
<td>3</td>
<td>0</td>
<td>7</td>
<td>sw</td>
<td>72</td>
</tr>
<tr>
<td>S</td>
<td>78</td>
<td>55</td>
<td>65</td>
<td>96</td>
<td>34</td>
<td>90</td>
<td>169</td>
<td>58</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>sw</td>
<td>66</td>
</tr>
<tr>
<td>O</td>
<td>67</td>
<td>44</td>
<td>55</td>
<td>88</td>
<td>20</td>
<td>316</td>
<td>40</td>
<td>56</td>
<td>3</td>
<td>T</td>
<td>9</td>
<td>sw</td>
<td>60</td>
</tr>
<tr>
<td>N</td>
<td>50</td>
<td>32</td>
<td>41</td>
<td>78</td>
<td>4</td>
<td>723</td>
<td>0</td>
<td>66</td>
<td>3</td>
<td>2</td>
<td>11</td>
<td>sw</td>
<td>43</td>
</tr>
<tr>
<td>O</td>
<td>39</td>
<td>23</td>
<td>31</td>
<td>70</td>
<td>-14</td>
<td>1051</td>
<td>0</td>
<td>77</td>
<td>3</td>
<td>4</td>
<td>11</td>
<td>sw</td>
<td>40</td>
</tr>
<tr>
<td>Y</td>
<td>62</td>
<td>42</td>
<td>52</td>
<td>99</td>
<td>-18</td>
<td>5699</td>
<td>1011</td>
<td>61</td>
<td>39</td>
<td>20</td>
<td>10</td>
<td>sw</td>
<td>5692</td>
</tr>
</tbody>
</table>

---

**40°N LATITUDE**

---

28
UTILITIES SERVING PROPERTY:

**WATER** - 12" WATER LINE IS LOCATED IN EAST 86TH STREET (INDIANAPOLIS WATER COMPANY)

**SEWER** - 24" INTERCEPTOR SEWER IN 86TH STREET AS FAR EAST AS 6300 EAST (INDIANAPOLIS DEPT. OF PUBLIC WORKS)

**GAS** - 4" GAS LINE LOCATED IN MASTERS RD., APPROX. 500 FT. TO THE WEST AND A 2" LINE TO THE SITE (CITIZENS GAS & COKE UTILITY)

**ELECTRIC** - 13.2 KV PRIMARY DISTRIBUTION (INDIANAPOLIS POWER & LIGHT COMPANY)

Owner private. Realtors name available from Indianapolis Power & Light Company — Area Development Department.
INDIANAPOLIS & NEARBY COUNTIES

INDIANAPOLIS, MARION COUNTY
1. BOONE COUNTY
2. HAMILTON COUNTY
3. HANCOCK COUNTY
4. HENDRICKS COUNTY
5. JOHNSON COUNTY
6. MONROE COUNTY
7. SHELBY COUNTY
WATER FEATURES & DRAINAGE

CULVERET UNDER RAILROAD TRACKS, THE STREAM WILL BECOME BELLER BRIDGE AND FLOW INTO THE WHITE RIVER.

THE POND IS ABOUT 300' X 400'. THE POND LEVEL CONTROLS THE FLOW OF THE STREAM.

DIRECTION OF A SMALL STREAM ABOUT 4' WIDE & 1' TO 2' DEEP

CULVERET UNDERNEATH INTERSTATE

MAJOR DRAINAGE DIRECTIONS

0' 400' 800' 1200'
EXISTING VEGETATION

EXISTING DECIDUOUS TREES. ABOUT 30' IN HEIGHT.

EXISTING FENCES W/VINES AND THINLEY SPOD W/SMALL TREES

EXISTING GROUND COVER IS HARVESTED CORN ROWS

N

0' 400' 800' 1200'
EFFECTIVE AREA
Mechanical Room

A great deal of steam is required throughout a brewery. Steam is used to run electric generators providing the brewery with its own electricity. It is also used to cook cereal, and boil the wort in the brew kettle. Steam is used to heat water for the bottle washers and pasteurizers, as well as other needs throughout the brewery.

