Use of Condensers versus Venting Steam into the Atmosphere

Use of Steam Condensers more common in very large-scale breweries. In these cases, the hot water that comes off the condenser is used for other purposes or brewing, and is routed automatically through process piping.

In Brew Pub breweries, steam from the kettle is predominately routed out of the building and vented to the atmosphere. This is the best method. There are scenarios where venting to the outside is not possible. Such reasons may include brewing in a basement with concrete ceilings, tenant restrictions preventing any penetrations out a wall, ceiling or roof, or the proximity of your building to neighborhoods that restrict businesses from emitting odors from their production process. The best method in small scale brewing is to vent steam is to the outside of the building, but when you can't you are going to require a Steam Condenser. Condensers are designed to convert steam back into water.

Condensers are typically made and installed on the kettle in components that are easily removed. This is important, as the kettle may be vented to the atmosphere should restrictions to do so change in the future. Perhaps the system is sold or relocated to where the more ideal method of steam venting can be achieved.

Common Issues/Concerns for Steam Condensers for Small Scale Breweries

Evaporation Rate Reduction

Some suggest the use of a steam condenser produce less desirable evaporation rates. From what we have discovered however, is that if the condenser is properly engineered, the equipment should achieve the expected evaporation rate as compared with venting your steam to the atmosphere.

When venting to the outside atmosphere, usually there are no issues with proper draw up the venting, so as long as the diameter of the steam vent is the correct size for the volume of the kettle, then a good evaporation rate is easily achieved (approximately 7%). In the condenser chamber, a large volume reduction occurs in the condensation of the steam vapor to water, which creates a small vacuum pulling (draw) more steam from the kettle. The now heated water and condensed steam flow out the bottom of the mixing chamber as (very) hot water.

Boil-Overs

Ideally need 40-50% headspace in the Kettle to mitigate boil-overs when using a steam condenser. All Forgeworks Kettles are designed with 40% heat space and are equipped with a 2" Port on the dome lid for the installation of a Foam Sensor, which triggers a heat cut off should there be a boil-over.

It is still recommended that the manway is cracked open during kettle operation. If the manway is closed, it will not create pressure in the kettle, but may contribute to a potential boil-over, and unless the manway has a glass window, you are not able to fully observe the boil. Forgeworks Kettles are equipped with a solid stainless steel manway.

Condensation Dripping into Kettle (not enough negative pressure)

Forgeworks Kettles are equipped with Condensation Rings, which capture condensation flowing down the venting wall at or before the first elbow in the venting. While this helps with the typical behavior in a steam vent of some amount of condensation following back down the vent wall, the real concern here with the use of a condenser is having the system create enough consistent draw of steam over to the down tube where the venting meets the condenser mechanism. If designed properly for the "steam load" and vent opening diameter, there will be enough draw to alleviate and excessive steam build up at the top of the first elbow out of the kettle. If the appropriate draw is not achieved, the concern is that there will be excessive condensation build up at the top of the first elbow, presenting the potential of DMS dripping directly back down in your kettle, instead of along the venting wall (which is captured by the condensation ring.

Water Waste

Tap water is utilized as the cooling agent in both styles of available condensers for brew kettles. With a simple "Sprayer" style condenser, the tap water which becomes heated, combines with the condensed steam (now water) and is either routed to a drain, or recaptured for other uses (other than brewing). Typically this hot water is routed to a drain as it contains DMS from the kettle, and is not suitable for brewing, and may not be considered suitable for cleaning (but landscaping usage is an option). With a "Shell and Tube" Style, the heated tap water is routed separate from the condensed steam, thus the recaptured tap water can be used for brewing and cleaning. A Shell and Tube Condenser saves water waste over the "Spray" type condenser.

Types Condensers Explained (aka Heat Exchangers):

Sprayer Style: Less expensive to fabricate, usually not engineered to exact specifications for optimal performance.

How it works: Large diameter open tubing(usually 6") with built-in downward facing spray nozzles. A lot of water is required, and is routed to the spray nozzles via a hose and hose bib).. In this single tube, the steam from the kettle and the cool tap water are combined. The hot water generated is typically routed to the floor which slopes to a drain, or to the drain via an attached hose. This very hot water cannot recaptured and used for brewing because of the presence of DMS from the kettle steam, but can be recaptured for other purposes, such as general cleaning or gray water for landscaping.

Shell & Tube style: These are engineered very precisely to a certain specification having to do with the steam vent diameter on your kettle's dome, the typical volume of wort in the kettle, and the steam load generated by the kettle. These style of condensers are much more expensive than the Sprayer style, but offer two major advantages. 1) they are calibrated such that they draw steam very well, thus reducing or eliminating condensation dripping from the middle of the first elbow leaving the kettle. Because of this, DMS does not drip back into your kettle. 2) You can use the hot water that exits the condenser for brewing as there is no DMS present, eliminating water waste.

How it works: A large diameter tube which houses internally, a center tube which routes the steam. This internal tube is surrounded by smaller tubes which circulate cold tap water under pressure, cooling the inner tube housing the steam. All tubes exit the large main tube, but the condensed steam exits separately from the now heated tap water. The heated tap water recaptured for other uses, including brewing. The condensed steam, now hot water that came off the kettle is routed to a drain, or can be used for cleaning (potentially) or landscaping but not brewing (presence of DMS)

If the hot water produced from the condensed steam produced with either style condenser is not recaptured into a holding tank, the two scenarios below may come into play:

Humidity Levels & Ambient Temperature on the Brew Floor

Increased humidity & indoor ambient temperature from hot water being routed to a drain.

Safety

Very hot water exits the condenser, so a safety issue is presented from hot water being routed to the floor or drain.