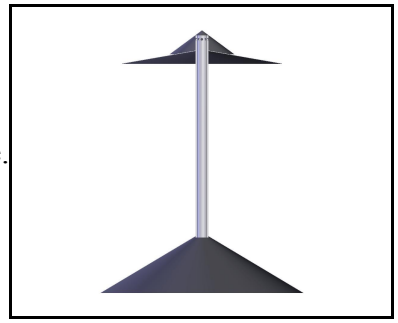
Krash Brewery Technology

Calandria for Home Brewers

Here is a Krash Brewery innovation to help the Home Brewer to prevent boil overs. It is technically termed a thermosiphon calandria. The thermosiphon portion creates the circulation from convection and gas expansion from steam bubbles; it acts like a pump. "Calandria" is a fancy name for an evaporator. We usually just call it the TopHat or ChinaHat around here. We built this small one for a 10 gallon Polar style kettle Home Brewers often use,but we designed the original one for our Krash custom 1.5 Bbl pilot system. There are videos in the home brew section at the Krash web site of both in operation. PDF's for the sheet metal pieces are also linked there. The up-tube needs to be welded to the bottom concentrator cone for a good seal, but only rivots and screws are needed for the rest. We can offer this as a kit or a completed unit; email us if you are interested.

How it works

When heating wort to a boil, the hot liquid rises and the cooler liquid will move to the bottom by suction action---simply convection. The water is also under a slight amount of pressure at the bottom of the kettle slightly raising the boil point and keeping water vapor (the steam) from forming. The deeper the liquid is the more this effect. The purely liquid convection is a small current. The normal circulation in boiling wort is mostly the result of the steam bubble forming and rising to the surface and carrying along liquid wort with it. The whole process seems random when the boil starts, the process can cascade quickly similar to a shaken beer bottle being opened.



The "TopHat" controls this whole ordeal by providing a controlled path for the heated wort and expanding gas to travel. The bottom cone, the concentrator, focuses the rising hot wort and gas bubbles into the up-tube. The top of the up-tube has 8 holes to disperse the wort outwardly. The top cone, the spreader, keeps the wort streams from splashing and directs the wort down onto the middle cone, the spreader. The hot wort sheets across the spreader and finally drops back into the kettle. The spreader cone also provides a large surface area for evaporation and dispersal of the volatiles that the brewing process tries to rid the wort of: mostly DMS. This evaporation is much more efficient than simple boiling and one will find a lower flame required for the boil process and that evaporation rates are much higher as well.

This can also be thought of as a nano "Merlin" system. We at Krash will let the Home Brewer Google around to find out what a "Merlin" is. If you absolutely give up, here is a hint:

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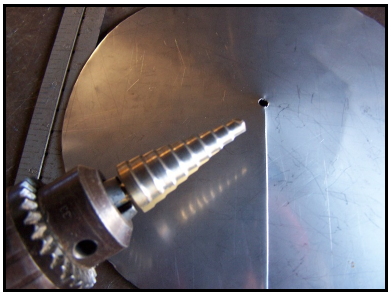
Construction

The Home Brew version is constructed of 26 gauge 304 stainless for the cones. The uptube is 304 stainless 0.675” diameter with a 0.065” wall. Smaller tubing can be used but weighting of the bottom cone may be required: heavier is better. Check with local metals suppliers or www.onlinemetals.com is a good source, though not the cheapest. Www.mcmaster.com also carries some metals but is very expensive.