In addition to steam and refrigeration requirements, there is a compressed air system. Carbon dioxide, given off during fermentation, is collected and piped to the mechanical room. Here it is liquified and stored for further use of carbonating stored beer and moving beer from vessel to vessel by means of counter pressuring.
**TYPE:** Mechanical Room

**SPACE:** Mechanical Room

**FUNCTION:** To Provide Steam, Compressed Air And Electricity.

**OCCUPANTS:**

**EQUIPMENT:** Coal Burning Stokers, Boilers, Compressed Air System, Electric Generators, Refrigeration Equipment

**SPECIAL REQUIREMENTS:** Floors To Be Clean, Excessive Noise Problem

**SPECIAL RELATIONSHIPS:** Water And Access To Coal And Coal Waste

<table>
<thead>
<tr>
<th>HVAC</th>
<th>MECHANICAL HEATING</th>
<th>MECHANICAL COOLING</th>
<th>MECHANICAL VENTILATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIGHTING</th>
<th>ARTIFICIAL</th>
<th>NATURAL</th>
<th>BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIVACY</th>
<th>ACOUSTICAL</th>
<th>VISUAL</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>INTERCOM</th>
<th>TELEPHONE</th>
<th>EXPANSION-FUTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIONSHIP TO OTHER SPACES</th>
<th>MECHANICAL R.A.</th>
<th>BREW HOUSE</th>
<th>FERMENTING CELLER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROCESS FUNCTION</th>
<th>DIRECT</th>
<th>INDIRECT</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OCCUPANTS</th>
<th>DIRECT</th>
<th>INDIRECT</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LABORATORY</th>
<th>VISITOR'S GALLERY</th>
<th>SATURATION TANKS</th>
<th>GRAIN TANKS</th>
<th>GRAIN INTAKE</th>
<th>WATER TANK</th>
<th>TRUCK MAINTENANCE</th>
<th>GATE CONTROL</th>
<th>MAINTENANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TYPE:** Grain Intake

**SPACE:** Grain Pick-Up

**FUNCTION:** To receive grain and prepare it for storage in grain silos.

**OCCUPANTS:**

**EQUIPMENT:** Pneumatic grain conveying system with an exhaust or and compressor, grain cleaner, scale

**SPECIAL REQUIREMENTS:**

**SPECIAL RELATIONSHIPS:**

<table>
<thead>
<tr>
<th>HVAC</th>
<th>MECHANICAL HEATING</th>
<th>MECHANICAL COOLING</th>
<th>MECHANICAL VENTING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL PARTIAL NONE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIGHTING</th>
<th>ARTIFICIAL</th>
<th>NATURAL</th>
<th>BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL PARTIAL NONE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIVACY</th>
<th>ACOUSTICAL</th>
<th>VISUAL</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL PARTIAL NONE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>INTERCO</th>
<th>TELEPHONE</th>
<th>EXPANSION-FUTURE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>RELATIONSHIP TO OTHER SPACES</th>
<th>MECHANICAL RA.</th>
<th>BREWHOUSE</th>
<th>FERMENTING CELLER</th>
<th>KEGGING</th>
<th>BOTTLING</th>
<th>WHAREHOUSE</th>
<th>LOADING DOCK</th>
<th>EMPLOYEE LOCK &amp; CUST.</th>
<th>OFFICES</th>
<th>LABORATORY</th>
<th>VISITOR'S GALLERY</th>
<th>SATURATION TANKS</th>
<th>GRAIN TANKS</th>
<th>GRAIN INTAKE</th>
<th>WATER TANK</th>
<th>TRUCK MAINTENCE</th>
<th>GATE CONTROL</th>
<th>MAINTENCE</th>
</tr>
</thead>
</table>
Grain Intake

Barley malt, corn, rice arrive in hopper rail-road cars and box cars. Hops arrive in refrigerated box cars. The hops are in 200 lb. bales which are loaded with forklifts to a refrigerated storage area. The malt, corn, rice is transmitted by a pneumatic grain conveying system.

The grain pick-up area is basically a shed for keeping the weather off during unloading. The enclosure should be protected from rodents, insects, and birds.

