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Cut Sheet Thermoforming

— by Michael P. Alongi —

As economic times change, competition increases, customers demand quicker deliveries, or end-users push for better products and pricing, thermoformers are being forced to step up to the next level. Our industry is changing rapidly, moving towards higher levels of sophistication. Whether you are a small or larger company, an OEM, a custom former or run your own proprietary products, there are several ways to reduce your downtime and start gaining efficiencies with all the new advancements and innovations in thermoforming machinery.

From quicker clampframe and mold changes to elaborate machine controls, thermoformers who are set up most effectively are proving to be the most profitable. Today's thermoformers need to set their goals much higher; reduce mold changeover to fewer than 15 minutes, reduce clampframe changeovers to fewer than 5 minutes (per station), and look to change all machine parameters in seconds!

Clampframe Changeover

Clampframe changeover has been one of the leading factors causing machine downtime. A routine clampframe

**Reduce your downtime;
increase your up-time –
with NEW TECHNOLOGY
and Quick Change Features!**

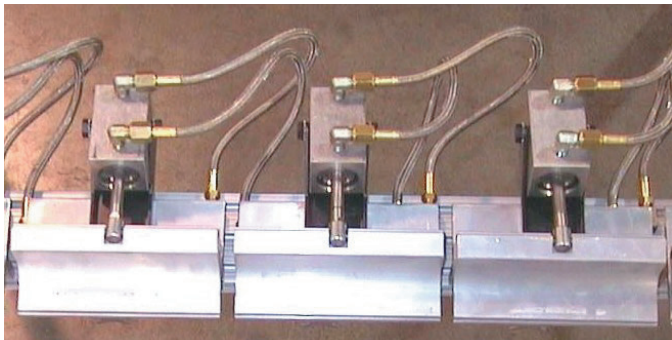
change can take up to 4 hours depending on how many stations a machine has. A clampframe change typically consists of replacing the short clampframe segments for every different sheet width. Not only do thermoformers have to buy all these different size short frames, they must store and

maintain them. One of the newest items available, Adjustable Clampframes, have been the single hottest items to hit the machinery market. You no longer need to store and replace different lengths of clampframe for the diverse sheet sizes required. Adjustable clampframes offer the ability to vary the length of the clampframes without having to add or remove clampframe sections from the machine and with no tools required. Not only can you change these frames in under 5 minutes, but you can also document the position of these clampframes and easily return them to the exact position the next time the product is run. This would also require a repeatable mold position. Adjustable clampframes are continually proving to save anywhere from 1 to 3 hours of downtime, (per mold changeover) depending on what type of machinery or how many stations the equipment has.

In addition to speeding up clampframe changeover time; look to reduce your sheet sizes. Some of the older or poorly designed clampframe systems require up to 2" of material to be clamped in their frames. This should be kept to a minimum of no more than a 1/2" of material per side.

Mold Changeover

Mold changeovers are another one of the leading factors causing machine downtime. Since most molds are unique, are built by different suppliers, or are moved from company to company, most thermoformers end up with a



large quantity of different mold bases and mold configurations. The key to quick mold change is to make all design factors on each mold common to each other, such as: utility location, mold base heights and general mold base construction. If this is not possible or cost-effective then consider using a stand alone – common mold base.

With uncommon mold bases, the use of steel plates with precisely spaced bolt patterns or aluminum plates with T-slots have been most popular. Molds are then secured using either a hold down fixture or simply by bolting the mold base to the platen. This may still be the most versatile system for some thermoformers.

With a stand alone – common mold base, thermoformers can utilize several mold bases or just two mold bases. The expense of changing all your mold bases may not be cost-effective, but the use of only two keeps your expenses minimal. This allows one mold (attached to the 1st mold base) to be run in production while another mold is being secured to the 2nd mold base outside the machine. This can even be taken a step further by having all of the utilities connected outside the machine.

The actual design of the mold base is unlimited but needs to be designed with maximum flexibility in mind. With a common mold base you can then look to automate the changeover process even further. You can use scales, locating pins, locating cones or back stops to consistently locate the mold base to the platen. You can use hand clamps or automatic clamps controlled through the machine to secure your base down to the platen.

Of course this is easier said than done, and other factors must be considered, but it usually is just a matter of discussing a few different approaches to determine what best fits your company. The technology is here and has been taken as far as fully automating mold changeovers. As a result with any of these systems you will start realizing more machine up-time.

Adjustable Lift Table Tops

On most high sheet line rotary machines and/or machines with lift tables, clients need to make different size boxes or use boards to assist holding and aligning sheet before it is loaded into the clampframe. Once these boxes and/or boards are not being used they must be stored away for future use. This has created the development of an adjustable lift tabletop which is custom built and mounted to the lift table. This allows quicker set-ups by avoiding the need to replace tabletops for every different sheet size. These tabletops feature four-way adjustments via clamping handle levers. No tools are required. This allows changing of the table top in seconds.

