

# Optimizing the Beverage Line

Replacing or overhauling an entire beverage line is seldom a viable solution. In most cases, the challenge is to optimize the existing line while addressing a number of factors such as time, money, space and dated equipment.

Such was the case when plant engineers at a premier beverage brand teamed up with Haskell to rebuild an existing line under a number of tight restrictions. The performance of the existing line had been severely compromised as a result of running it overtime to build inventory for the holiday season. Facing a very limited shutdown schedule, the team had to reconfigure a new line that would increase capacity by 30% and significantly ramp up Overall Equipment Effectiveness (OEE).

## Working Through Obstacles

The company had already invested in a multi-million dollar mono block filler that could increase the line's throughput capacity. The filler was a proven, high-performance piece of equipment, but it had to integrate with much older equipment on the line. Moreover, the filler took up an enormous amount of space, and workers in certain sections around the existing labeler were already working shoulder-to-shoulder.

The team explored more than a dozen out-of-the-box design options, including going up in the air with as much equipment as possible. They knew the right

answer was to build an accumulation system on the line, even though it was not in the project budget. Then there was the question of where to put the accumulation system on the line. Ultimately, they made the decision to test the accumulator in three different locations on the line, with an eye on optimizing value in design and installation.

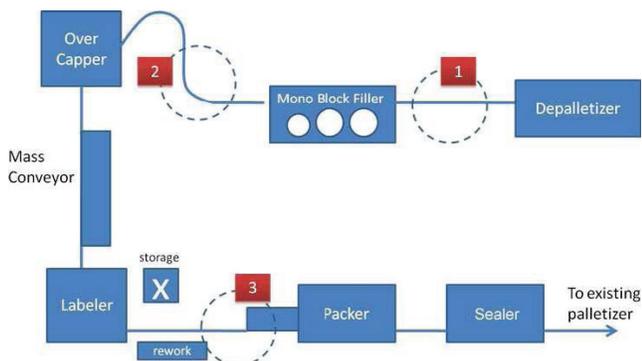
### Goals and Challenges

- ▶ Increase Bottles Per Minute (BPM) by 30%
- ▶ Raise the Overall Equipment Effectiveness (OEE) by 18%
- ▶ Raise the Overall Equipment Effectiveness (OEE) by 18%
- ▶ Rebuild the line in severely cramped quarters
- ▶ Make line improvements during a tight shutdown period

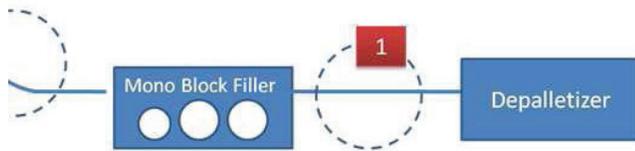
## The Power of Modeling

The team tested potential locations of the accumulation system using emulation, a model that allows testing to be conducted in a simulated environment prior to start-up. It works by interacting with the PLC program that controls the line. The PLC reads input from the model and directs the outputs to cause actions in the model, according to the logic. This interaction allows the engineers – as well as the entire team – to verify the logic and confirm the line will operate as intended.

Engineers also connected the HMI to the PLC to verify all the operator controls, alarms and enunciators. Prior to start-up, the entire team participated in a control system Factory Acceptance Test (FAT) in the Haskell office. The logic was completely verified, along with the interface for the operators and the code for including the additional accumulation. As a result, the team was able to effectively test the accumulation system in each of the three proposed locations on the line.



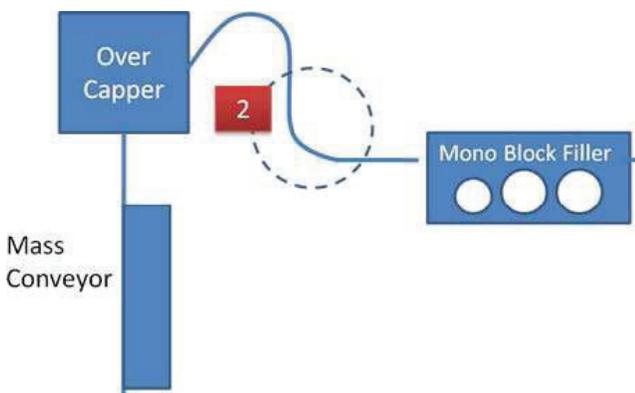
### Location 1: Accumulation Before Filler



The team knew they needed to protect the filler, but from what? Adding accumulation pre- or post-filler was the first consideration to be addressed.