General Notes:

1. 4'-8½" gauge is from inside to inside of rail heads.
2. On curved track the clearance shall be increased to allow for overhanging and tilting of a car 85'-0" long x 16'-0" high
3. 16'-0" min. required to clear highest cars and locomotives.
**TYPE:** Grain Intake  
**SPACE:** Hops Storage  
**FUNCTION:** To receive and store hops

**占用者:**  
**设备:** Forklift

**特殊要求:**  
空间必须是冷藏的

**特殊关系:**  
必须靠近铁路码头以接收并应有访问到金库的存储空间。
**Type:** Grain Intake

**Space:** Grain Handling

**Function:** To weight and clean incoming grain for storage in silos.

**Occupants:**

**Equipment:** Weigher, cleaner, which includes a magnetic separator, screens, aspirator

**Special Requirements:**

Explosive Conditions

**Special Relationships:**

Physically connected to grain pick-up area. This area may be physically connected to grain silos or may be separate.
Grain Handling

To obtain uniformity of milling, it is necessary to have reasonable consistency in size of corns. In some breweries, all samples of malt are graded or screened to obtain such consistency, while in others only those batches which fail to meet the specifications laid down for range of corn size are so treated. The malt is conveyed by pneumatic or mechanical means to rotating, cylindrical, oscillating or flat-bed screens. Not only are corns of abnormal size rejected, but foreign matter such as straw, stones, string, sacking and metal particles are removed. After screening the malt is weighed often on a continuous basis until a predetermined total is reached.

Dust arising from malt-handling and processing is an important hazard in breweries because of its long-term effects upon the mucous membranes of those that inhale it and because of explosion risk. Where possible, dust is aspirated by air-cyclones and trapped in cloth-sleeve filters. Sparks may be avoided by removing stones and metal from the malt before it enters the mill; careful attention should also be paid to mechanical and electrical installations wherever there is malt dust. Easily collapsible sections of chutes, elevators, and conveyors are provided so that should there be an explosion, blast is vented at convenient locations.
TYPE: Grain Intake
SPACE: Grain Silos
FUNCTION: To store grains
To store "spent grains"

OCCUPANTS:

EQUIPMENT: Pneumatic grain conveying systems

SPECIAL REQUIREMENTS:
They must be watertight
Barley:
Corn:
Rice:

SPECIAL RELATIONSHIPS:
Grain Silos

Batches of malt arriving in bulk transporters are conveyed into separate stores by elevator or conveyor. The grain is usually held in silos or storage bins, of steel and concrete construction, with smooth walls and hopper bottoms. Adequate facilities for receiving and storing malt are required to obviate unforeseen delays in delivery but not exceeding a few days' requirements. Otherwise capital is held unnecessarily in stocks of malt and in storage equipment.

Some breweries go farther than is required for grain storage. For example, the malt is maintained at the moisture level at which it arrived at the brewery in order to discourage the breeding of insects and to prevent the malt from changing biochemically because of the presence of water, that is from becoming slack. By the use of suitable electrodes, the levels of malt in the silos, the temperature and the humidity can be indicated or recorded automatically, preferably at the central panel where the various conveyor/silo-filling and emptying systems are also controlled.

Space must be allowed above the bins to provide relief area in case of an explosion to preserve the basic structure.
**TYPE:** Grain Intake  

**SPACE:** Mill Rooms  

**FUNCTION:** To break up the malt kernels into a relatively coarse malt meal without shattering the exterior husk too much  

**OCCUPANTS:**  

**EQUIPMENT:** Automatic malt mills, automatic cleaning and weighing equipment  

**SPECIAL REQUIREMENTS:**  

- Electric Motors  
- Fire Walls, Explosive Area, Ventilation For Mills  
- Floors, Walls To Be Washed Down  

**SPECIAL RELATIONSHIPS:**  

- Mill room has direct access to grain silos and to the mashing operation in brewhouse.
Grinding Of Malt

The first step in the actual brewing of beer is represented by the grinding of malt in specially designed mills.

The malt husks, separated cleanly from the endosperm portion of the kernel, eventually must serve as a filtering medium at the end of the mashing process, except where special mash filters are being used.

To facilitate proper mashing, it is also desirable to avoid the production of excessive amounts of finely-ground malt flour. Malt mills, which range in size from one to six pairs of steel rolls, are therefore so designed that they subject the malt to a crushing, rather than a grinding action.

The millroom itself is frequently located fairly high in the brewery so that in case of an explosion, damage to the rest of the brewery is minimized.

In milling, there are two basic (unit) operations, namely size reduction and particle size control or screening.