The bottom concentrator and middle evaporator cones are fabricated similarly. Draw the cone patterns on the sheet metal with a compass. Center punching the cones center will help keep the compass from wandering. Also a nail can be sharpened to replace the graphite lead as a scribe. At Krash we use worn out TIG electrodes for this. After scribing the circle, scribe the radial lines defining the “pie” slice then drill a 0.250” hole at the circle center that has already been center punched. The cones do not need to have the excess metal removed, leave the pie slice, just cut one radial then lap the cut edge to the uncut scribe line. Clamp together with vice-grips, drill, then rivot with a 1/8” stainless steel rivet about 1/2” from the outer edge. To help form the cone, place the center hole at the corner of a workbench. Keeping the center at the corner, gently and slightly bend the metal across the edge. Rotate the circle a few degrees and repeat. Keep going around until the cone is in the desired shape. Once riveted the center hole needs to be drill for the uptube size of 5/8” or the size used. Use a step drill as shown in the picture. Since it has a single non-spiraled flute, it will grab and tear the thin sheet metal much less. It will also deburr the top side from the shape of the drill. Harbor freight has great prices on these of less than $10 for a set. Home Depot will charge about $25 for a single bit. The bottom cone needs to be welded to the up-tube to get a good seal of the steam bubbles can get around the up-tube and not work as well. I haven't found a way around this for the home brewer so make friends with a welder. Fortunately we weld constantly around here since we are fabricating everything. Spot welding is another option. After drilling check for a good fit....and the correct hole size. Be careful not to go past the desired hole size with the step drill; this is easy to do. The evaporator cone can be seen at left for a fit check with the up-tube.

The top spreader cone is made as the other two cones but do not drill the center hole. Warping method and riveting is the same as previously described.

The down tube is about 10” long but the whole apparatus needs to be set so that the outer edge of the evaporator is about 1” above the wort level of a maximum batch size. Drill 8 1/8” or 3/16” holes 45 degrees apart. Really only 4 need to be drilled all the way through both sides of the tube. Getting them even will be a challenge but will be aesthetical only. Deburr everything and round the corners of all the sheet metal to help prevent blood in the wort later...and wear gloves when working with sheet metal. The top of an up-tube with the dispersion holes can be seen at left.

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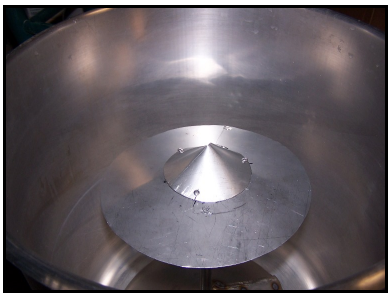

The top spreader cones needs to be joined to the middle evaporator cone. For this project we used 3 4-40 1" long stainless steel (of course) screws with corresponding nylock nuts. It could be welded but most home brewers don't have a TIG or a TIG that can weld 26 gauge sheet metal (pulser option). The screws will also allow for disassembly in case a good cleaning is in order. A friend could be useful at this point unless you have 3 arms already. First slide the middle cone onto the up-tube to about the midway point. Then place and hold the top cone onto the up-tube and adjust it so it is level or even with the up-tube. Now use your third arm to slide the middle cone up until it touches the top cone. Use your fourth arm to make alignment marks at 90 or 120 degree intervals and also mark the outside of the top cone onto the middle cone. Now take it all apart again and drill the holes into the top cone about 3/8" up from the edge. Drill perpendicular to the metal, but when the drill penetrates, move the drill parallel to the cone axis to gently ream the hole so the screws will go in easier. The alignment marks can be seen in the top two pictures at left. Permanent ink is very hardy to the brew process we have discovered; alcohol removes it quickly. Now put the top cone back onto the middle cone which can just be on the workbench off the up-tube for this portion. Realign the two and find something to mark the hole location onto the middle cone. Drill these out, deburr, and assemble with the screws. Adjust the nuts so that there is about 1/8" gap between the top spreader cone and the middle evaporator cone. The gap is to allow a good flow and prevent back pressure into the up-tube. Clean and degrease everything so your wort doesn't taste funny. The upper stack will friction fit onto the lower-cone/up-tube assembly.

Operation

Place the new gadget into your kettle and start heating for a good boil. Around 190-->200F you may start to see some fluid or foam coming across the evaporator cone. It may take another 10 minutes before a "real" boil starts. We usual wait until we get some pulsating noise to call the start of the boil and add any bittering hops. Once this "full throttle" sound is achieved, slowly back off the heat until it just reduces a bit. Over time your preferred setting will be dialed in. During the boil process, a crud line will form on the side of the kettle that can be used to judge the evaporation rate. Watch this closely since the evaporation efficiency is much higher than with a plain rolling boil, you may miss you marks and end up with a double Pilsner...but that may not be a bad thing.

Be sure to clean the inside the of up-tube after brewing along with the outsides of course.

Happy Brewerying!!!

--KrashBrewery
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HOT