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The Emhart Glass Cycle Optimizer Software Package

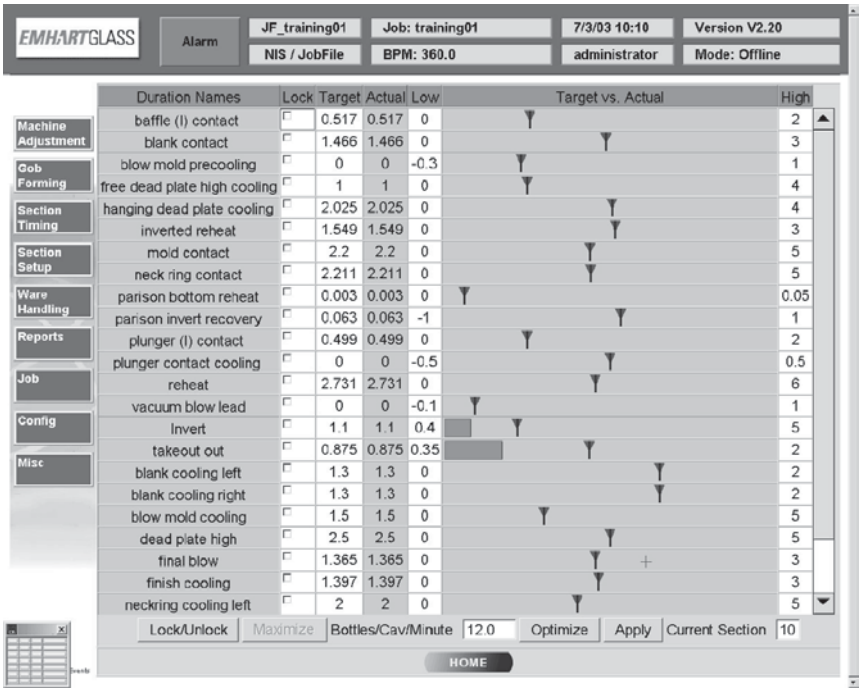
The Emhart Glass NIS total servo machine opened the door for the introduction of new software products that can run only on a full-servo machine. Emhart Glass has developed the first of these products - the Cycle Optimizer. The user of this new program has the ability to set thermal process durations and cycle times, and to automatically develop a job that is free of mechanism collisions. The purpose of this article is to give the reader some background on the appearance and functionality of the Cycle Optimizer software program.

Product Description

The Cycle Optimizer software package provides a screen that is integrated with all of the other NIS Universal Console screens. Figure 1 displays a representation of the cycle optimizer screen as it appears on the Universal Console. The information shown on the screen varies slightly from standard event names and mechanism timing bar graphs. For the first time, the forming process can be modified by what Emhart Glass has chosen to designate as "thermal forming process durations". The *Duration Names* are found in the left column in the interface screen. If an operator judges that a certain duration time should *not* be modified during the optimization process, simply checking the box in the *Lock* column next to the specific duration will assure that it remains the same. Durations are automatically calculated by the optimizer program, and are based on the machine timing and the target machine speed (in bottles per cavity per minute). To modify a duration, an operator next selects a *Target* time length. This can be different than the *Actual* time length. It should be noted that before optimization, the target and actual time lengths are exactly the same. For the optimization to be properly bounded, operators must define *High* and *Low* limits for the duration times. The *Target vs. Actual* column gives the user a graphical representation of changes during the optimization process.

Operation

The mechanics of operating the optimizer are very straightforward. When the optimization page is first entered, operators should run the program with the current data as displayed. This is accomplished by touching the "Optimize" hot button located at the bottom of the screen. From this point onward, values can be entered into the target data column. High and low limits also can be modified at this time, and any durations not being modified can be "locked" as desired. If the chosen target data falls between the high and the low limits and the system finds this setting to be unachievable, the optimizer will automatically choose the best compromise. For example, if mold contact time were increased to an undesirable duration given all other system constraints (including production speed), the Cycle Optimizer would