Size reduction in breweries is normally achieved by roller mills. Roller mills operate by using both direct pressure and shear.
Malt Mills:

The first reduction rolls of a modern mill receive the individual malt corns end-on from the feed rolls so that crushing occurs over the whole length of the corn, thus preserving the husk almost intact. The least modified part of the endosperm (that part distal to the embryo) may remain attached to the husk as a 'hard end' and it is necessary to detach it after the initial crushing without undue damage to the husk. The endosperm and embryo are crushed to produce fine grits rather than flour, although some flour production is inevitable.

Considerable care is taken during milling to ensure that the proportion of flour, grits, and husk conform to specification. This entails careful setting of the mills so that clearances between rolls are correct along their whole length. Samples may be removed in most mills below each pair of rolls, and analysed using sieves to assess the proportions of malt fractions.

In a four-roll mill, malt is fed through a chute incorporating a magnetic separator to remove iron and steel objects, a deeply grooved feed roll, and the first pair of reduction rolls of 12 in. dia. operating at 210-230 rev./min. Immediately beneath the rolls is a series of plates which keep the space full of grist and so reduce the risk of explosion by smothering any sparks generated if particles of flint or steel strike the rolls. The ground malt is forced on to the second pair of rolls by a revolving beater which also serves to separate flour and grits from the husks. This second pair, equal in size to the first and operating at about 280 rev./min., breaks the hard unmodified ends. But the flour and grits which do not require further milling also have to pass between them, an inefficient arrangement. From the rolls, the grist is detained by further anti-explosion shelves before falling to a grist case.

Fig. 9.6 Four-roll mill. 'Fixed' refers to driven rolls.
Six-Roll Mills:

With six-roll mills, that is three pairs of rolls, more effective separation and differential size reduction can take place. This is particularly necessary with less well-modified malts. Flour produced by the first pair of rolls fall through to the grist case while fine grits are screened into the third pair of rolls. In the second pair of rolls, the hard ends are crushed from the husks and coarse grits are reduced in size. Only grits from this second pair find their way to the third pair of rolls, the flour being delivered to the grist case. The screening is achieved either with inclined static screens or ones vibrating at about 400 oscillations per minute. Such mills allow both well-modified and poorly modified malts to be satisfactorily milled.

In batch brewing, it is usually required that the mill grinds sufficient for a mash in less than 2 hours.

Fig. 9.8 Six-roll mill with screens.  
Fig. 9.9 Five-roll mill with screens.

H – husks; G – grits; CG – coarse grits; FG – fine grits; F – flour.
**TYPE:** Brewhouse

**SPACE:** Mashing Operation

**FUNCTION:** Combines ground malt and adjuncts with water to produce wort. (May include lautering and sparging.)

**OCCUPANTS:**

**EQUIPMENT:** Mash tubs, temperature indicating and controlling instruments

**SPECIAL REQUIREMENTS:**
- Hot Water, Steam, Electrical
- Floors, Walls To Be Washed Down
- Flue Venting

**SPECIAL RELATIONSHIPS:**
- Mashing operation receives milled barley malt, and adjuncts directly from storage. After mashing, is lautering or boiling.
Mashing

The mashing operation, which combines the ground malt and adjuncts with water in the proportion of one barrel of water for each 100 pounds of brewing materials, is carried out in the mash-tub, which is a large circular metal vessel equipped with hot water and steam inlets, a stirring device of the rake, paddle or propeller type, and a multitude of temperature indicating and controlling instruments.

Mashing accomplishes a three-fold purpose. First, it brings malt and adjuncts that are readily soluble in warm water. Secondly, it permits the malt enzymes to act upon the insoluble substances and render them soluble. Thirdly, it allows a far-reaching enzymatic degradation of starchy, proteins, gums, etc., into products of lower molecular weight and of a kind that ensures a sort of proper composition and acidity. The enzymatic processes involved are by far the most important. Thus starch must be rendered soluble and degraded by diastatic enzymes into dextrins and maltose. The proteolytic enzymes must perform a similar action on otherwise insoluble proteins. Since each of the enzymes involved in these vital reactions exhibits its optimum activity within rather narrow temperature and pH ranges, it is evident that proper mashing involves the close control of time and temperature conditions.

In the actual mashing procedure a portion of the ground malt, representing about 25-30% of the weight of adjuncts used, is first withdrawn from the total malt and combined with the adjuncts to make up the so-called cooker mash. Since common or refined corn grits and rice contain raw starch, they must first be gelatinized in a special cooker, which is a steam-heated vessel equipped with stirrers. The adjuncts and malt are doughed-in at a temperature of about 100°F. and the temperature is then gradually brought to the boiling point and held there until the adjuncts are completely gelatinized.

