Reduce Makeready Time with Kaizen

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It's difficult to have a discussion on Lean or continuous improvement without the Toyota Production System finding its way into the conversation. The Toyota engineers were architects of some of the most effective continuous improvement platforms of the twentieth century. Shigeo Shingo, one of the more notable Toyota engineers, is credited with developing the Single Minute Exchange of Die process, which is the methodology used in the following kaizen event.

The Single Minute Exchange of Die (SMED) process was developed initially for use on large steel stamping machines that stamp out hoods, doors, fenders, etc. The term "single minute" in this case doesn't mean one minute but rather single-digit minutes, less than ten minutes. When they began, the changeover time on these machines took anywhere from twelve hours to three days. The SMED process involves seven basic steps:

- Observe the current method.
- Separate internal from external activities. Internal activities can only be performed when the machine is stopped. External can be performed while the machine is in operation.
- Try to convert internal activities to external activities.
- Simplify internal activities.
- Simplify external activities. Coordinate with internal ones.
- Document improved procedure; establish as Standard Work.
- Do it again!

These principles, among others, have been used so extensively throughout Toyota since the 1970s that they are ingrained in the fabric of their culture. It's how they think and who they are. These same principles can be applied to reduce changeover time on any piece of equipment in your facility. A word of caution at this point though: without transforming our culture the following will be nothing more than a "drive-by" exercise. And the preliminary gains realized by these initial steps will eventually be lost to old habits and thinking. The following steps are a proven method of applying Shingo's SMED process to our printing facilities.

Cross-Functional Team. Assemble a team to observe and analyze the makeready. The team should be comprised of operators, helpers, at least one supervisor, and a couple of associates from outside the respective department for a fresh set of eyes. The size of the team should be reflective of the number of people performing the makeready. For example a two-person makeready might have a team of six to seven total where a makeready involving three people would have a team of eight to nine. Be certain to include your silent leaders on this team, by the end of this kaizen event we'll have established by consensus the Standard Work for all makereadies going forward. Once the team is assembled, have them agree upon a measurable goal. For example, if makereadies are averaging 1.5 hours, perhaps set a goal of 1.0 hours.

Observe the Current Makeready. We begin by videotaping each individual involved in the makeready. Makeready time is defined as the amount of time between the last good piece of a running job to the first good piece of the next running job. Use volunteers on the team to hold the video cameras, and capture everything! Select and stage a makeready that is indicative of your average makereadies.

Analyze the Makeready. The team will sit down and view each video separately to identify and document what specific tasks are being performed. Use a simple Excel template to capture this information. We time and list each task performed in seconds. We want to establish a "pit stop" mentality to makereadies. In a NASCAR race the difference between winning and losing is usually mere seconds lost in the pit. When we're through the analysis we'll total the amount of seconds the makeready took. During this analysis we'll also generate process maps (spaghetti diagrams). Have blank templates of the piece of equipment available for this. During the video analysis have a volunteer trace the movements of the operator to visualize the amount of movement taking place. We'll be doing another process map on the second makeready with amended procedures to compare the amount of movement involved. Shigeo Shingo observed that it's only the last turn of a bolt that tightens it; the rest is just movement.

Internal vs. External. As a team we'll then review each task to determine if it is internal (can only be completed while the machine is stopped) or external (can be done while the machine is running,either the previous job or the next job). Some examples of internal tasks would be plate changing, roller washing, blanket washing, etc. Some examples of external tasks would be paperwork, staging materials, and retrieving tools or supplies. During this review we'll brainstorm each task to see which internal tasks can be converted to external tasks. In our experience the biggest gains here are going to be in staging materials beforehand, having tools available at the point of use (use of toolboards), and having jobs reviewed and ready ahead of time, in essence doing as much premakeready as possible.

Coordinate Internal Tasks. As we review the internal tasks we should look at ways to simplify and streamline them. Coordinate the timing of these tasks so crew members aren't waiting for the machine to be free to complete a task. Look for ways to convert internal tasks to external tasks as well as to integrate internal with external.

Standard Work Procedures. Now that we've gone through the analysis of the makeready, identified and separated the internal from external tasks, and focused on premakeready work, we're ready to establish a new way to perform the makeready. Coordinate the movements between all involved to document a step-by-step procedure for performing the second makeready. This will be the foundation for the finished makeready Standard Work. If time allows we can perform some 5S or POUS (point-of-use-storage) activities between the two makereadies to help facilitate some of the needed improvements we observed during our analysis. Again, we should have a primary focus of premakeready. A major press manufacturer at GRAPH EXPO 2010 performed sixteen makereadies, four-color process over four-color process, and ran 500 good copies of each job in less than an hour—that's less than four minutes for each makeready and run. This was possible because everything was staged and choreographed. That's exactly what we're trying to do with our everyday work.

Second Makeready. The ideal situation would have us using the exact same makeready that we used the first time. We will repeat the same video, analysis, timing, and process mapping as the first time only using our revised Standard Work procedures. We will undoubtedly see some reduction in time and waste, but we'll likely see more opportunities for improvement as well. Calculate the improvement in time and material and capture the opportunities observed in the second makeready as well. At this point compare the spaghetti diagrams from the two makereadies; you'll undoubtedly see a significant reduction in wasted movement in the second makeready.

Action Item List. At the end of a kaizen event like this there is usually a fairly lengthy list of items that were discovered during the kaizen that need to be completed. These will range from machine repairs to toolboards to rearranging work tables and service areas. It's critical to capture all of these as we go along and compile a list of them as a working document. Be sure to assign individual responsibility and completion dates to each task.

In our experience the initial improvement in makeready times at the conclusion of this first kaizen will be somewhere between 35% to 65%, sometimes much greater than 65%, very rarely any less than 35%. But as we've alluded to, the real value is in the shift in thinking and the transformation of the culture. With Toyota, Shingo claims that, between 1975 and 1985, setup times had been reduced to 2.5% of the original time, a 40-times improvement. The real power in this process lies in the culture change.

To learn more from Jim Watson be sure to attend the Continuous Improvement Conference, April 10–13, in Kansas City, Missouri. For details visit www.printing.org/ciconference.

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