

## Pasteurizers - It's All About the Process

Like many beverages, beer is made following a strict process. The process repeatability in the brew house guarantees consistent quality. As it can have an effect on product flavor, the pasteurizer needs to provide the same consistent process to the product as the brew house.

The pasteurizer has four functions:

- Accomplish Pasteurization Process
- Accomplish Discharge Temperature
- Minimize Utilities & Maintenance Cost
- Be Consistent

The pasteurization process is intended to minimize bacteria and active yeast in beer. It is a balance between minimal flavor impact and extended shelf life which the process is meant to accomplish, however the consistency of treatment of all product is of equal importance. The tunnel pasteurizer is effective in its service by pasteurizing both product and package in their completed state.

Success in this area is often based on the accumulation of a specific number of "Pasteurization Units". A pasteurizer can accomplish the required PU's, but yet not remove the living elements in the product to create the shelf life stability and process consistency.

Achieving lethal temperature is only the first step since many microorganisms require a continuous exposure to certain temperatures for some time before they die. Achieving lethal PU's is what guarantees the extended shelf life, and there are no compromises in this regard.

Generally pasteurization units can be counted above 25°C, however these temperatures are not necessarily high enough to accomplish the process. Conversely, if the same PU count is accomplished applying inconsistent high temperatures, inconsistent flavor effects can result in the brewery production.

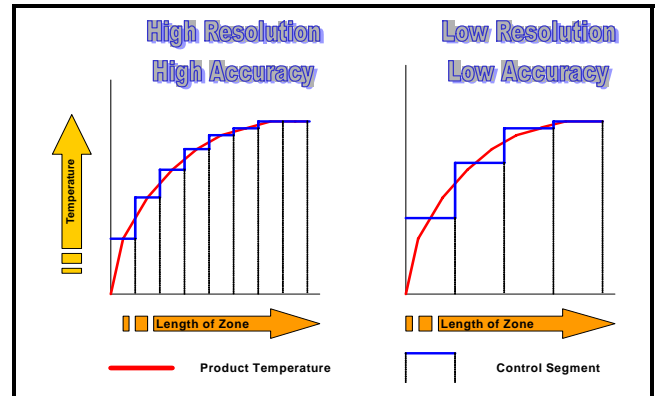
Therefore, a pasteurizer which consistently achieves the same lethal or non lethal PU count *is not necessarily repeating the same thermal process.*

A PU range should be consistent *because the machine has executed the same time-temperature curve consistently* – irrelevant of packaging line conditions. The PU count is the end, but not the means. Product in the machine should not be treated differently in the event of a line gap or

stoppage. The process should be identical if we expect shelf life and flavor to be the same across all production.

Some pasteurizers use temperature manipulations as the control variable to make the statement that a machine has maintained a consistent PU count. An obvious byproduct of this control scheme is that the time-temperature curve cannot be consistent during a stoppage, and it cannot be said that all the production has been treated equally. Repeatability in the time temperature-curve is the most important metric in pasteurization. If this is done, a consistent PU count will be produced automatically.

**Figure 1**



The key factor in achieving accuracy (a tight PU range) is accomplished by the size of the temperature controlled zone. The greater the number of "physical" thermal zones, the higher the control, and the better the accuracy. The reality of this can be viewed above in Figure 1.

The curve in figure 1 is not a time-temperature or PU curve but has been selected and is referred to as "temperature" to demonstrate the effect of physical thermal zones. The machine on the right attempts to model the curve with four physical thermal zones, while the machine on the left models it with eight physical thermal zones. Properly controlled, the machine on the left will have more accuracy than the machine on the right.

In order to be a true thermal zone, a zone's temperature must be able to be positively known and positively controlled. The control of the process can only be done over the thermal zones within the mechanical limits of the machine.

Figure 2



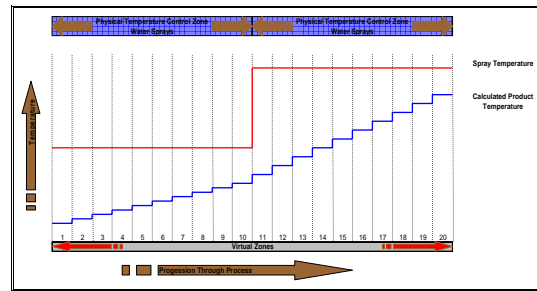
After all, the goal is to consistently execute a time-temperature curve across the entire production; consistency matters in the pasteurizer as in the brew house. As shown in figure 1, accomplishing this consistent accuracy calls for more physical *thermal zones*. *The more physical thermal zones, the more closely the time temperature curve can be modeled.*

Figure 2 demonstrates a physical thermal zone on the machine. We can see by the piping that this zones temperature must be one, and all product in the zone will receive the same treatment at any given time. During a stoppage the product at the end of this zone has been exposed to heat for several minutes, while the product at the entrance of the zone has been exposed for several seconds. In a stop condition, all product in this physical thermal zone will be treated the same. The machine cannot stop treating the product at the end of the physical thermal zone, until the product at the beginning of that zone has been fully treated. During a stoppage the product at the end of a physical thermal zone will be treated more than the product at the beginning of that zone. As the zone becomes smaller, there is less over-treatment at the end of the zone, and less under-treatment at the beginning of the zone. Thus, the smaller the physical thermal zones on the machine are made in design and fabrication, the better the machines performance will be in operation. The engineering ideal would be to divide the machine into an infinite number of temperature controlled zones, which is not commercially feasible.

Figure 3 demonstrates two physical thermal zones which - using the machines PC/PLC - are broken into 10 “virtual” zones for reporting purposes. While “Virtual zones” produce higher level reporting, they cannot increase the machines ability beyond the limits of the thermal zones.

Achieving consistency in the process is a matter of ensuring that regardless of the line conditions, the same *thermal process* is maintained in all conditions. Only in this way can we consistently accomplish the process with out endangering flavor.

Figure 3



An ideal machine accomplishes the process as outlined above. The ideal machine works on simple concept – if the product cannot be moved to the process, the process is stepped through the machine to the product. In this way the machine ensures that under all line conditions it’s able to consistently deliver a time-temperature process specific to each package irrelevant of conditions on the packaging line. The machine would not only maintain a PU range, but would achieve it by maintaining the consistency of the process. This is the “brewers approach”.

Many modern machines have graphic interfaces which attempt to depict the pasteurization process including the PU accuracy. Data produced on the machine display is calculated based on the temperature of the spray and anticipated properties of the container and product. While useful and generally accurate, the only true method of confirmation of the pasteurization process is the traveling recorder. The QC regimen for testing should include actual traveler data taken during stoppages and / or multiple stops on the packaging line. The machine should not be allowed to “regulate” itself. Clogged water delivery systems or numerous other factors can effect the process which temperature sensors will not be able see. A “PU control” system is built to maintain the machines process during a stoppage, and the best method of comparing performance of PU control systems is to judge them based on their ability to keep time-temperature curves and PU counts during stoppage or multiple stoppage conditions using actual travelers.

Stoppages and gaps produce imbalanced conditions in the machine. Systems should be incorporated to allow the PU control system to execute a time-temperature curve while *negating* utility impacts typically produced during a stoppage.

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