The main mash combines the remaining 75-80% of malt with water at an initial temperature of 95°F. This temperature is maintained for 30 minutes or more to promote the formation of lactic acid, and this initial step is therefore called the lactic acid rest. The temperature is then increased to 113°F. for the protein rest of some 30 to 60 minutes' duration, during which period the enzyme proteinase attains its maximum activity and breaks down the large protein molecules into compounds of lower molecular weight. Some additional acidification of the mash also occurs at this temperature level and the formation of buffer substances is promoted. Some brewers initiate the mashing process at this temperature, eliminating the lactic acid rest by the use of special acidifying agents. Next follows the sugar rest at 133-140°F., lasting from 5 to 20 minutes,
COOKER MASH: ground malt that is about 25% - 30% of the wt. of adjuncts and adjuncts.

MALT  ADJUNCTS

STEAM HEATED
100°F TO BOILING PT.

MAIN MASH: the remaining 75% - 80% of malt.

1) Initial 95°F @ 30 min.
2) ↑ 113°F @ 30 - 60 min.

COOKER MASH is combined with the MAIN MASH.

3) 133 - 140°F @ 5 to 20 min.
4) 153 - 160°F @ 15 to 45 min.
5) 167 - 173°F.

during which the bulk of the sugar maltose is formed by the action of beta-amylase. The duration of this sugar rest governs the final alcohol content of the beer, higher alcohol contents being attained as this stage of the mashing process is prolonged. A further rise in the temperature to 153-160°F. initiates a pronounced dextrin formation by alpha-amylase which is allowed to proceed for 15 to 45 minutes. It is during these last two stages that the cooker mash is combined with the main mash. Mashing is terminated when starch conversion is complete which is indicated by the absence of a color reaction when samples of the wort are treated with a dilute iodine solution. The temperature is raised to a final level of 167-173°F. to inactivate all the enzymes present.
Mash Tub:

The infusion-mash tub is traditionally circular, varies very much in diameter, but is usually 6-8 feet in depth and in some cases even deeper. Although the traditional wooden construction has the advantage of heat insulation, wood soon becomes spongy. The tubs are therefore constructed of copper or stainless steel and are well insulated on the vertical sides and the base. The old traditional open mash tubs have been replaced by enclosed ones in order to conserve heat and avoid steamy conditions in the brewing room. The dome-shaped lid to a mash tub is fitted with sliding panels for inspection purposes. Sometimes the steam is permitted to escape by a flue pipe. Inspection lamps and detergent spraying equipment are often fitted to the lid. Standing some 2 inches above the mash tub base are a series of slotted plates which form a removable false bottom to the tub. Before charging the mash tub, these filter-plates are barely covered with hot liquor in order that the mash falling on to them does not block the slots which are typically 0.028-0.040 inches wide at the top of the plates, widening to 0.18 inches at the lower surface, 2.25 inches in length and are cut with a 0.5 inch staggered pitch. The total slot area represents about 11% of the filter-plate area. Plates are usually constructed of gun-metal or stainless steel and interlock in a unique pattern so that, after they have been removed for cleaning, they can be reassembled correctly. One or more large diameter holes in the false bottom can be uncovered at the end of mashing. The spent grains are swept through the holes by a pair of large arms rotating horizontally. The discharged grains fall into a chute and are collected for animal feed. Other methods of grain discharge include manual digging, or slurring the grains in water and pumping the slurry out of the tub. Other rotating machinery within the mash tub comprises sparge arms (which are moved by water pressure) for spraying liquor evenly over the goods. Arms bearing rakes or knives for loosening the mash and driven by a central spindle are provided in some mash tubs. By adjusting the angle of the knives, this equipment can also serve to discharge grains. Mash is loaded into the tub to a depth of 3-4 feet in most cases, but considerably deeper in some breweries. After a standing period ranging from 15 minutes to 2 hours, the wort is allowed to run from the tub through one or more discharge pipes set in the true base of the tub, each pipe serving an approximately equal area of the base, sat 20-25 feet and terminating in a tap. The taps are grouped above an open trough (the spend safe or grant) and are manually controlled with care so that there is very gentle, even withdrawal of wort from the mash bed. Wort in the trough is in some cases recycled back to the bed until the wort runs clear. This recycling has recently been criticized on the grounds that it reintroduces 'finest' on top of the bed and thus impedes run-off. It is advocated that the turbid worts should be clarified away from the tub, if in fact starch-free worts require to be completely clarified.
Fig. 10.4 Infusion-mash tun.