The team found the speed of the depalletizer was enough to make up for any hiccups an accumulation system may have caused to the line; however, they determined that adding pre-filler accumulation would not help to optimize the line.

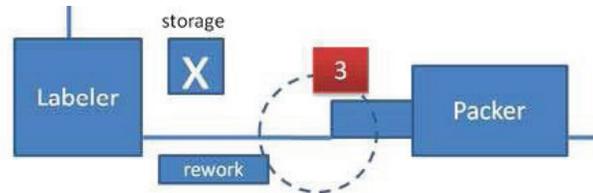
### Location 2: Accumulation Between Filler & Capper



The team found that post-filler accumulation would provide the most benefit, given the tight floor space. Although adding accumulation between the filler and the over capper was not their preferred option, it proved to be the right answer.

Adding an accumulation system in this location allowed the mono block filler to empty out if a stoppage occurred downstream (a quality requirement). It also buffered the filler from over capper downtime events as well. Adding

### Location 3: Accumulation Between Labeler & Packer



accumulation after the labeler was beneficial from a statistical point of view. But the need for full operator access around the machine, necessary storage for materials, and a rework area all added to the congestion. The team believed while accumulation would help buffer the outages between the packer and the labeler, the congestion would increase the time the labeler was down because it would be even more difficult to work in that area.

### Final Decision, Final Testing

The team ultimately placed a 500-bottle accumulator between the filler and the over capper. This decision resulted in a beverage line that could achieve OEE targets while meeting quality requirements. In addition, it helped to simplify the line automation programming, alleviating the need for complicated algorithms that had to account for each and every circumstance.

After identifying this location, the engineers decided to model each of the three options as an added precaution. They created a simple flowchart simulation for four-line configuration. The only change between the configurations was the location of 500 bottles worth of accumulation.

HASKELL		No accum.	Pre-filler	Post-filler	Post-labeler	
Actual Production:		162,126	168,176	167,772	163,020	
Theoretical Production:		172,800	172,800	172,800	172,800	
Availability:		93.8%	94.4%	97.1%	94.3%	
Options Selected	Machine Availability	Failures Per Shift	Bottles of Accumulation	Bottles of Accumulation	Bottles of Accumulation	Bottles of Accumulation
(#)	(%)	(#)	(# bottles)	(# bottles)	(# bottles)	(# bottles)
1	Depal	96.00%	4.8			
2	Empty Bottle Conv	99.60%		500	1,000	500
3	Rinser/Filler/Capper	98.00%	7.2			
4	Full Bottle Conv/Acc	99.60%		250	250	750
5	Overcapper	93.00%	33.6			
6	Full Bottle Conv/Acc	99.60%		400	400	400
7	Labeler	92.00%	38.4			
8	Full Bottle Conv/Acc	99.60%		200	200	200
9	Case Packer	99.00%	1.4	6	6	6
Sim. Time:			2 min.	2 min.	2 min.	2 min.

Results were dramatic: the availability for the line increased by 3.3 points, more than 2.5 points better for accumulation located between the filler and the over capper than the other two line locations.

## The Impact on Start-Up

Emulation was key in enabling the team to make the right decision and to accelerate start-up on the line. Through this technology, they were able to validate controls and test outputs on the line to determine the best location for the accumulation system – all prior to start-up, with no loss in actual production time.

The ability to test the line in this manner greatly diminished the challenge of a short shutdown schedule, which alleviated stress on a number of levels. In fact, the plant surpassed its OEE targets within four weeks of starting the line, a full six weeks ahead of schedule. The line also set new production records, so much so that the line had to be stopped in order for new materials to arrive.

In the end, the team surpassed every one of its goals, converting a compromised beverage line into a highly profitable manufacturing system.

