Automation

Control of the research brewery and cellar consists of a step sequence editor and a process visualization screen.

The underlying software is WinBrew (developed by Esau and Hueber) that is based on Siemens SIMATIC S7 Hardware SPS utilizing Profibus structure with an Ethernet interface along with Zenon visualization.

Analogue and digital inputs and outputs are employed with all I/Os wired to Siemens modules type ET200S.

All pumps are controlled via Siemens VFDs (Variable Frequency Drives).

Energy Efficient

Hot exit water from the wort heat exchanger, sub-cooler between the kettle and whirlpool, and vapor condenser is captured in the hot liquor tank for use in subsequent brews.

All steam condensate is captured and returned to the OSU steam plant.
Equipment

Mash Group

Täuber 4-roller mill - fully adjustable gaps for both sets of rollers. It typically runs 400kg/hour and mashes directly into MK1 or MK2.

MK 1 (Mash Kettle/Pre-run Vessel) and MK 2 (Mash Kettle/Cereal Cooker) are identical and both vessels can also serve as jacketed boiling kettles for use with whole hops. They have precise temperature control utilizing dual steam jacket zones.

The tanks have variable speed agitation so they are also perfect bio-reactors for kettle souring or propagations.

Mash kettles have a total usable volume of 3.6hl with a minimum volume of 15 liters.

The mash group can support any mashing regimes (standard infusion, step mash, American double mash with cereal adjuncts, sophisticated decoctions). Using MK 1 as a pre-run vessel allows for over-lapping brews.

Mash Filter

A hammer mill is used to reduce grains to a coarse flour. The mill runs 400-600kg per hour.

The Meura 2001 Micro Mash Filter has a flexible capacity of 11 to 131kg of malt (more or less for other cereal grains) and is capable of producing very high gravity worts (>25). It is also ideal for mashing/running off hard to lauter grist bills or husk-less cereal grains.

The mash filter can handle just about any cereal grain you can throw at it.
**Lauter Tun**

Equipped with variable speed and adjustable height rakes/knives and aided with differential pressure measurement for smooth run-offs.

Programmable sparging routines with acidified or non-acidified brewhouse water.

Variable speed run-off pump with a mass flow meter for measuring concentration of the wort.

Lauter has a 4 hl total capacity with malt loads of 95kg/m² @3hl of 8P wort and 131kg/m² @1.5hl of 22P wort.

**Kettle System**

The kettle system is composed of an external calandria (tube and shell heat exchanger) and a variable speed wort recirculation pump. It is designed to run with hop pellets or hop products and creates a vigorous boil when wort is pumped over a spreader.

The exit temperature of the wort from the calandria is variable and is typically 103°C, the pump speed is set to achieve 8-10 turns per hour of the final volume of wort being boiled.

Evaporation rates are easily controllable in the range of 3-12%/hr. Hop utilization with pelletize hops at 8%/hr evaporation is typically 38%. There is a vapor condenser on the steam vent of the kettle to create negative pressure in the vessel, this allows us to achieve evaporation rates up to 12%.

Cold water from the cold liquor tank is used to condense the steam vapor and the resulting hot water is captured in the hot liquor tank.

The use of a steam jacketed, external calandria provides flexibility with volumes of wort, and this system can accommodate brew lengths from 1 to 4 hl.
**Whirlpool**

The whirlpool is designed to separate solid material (hops, denatured proteins...) from the wort using centrifugal force thus, helping to clarify the wort.

There is a large, tube and shell, heat exchanger located between the kettle and whirlpool that can be utilized to lower cast-out wort temperatures to as low as 70°C.

Usable capacity of the whirlpool is 5.5 hl with a wort ratio diameter:height of 3.1:1 @2.5hl. Hop pellet charge in the whirlpool can be as high as 400g/hl.

**Turbo Air Craft**

Oxygenation of the cooled wort is carried out with the Turbo Air Craft using sterile, oil-less, house air.

**Wort Heat Exchanger**

A two-stage heat exchanger is employed to cool hot wort from the whirlpool on the way to the fermenter tank farm.

The first stage uses cold water as the cooling medium from the cold liquor tank. The second stage uses cold glycol to trim the temperature precisely to a set temperature.

Hot water exiting the heat exchanger is returned to the hot liquor tank.

**Hop X-Tract**

Pressure rated hop-back that can be used for whole or pelletized hops (2.5 and 5kg respectively) in virtually any location on the hot side or in the cellar as a “torpedo”.

The screen can be removed so the vessel can be charged with hops, oxygen removed, and hops dosed into a fermenter.
**Water House**

Hot and cold liquor (carbon filtered water) is housed in these 10 hl tanks. The hot water is automatically held at 80-85°C by way of an internal steam coil.

The cold liquor tank is has glycol circulating through its jacket to maintain a temperature of 3-5°C. Cold water is used for the first stage of the heat exchanger reducing peak demand on the glycol cooling system.

**CIP Plant**

Oxygenation of the cooled wort is carried out with the Turbo The CIP (Clean In Place) plant is inter-connected to the brewery and fermenter tank farm by a system of hard pipping and soft piping (DIN40 brewery hose) utilizing a CIP return pump.

The brewery is set up for automated, operator free CIP of the brewery every 8-10 brews. Useable volume of the CIP tank is 1.8hl.

**Cellar - Fermenter Tank Farm**

The cellar consists of twenty, 2.5hl fermentation tanks. Each tank has precise temperature control utilizing two glycol jacketed zones and controlled via the brewery automation system.

The tanks are equipped with 2” bottom valves to ease blowing out of dry-hop material and yeast harvesting, 4” top ports for dry-hopping, adjustable racking arms, sample ports, pressure gauge, auxiliary port for carbonation stone, and a blow-off/CIP arm.

Two tanks are equipped with variable speed mixers and there are five spunding devices available for use on traditional lager beers that require controlled over-pressure of carbon dioxide during fermentation/cellaring.
The hammer mill reduces hop cones to a fine powder.

The drive motor is equipped with a variable frequency drive to control the tip-speed of the knives thus allowing a range of particle size of the hop powder.

The unit is equipped with an air handling system to remove any fine dust or particles during the process.

The pellet mill produces 6mm (0.25”) diameter pellets, it is equipped with a liquid nitrogen doser to control the temperature of the pellets as they are pushed through the die.

This system produces hop pellets of the finest quality from small samples of hops.