Fig. 10.5 Slots in mash-tun plates. A: Plan, upper surface. B: Vertical section. C: Plan, lower surface. D: Vertical section (at right angles to B).
**Type:** Brew House

**Space:** Hop Day Storage

**Function:** To store smaller amounts of hops that are put in the brew kettle

**Occupants:**

**Equipment:** Buckets Or Tubs The Size Of A Garbage Can Scales

**Special Requirements:**

Hops are stored at 33°F

**Special Relationships:**

Must be next to brewhouse(kettle) and main hop storage area.
**TYPE:** Brewhouse  
**SPACE:** Brew Kettle  
**FUNCTION:** To add hops and to boil the wort  

<table>
<thead>
<tr>
<th>HVAC</th>
<th>MECHANICAL HEATING</th>
<th>MECHANICAL COOLING</th>
<th>MECHANICAL VENTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
<td>PARTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIGHTING</th>
<th>ARTIFICIAL</th>
<th>NATURAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIVACY</th>
<th>ACoustical</th>
<th>VISual</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
<td>PARTIAL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION</th>
<th>INTERCOM</th>
<th>TELEPHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| EXPANSION-FUTURE | |
|------------------| |

<table>
<thead>
<tr>
<th>RELATIONSHIP TO OTHER SPACES</th>
<th>MECHANICAL RA. BREWHOUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROCESS FUNCTION</td>
<td>FERMENTING CELER KEGGING BOTTLING WHAREHOUSE LOADING DOCK EMPLOYEE LOCK &amp; KEY OFFICES</td>
</tr>
<tr>
<td>DIRECT INDIRECT NONE</td>
<td></td>
</tr>
<tr>
<td>OCCUPANTS DIRECT INDIRECT NONE</td>
<td></td>
</tr>
</tbody>
</table>

| SPECIAL REQUIREMENTS: | Electrical, Steam  
Wide Venting Pipe To Roof |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIAL RELATIONSHIPS:</td>
<td>Hops must be available.</td>
</tr>
</tbody>
</table>
Boiling And Hopping Of Wort

The wort obtained from the mash is next subjected to vigorous boiling for two to two and one-half hours in the brew kettle. Brew kettles are large vessels, made either of copper or stainless steel and are available in various designs and shapes. They are covered by a high dome from which rises a fairly wide venting pipe to the roof of the brewhouse to permit the escape of vapors. Heat is supplied in the form of steam and the heating element may be either a steam jacket, a heating coil or a percolator. The capacities of some of the larger kettles may exceed 600 barrels of wort.

Wort boiling has for its objectives: (1) the concentration of the diluted wort; (2) the complete inactivation of any enzymes that may have survived the final mashing temperature; (3) the coagulation and precipitation in the form of "kettle break" of high-molecular proteins; (4) the extraction of desirable hop constituents; and (5) the complete sterilization of the wort.

Hops are usually added at various stages of the boiling process at the rate of about 0.35 to 0.50 lb. per barrel of beer. A common procedure is to add about one-fifth of the total hops about one hour after the start of boiling, two-fifths some 30 minutes later, and the rest just prior to the termination of boiling. The advantages of this procedure are that maximum protein precipitation is attained by means of the first addition, adequate bittering of the wort is obtained by the second addition, while the third addition imparts the delicate hop aroma to the wort.
Brew Kettle:

To ensure complete dissolution of the hop principles and the formation of a satisfactory break it is necessary that there should be vigorous ebullition during wort boiling. Such a boil was a feature of open-fired kettles and there was a marked deterioration in the vigour of the boil in kettles heated with a steam jacket. British kettles were therefore often fitted with fountains or calandria which, working on the principle of a coffee percolator, increased the circulation of the boiling wort. It was also found that internal steam coils were more successful in promoting a vigorous boil than a steam jacket. The steam coils were most conveniently mounted around and in the fountain. Such a heat exchange has high thermal efficiency and promotes a vigorous boil but is extremely difficult to clean. Fountains are less often found in continental kettles which may be fitted with a propeller to ensure good circulation of hops and wort.