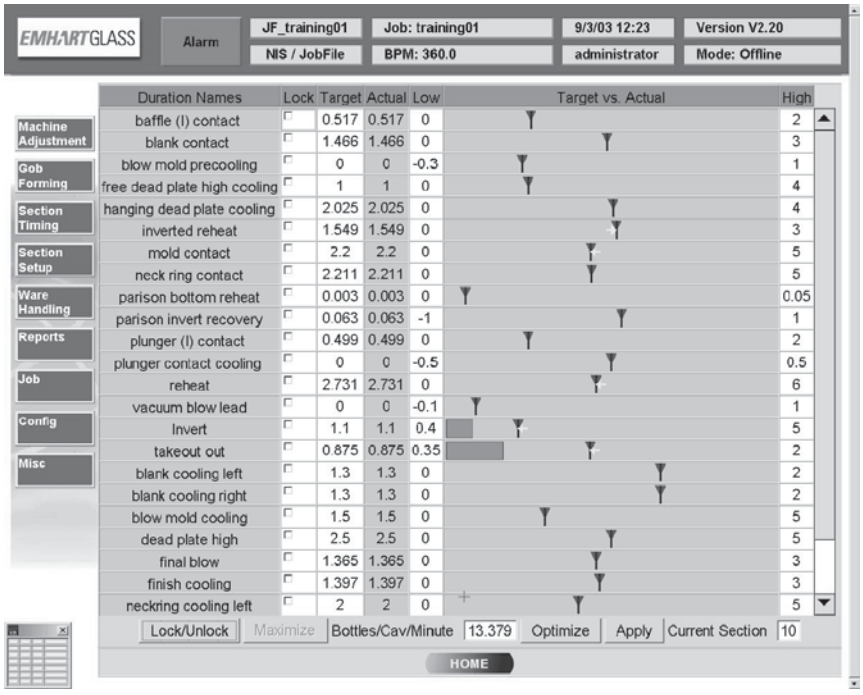


Cycle Optimizer Screen. Photo: Emhart

indicate the compromised value in the *Actual* column. If it is vital that this target be achieved, the operator should "lock" the value in after it has been entered. If optimization is chosen with the target locked, it will be achieved, but several other parameters will have been changed to support the target time. The Cycle Optimizer does not make judgements on the targets that have been chosen, it only makes calculations and moves the mechanism angles to support the desired changes.

To maximize the machine throughput, the "Optimize" hot button at the bottom of the screen must be touched. Next, the "Maximize" hot button must be pressed so that the *Bottles per Cavity per Minute* display will change to reflect the minimum cycle time possible for the current settings. At that time, some small yellow horizontal arrows will appear in the *Target vs. Actual* display indicating a direction to move each value to further improve the throughput (see Fig. 2). If the targets are moved in the direction indicated by the arrows, they can be "maximized" *again* to further improve throughput. In addition, the operator can also specify a production rate and optimize the settings to that rate. The program will do the necessary calculations and set the proper mechanism (on and off) angles to support the changes.

When satisfied with the optimized "durations" and corresponding mechanism on and off angles, the information may be sent to the subject section by touching the "Apply" hot button. Once the "Apply" button is pressed, a window display offers the operator the option to *Minimize Risk*. If "Yes" is chosen, the system minimizes the risk of a mechanism collision by spreading any extra time in the cycle over all mechanisms that could collide. If "No" is chosen, the movement timing is kept at the minimum. Once the minimize risk feature is complete, another window display queries the operator whether the system should *Minimize Wear* on the mechanisms. If "yes" is pressed, the system will slow down mechanism movements within the allowable time to reduce wear. If "No" is selected, there will be no alteration to mechanism speed. If all sections are stopped, a third window will appear giving the operator the choice of updating all sections. If "No" is chosen, only the current section will be updated.



Result of Maximizing Bottles. Photo: Emhart

Conclusion

The Emhart Glass Cycle Optimizer, in combination with the fully servo NIS Machine, opens a new chapter in forming technology. For over 70 years, operators have adjusted the process by changing mechanism angles - all the time knowing that controlling the thermal times (durations) was the key to making the best containers. With the NIS and Cycle Optimizer program, the thermal times can be adjusted directly and safely with minimal concern for causing mechanism collisions. Time from machine start to producing the best possible container is reduced drastically since the old iterative method of "change and try" has been mathematically eliminated.

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