MAAC
THERMOFORMING MACHINERY

The Thermoformers Resource

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Top 10 Tips to Becoming More Efficient in Sheet Fed Thermoforming

— by Michael P. Alongi —

As today's heavy gauge thermoforming market is growing and becoming more competitive, companies are looking for better ways to gain efficiencies. A large portion of a company's success comes from the efficiencies they have or the efficiencies they create.

Through years of working with thermoformers, we often work with companies that we can help gain major efficiencies. Although engineering firms, suppliers and consultants are not necessarily needed to implement improvements, they all have the continual opportunity to work with thousands of thermoformers and thousands of different applications. From a general viewpoint, here are 10 tips to be more efficient, or areas where improvements can be implemented. With the proper knowledge, companies should assess their strengths and weaknesses and begin preparing for future plans to address their major inefficiencies.

1 Outdated Equipment

As thermoforming is not a new process, thermoforming equipment has been around for over 50 years. This does not mean you should keep your machines for 50 years! Begin putting together long-term plans to replace or upgrade them. Old inefficient machines are the single largest item that restricts manufacturers' ability to run at their most efficient. Older machines also tend to have limited capabilities and offer no real competitive advantage. The term, "it paid for itself already" does not make you efficient.

A large portion of a company's success comes from the equipment they utilize. If you never investigate the latest technology or do not have plans to invest in the latest technology, this may be the single largest mistake you can make. With all of the technological advancements available in today's new machinery, older machines cannot be compared and certainly cannot compete in terms of performance, cycle time, material distribution, energy use, repeatability, change-over time, flexibility and even maintenance.

2 Tooling/Molds

One of the most limiting factors leading to running efficient stems from poor mold designs and, even worse, the type of material chosen to construct the mold. Regardless of your machinery being new or old, a bad mold will dictate your ability to be efficient.

Although the volume of products produced or the design of the finished product may dictate what can be used, too many formers start with looking for the least expensive way to get a mold and start producing products the fastest. A badly designed mold or molds that are not water cooled aluminum will allow competitors to redesign and improve cycle times lowering overall manufacturing costs. Patching up poorly designed molds may help, but will only allow you to

run your product at what the mold design allows for. Too often formers are running high volume jobs, in some cases several shifts, with multiple non-water cooled molds; when one good aluminum water cooled mold can be utilized to produce parts up to three times faster. Production cycle times should never be based upon how long it takes your mold to cool off between shots unless the volume is very low or you are prototyping.

Cycle Times

As there are many ways to improve cycle times, we far too often see products running too slow. Thermoformers need to take the time to improve, determine the bottle neck and implement a way to correct it. If the problem is heating times, make plans to improve your ovens or spend more time setting them up and tweaking them. If the issue is forming and cooling times, look to replace tooling with better molds or investigate alternative cooling options. If secondary operations are much more time consuming, look for more options and capabilities to speed up the process or be open to jobbing the work out to someone who may be more efficient in that portion of the process.

Sheet Size

Use smaller sheets: far too many thermoformers are using too much material. Look for ways to reduce your material costs and implement a new standard. Look at your clamp frames; are you clamping more than 1/2"? Do not try to get 50 years out of a piece of clamp frame, you will easily spend the money in material costs in the long run due to sheets pulling out, oversizing the sheet and increased scrap rates. Replace damaged or bent frames: utilize frames that require less than 1 inch in the clamp.

Work on utilizing thinner gauge sheets too. This can be achieved with more oven control, better oven designs and the use of different forming techniques. Material gauges can be greatly reduced and still meet your finished parts' minimum thickness requirements.

Ovens and Oven Controls

Older ovens need attention. Maintain them to get the most out of your machines. Costly retrofits are one option, but typically only help in one area of your machine. For 30% to 40% of a new machine cost, oven retrofits are typically seen as a short term solution to gain efficiencies.

Get more oven control, or at least some control. Machines with no "Zones" should not be used unless you have no competition and are a non-profit organization. The additional utility costs for operating the entire oven when smaller sheets are used is not efficient and costs too much with today's utility prices. You need oven zones to shut off areas that are not heating the sheet, zones also allow you to gain more control over the process to decrease heating times and even decrease starting sheet gauges. Having zones in your oven also eliminates the need to physically screen an oven or block heat transferring into the sheet. Physical screening is both time consuming and an inefficient use of energy.

Over Heating the Sheet

Stop overheating the sheet. Many thermoformers are overheating the sheet as they do not know what temperature the sheet is. The days of visually detecting sag or touching the sheet to measure temperature are gone. Photo eyes and infrared pyrometers are used for detecting sheet sag or sheet temperature. Some of these devices can be purchased for less than $100. If you overheat the sheet, forming and cooling times are extended, making cycle times much longer than necessary. Not to mention the additional wear and tear on your machine, your mold, the extra costs you pay for labor and the added utility cost used to overheat the material.

PLC's and Quick Set Ups

Updating machines from manual timers to PLC controls is a step forward but PLC's programmed by non-industry professionals will most likely limit the machines capabilities and only allow a slight increase in efficiencies. Again, this should be looked at as a short term fix. Thermoforming machine manufacturers who build these controllers can at least guarantee flexibility, full functioning and support.

Companies must fully investigate the control systems and all features that will benefit their operation. The latest controllers allow you to memorize all functions of the machine for each job you run. This means all the time it takes to manually program a machine is reduced to the touch of a button the second time the machine is set up. The possibility of damaging the machine or producing scrap is greatly reduced, and the ease of continually tweaking specific applications is simplified.

Cooling

The thermoforming process may begin with heating the sheet but acquiring the fastest cycle times is not solely based on how fast you can heat the sheet. In order to establish faster cycles with materials that have longer cooling characteristics (than heating characteristics), you must accommodate the cooling process.

Whether you need additional cooling fans, a directional blower, spray mist or even air conditioned cooling, there are numerous ways to incorporate these. Precise location and positioning of these cooling systems will also lead to faster cooling times. Automated in-machine post cooling may be needed for heavy gauge products in order to run the machine based on heating times rather than cooling times. Depending on part specifications and tolerances, post cooling can be the key to gaining more parts per hour.

Trimming

Too often thermoforming machine cycle times are extended to match the trimming process time. Again, companies who investigate in the newest methods of trimming and trimming speeds may find ways to speed up the parts trimmed per hour. With newer equipment with faster speeds, some applications can see a 300% increase in parts per hour. A little more time spent on tightening up the programming can now result in parts per hour increases as high as 500%.

Vacuum

Insufficient volume, recovery time and insufficient pressure are often the cause for deficient processing causing part variation and increasing scrap rates. Determine the amount of work to be done in cubic feet or cubic inches. Items needed

to calculate amount of work are: process (possible predraw box), sag, tool and tool cavity. Large tool cavities are backfilled with polyethylene balls to reduce the amount of cubic feet needed. Determining the flow in cubic feet per minute will result in the amount of time at a specific pressure (hg) to evacuate the needed cubic feet of work. Items needed to calculate are: tool port size, distance from tool port to vacuum valve, vacuum valve flow in cfm, starting pressure and tank volume. By adding pump starting pressure and cfm capacity, the recovery time may be calculated.

Although this is all easier said than done, companies who are in it for the long run will continually look for ways to improve and gain efficiencies. Whether you develop short or long term plans, or implement temporary fixes to help gain efficiencies, you must start preparing to stay ahead of the market.

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