It is essential that all coppers should be kept clean, as a layer of scum or scale will rapidly decrease the thermal efficiency and decomposition products of the remnants of the break from earlier batches of wort will produce off flavours. Kettles were cleaned manually by men with scrubbing-brushes within the vessel and even then it was easier to keep the sides of the kettle clean than the interstices between fountains and heating coils, etc. The modern trend, with increased labour costs, is to replace manual cleaning with "in-place" cleaning where the walls of the kettle are sprayed with solutions of specially formulated detergents. The spray nozzles are either permanently mounted within the kettle or occasionally may be mounted on a false or substitute door for the kettle. However, for in-place cleaning to be successful it is necessary to have as few obstructions as possible to the detergent solution. Recent kettle designs has therefore gone away from fountains and internal heating coils and sought alternative methods of ensuring a vigorous boil.
TYPE: Brewhouse

SPACE: Lautering And Sparging

FUNCTION: Lautering - The removal of the wort from spent grains.  
Sparging - To spray the spent grains to wash out all the extractives.

OCCUPANTS:

EQUIPMENT: Combination Mash-Lauter Tub  
Or A Separate Lauter Tub

SPECIAL REQUIREMENTS:

Electrical, Hot Water  
Floors, Walls To Be Washed Down

SPECIAL RELATIONSHIPS:

This process may be carried out in the mashing process with a combination mash-lauter tub.  Lautering is the last step before brew kettle.  Spent grains are removed.
Lautering And Sparging:

The removal of the wort from the insoluble husk, or "spent grains", is termed lautering and is carried out either in a combination mash-lauter tub or in a separate lauter tub. Both of these units are equipped with a false bottom containing numerous perforations and with a number of outlets in their real bottom leading to a tapping device called the "pfaff". The tubs are further equipped with rakes and sparge arms, the latter consisting of hot water pipes with perforations that will give an even spray of water as the arms revolve slowly about their central axis. The purpose of the revolving rakes is to prevent channelling of the layers of spent grains.

On termination of the mashing process, the mash is allowed to rest for about 30 minutes to permit the spent grains to settle out and form a filter bed about 18 inches deep on the false bottom. The faucets of the pfaff are then slowly opened and the wort permitted to run into a cylindrical wort receiver called the grant. The initial turbid run is returned to the lauter tub until the wort runs clear when it is allowed to flow into the brew kettle. When the wort surface reaches the top of the spent grains, the sparge arms are turned on and water at a temperature of 167°-178°F. sprayed onto the spent grains to wash out all the extractives.

Sparging is continued until the wort reaches an extract content of about one per cent.

Lautering and sparging may also be carried out by means of a special mash filter which gives a more rapid and efficient separation of the extractives from the spent grains and which is gaining increasing acceptance in American breweries.
Lauter Tub

The lauter tub is rather like an infusion-mash tub in general appearance. It is placed at a higher level than the other brewing vessels, or at least above the brew kettle which receives wort from it. The depth of goods in a lauter tub is usually about 18 inches so that rapid filtration of the wort can occur. The shallow bed means that the lauter tub has to be about 50% greater in diameter than an infusion-mash tub of the same capacity.

Because the mash is thinner, the 20-30 minutes needed to fill the lauter tub permits segregation of fine material from the husks. The mash fails to float as it does in infusion mashing, because the air has been driven from it by the mixing, pumping, and boiling. It assumes a water-logged appearance with a considerable depth of free liquid over the bed. The slots in the false bottom of the lauter tub are narrower than those of the infusion-mash tub, about 0.02 inches, and represent about 8% of the area of the plates. Wort is run off as in infusion mashing.

In order to run-off the second and subsequent worts, sparge water may be introduced rapidly, the whole mash reslurried with rakes and then permitted to resettle. After running-off worts for a period of time, the sparging and the raking is repeated.
**TYPE:** Brewhouse  

**SPACE:** Straining And Cooling  

**FUNCTION:** To Strain And Cool Down The Wort  

**OCCUPANTS:**  

**EQUIPMENT:** Hop Strainer Or 'Hop Jack'  
Heat Exchangers, Temperature Indicating And Controlling Instruments  

**SPECIAL REQUIREMENTS:**  
After straining, wort must maintain a temperature at around 47°F.  
A Cooling Room  

**SPECIAL RELATIONSHIPS:**  
Permentation Occurs Next.
Straining And Cooling Of Wort

The boiled wort is next passed through a hop strainer or "hop jack" which is a large vessel of variable design equipped with basketshaped screens which strain the spent hops and sludge comprising the kettle-break from the wort.