Machine Control Changeover

Machine controls should be looked at closely, as they are one of the most powerful components associated with quick changeover. Machines with simple controls are limited, and typically more time consuming which causes inefficiencies. Machines with elaborate controls are able to be set up much quicker, offering maximum flexibility and maximum efficiencies.



Computerized controls offer numerous benefits. Replacing relays and timers, manual buttons and switches with flat panel touch screen interfaces and innovative software allows thermoformers the ability to change every machine parameter within seconds. This eliminates the manual process of setting up different machine sequences, adjusting limit switches, opening and closing

valves, setting oven heat configurations and even reading job setup sheets. Below is a brief description of the many items now being fully controlled and automated through new technology and new control systems:

Limited or Basic Controls

Less process control, higher scrap rates, no reliability, no repeatability, longer setups.

Elaborate Controls

Most process control, less scrap, repeatability, quicker setups.

Preprogrammed Forming Techniques are absolutely necessary. Instead of having to physically program the entire sequence of the machine during the initial setup (which can take a great deal of time), your machine should have pre-programmed forming techniques. This means setup personnel can choose from a selection of different preprogrammed sequences, eliminating the need to program all functions of an entire machine sequence every time the job is run. Preprogrammed forming techniques cover over 90% of the thermoforming work today and only take seconds to set up. In addition, the newer control systems offer the ability to modify these preprogrammed forming techniques to create your own proprietary methods if a challenging application is introduced.

Platen positioning and motor speeds are now controlled through the control system. Gone are the time-consuming days of manually adjusting collars or limit switches. Today motor driven platens are typically equipped with encoders for fast setups, repeatable speeds and precise positioning. The encoders are then interfaced into the control system with real time graphic emulation of platen movement dis-



played on screen. The platen settings are then stored in the controller with each job for future recall. Although this has been available for quite some time, it is being taken further every year. Encoder driven platens no longer require homing or zeroing and the machine may be turned off without losing platen home position.

Vacuum and air valve positioning typically requires setup personnel to manually adjust vacuum and/or air ball valve settings. On more complex products these settings can be crucial to forming an acceptable part. Too much vacuum can cause improper material distribution on certain applications and not enough vacuum can cause the material to not fully form to the shape of the mold. New technology now offers computer controlled valves, which provide maximum consistency and repeatability with positioning increments from 0-99%. With computer controlled valves, all vacuum and air valve settings are entered into the control system and saved with each job for future recall. By saving and recalling valve positioning with every job, computerized valves eliminate the manual guess work of finding the correct vacuum and/or air valve openings, which in some cases can eliminate hours of fine tuning.

Automatic lance adjustments are also completely programmable through the control system. If pressure forming or twin sheet forming is your company's focus, adjusting the lances (or bayonets) adds on to your setup time. Typical pressure forming applications require setup personnel to manually adjust the bayonets when the mold lock-up heights change. This can be a lengthy process since setup personnel must physically measure and position anywhere from 4-12 lances (or bayonets) for each setup. There is also room for error when manually adjusting, as each bayonet's positioning should be exactly the same or damage can be caused to the machine and/or molds. Automatic lance adjustment was created to eliminate the manual process of setting up the lances, which on some machines can take up to 4 hours. New pressure forming machinery fitted with automatic lance (or bayonet) adjustment assure: repeatable, accurate and fast changeovers within seconds. The lock up height is automatically set by

finalizing both platen positions, simply activate and the lances will self adjust. The positioning is then stored and saved for each job for future recall.

In addition to faster changeovers, new technology is offering even more features to gain efficiencies. Between elaborate diagnostic systems and automatic lubrication systems, machinery manufacturers are continually looking to add to the thermoformer's bottom line. Diagnostic systems are eliminating lengthy trouble shooting procedures and automatic lubrication systems are reducing the maintenance required and increasing the life of the machinery.

As machines get smarter, faster and are equipped with these types of quick change features, thermoformers who lag behind in technology will find it much harder to compete and be successful. Many thermoformers are acquiring all of this technology in their new machinery. Some have even found they can meet their increased production requirements with these new technologies after getting rid of older machinery. Meaning, one new machine has replaced the need and production requirements of two older machines.

Clients who are investing in this machinery are gaining efficiencies; they are making better products faster, more repeatable, reducing scrap rates, reducing maintenance, reducing personnel and of course adding to their bottom line! In years to come those who do not start adapting new technology will no longer be competitive, as today's thermoformers are taking large steps to leap ahead in technology. Learn and investigate, start planning to eliminate all the old mind sets and inefficiencies. As labor rates increase and material rates increase, the market will continue changing. Ask yourself "How will I compete?"

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