The wort then passes to the cooling room where its temperature is reduced to approximately 47°F. Wort coolers are of several types. Formerly, the wort was allowed to cool in large shallow vessels, called cool ships. This method of cooling has now been largely superseded by more efficient methods in which the wort passes either through closed double-pipe or plate-type heat exchangers, or flows over vertical baudelot coolers, which bring about rapid and effective temperature reduction. Frequently the cooled wort is subjected to the first of a series of clarifications either by means of centrifuges or diatomaceous earth filters.
Wort Cooling:

The traditional open coolers have virtually disappeared from the brewing scene, having been replaced by closed coolers of the tubular or plate heat exchanger type. The function of the wort coolers is to:

1. Cool the wort to fermentation temperature.
2. Generate hot brewing water.
3. Saturate the wort with air for fermentation.
4. Precipitate cold break in a flocculent form.

At present, the design of tubular exchangers or plate exchangers is, however, entirely a matter of mechanical and thermal performance, cost and hygienic design, without regard for the existence or requirements of "fast" or "slow" worts.

The generation of hot brewing water is readily carried out by running the hot wort counter current to cold brewing water. The mechanical design of plate heat exchangers can lead to a very efficient countercurrent operation, which enables a very close approach of wort outlet temperature to cooling water inlet temperature, and of hot brewing water outlet temperature close to the hot wort inlet temperature.

Cold Wort Filtration

Cold wort filtration has been widely practiced and has two prime features:

1. To remove potential haze-forming materials from the wort and hence the beer, thus enhancing chill haze stability and reducing the cold conditioning time needed to attain a certain degree of chill haze stability.
2. To remove sulphur-bearing proteins from the wort, thus reducing the level of volatile sulphur compounds in the beer, and hence minimizing the maturation time required to achieve the desired flavour stability.

The two main classes of filters which have been used for this purpose have been plate and frame filters using kieselguhr as a filter aid supported on cloths and kieselguhr filters using rigid metal supports. The quantity of kieselguhr used is relatively small, amounting to 10g or of powder to remove 10g per hectolitre of suspended protein from the wort.

While cold wort filtration is not popular due to the additional handling and losses involved, there is no doubt that it does contribute to the rapid maturation of beers.
TYPE: Brewhouse

SPACE: Spent Grains Room

FUNCTION: To store and treat the spent grains for shipment

OCCUPANTS:

EQUIPMENT: Storage Tank, Spent Grains Equipment

SPECIAL REQUIREMENTS:

SPECIAL RELATIONSHIPS:

Spent grains are received from lauter tub and hop strainer. Spent grain return to hopper cars.
**TYPE:** Brewhouse

**SPACE:** Supporting Facilities

**FUNCTION:** To support the operation and workers.

**OCCUPANTS:**

**EQUIPMENT:** Brewing Panel, H. & V. Equipment
Elect. Substation, Toilet Room

**SPECIAL REQUIREMENTS:**

**SPECIAL RELATIONSHIPS:**

<table>
<thead>
<tr>
<th>HVAC</th>
<th>MECHANICAL HEATING</th>
<th>MECHANICAL COOLING</th>
<th>MECHANICAL VENTING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td>@</td>
<td>@</td>
<td>@</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LITING</th>
<th>ARTIFICIAL</th>
<th>NATURAL</th>
<th>BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>PARTIAL</td>
<td>NONE</td>
<td>TOTAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIVACY</th>
<th>ACOUSTICAL</th>
<th>VISUAL</th>
<th>TOTAL</th>
</tr>
</thead>
</table>
| TOTAL   | PARTIAL | NONE | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | TOTAL | PARTIAL | NONE | TOTAL | T...
**TYPE:** Brewhouse

**SPACE:** Brewhouse Office Area

**FUNCTION:** General Office Area For Brewmaster.

**OCCUPANTS:** Brewmaster, Secretary, 3 Assistants

**EQUIPMENT:**

**SPECIAL REQUIREMENTS:**
General Office with Secretary
Brewmaster's Office
Assistant's Office
Taste Room
Storage
Men's Restroom
Women's Restroom

**SPECIAL RELATIONSHIPS:**
The brewmaster is responsible for everything in the brewery.