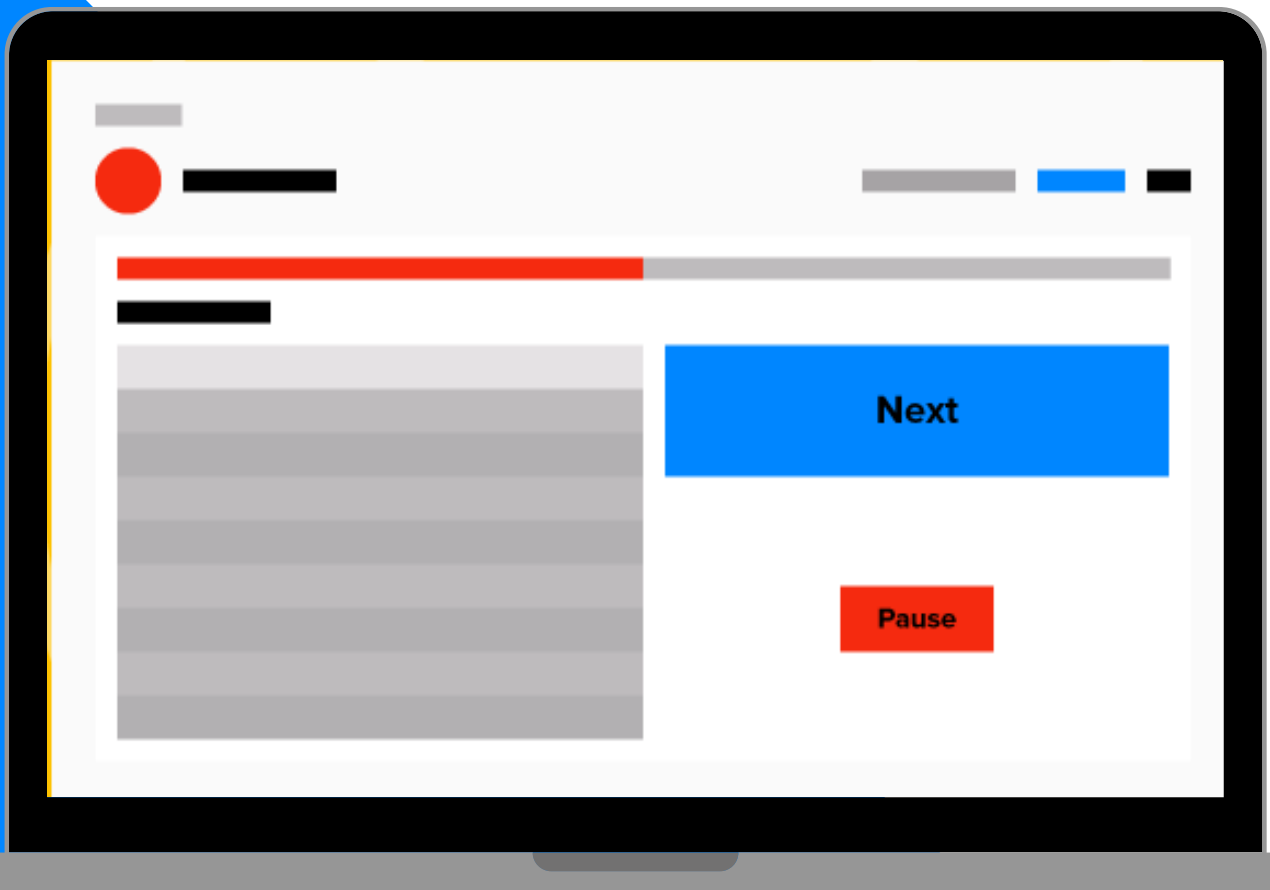




How to Conduct a SMED Event

To Reduce Changeover Time

Amper's 9-Step Guide for Manufacturers



SMED: A Proven Method of Boosting Productivity

To remain successful in today's economy, many manufacturers are looking for ways to:

- Run more lean
- Reduce waste
- Eliminate downtime
- Boost factory productivity

As a result, a growing number of manufacturers are employing elements of lean manufacturing, a philosophy Amper embraces.

One of the most powerful lean manufacturing tools available to manufacturers is the SMED event. In a nutshell, SMED events enable manufacturers to identify—and remove—the waste in their changeover processes. All manufacturers, regardless of size, can benefit from SMED. You don't need any special equipment to conduct a SMED event, although if you're using Amper's digital tools, you will enjoy several advantages. Is it worthwhile? Absolutely. Typically, SMED events reduce changeover times by 50%!

30-50%

Average reduction in changeover times after conducting a SMED event

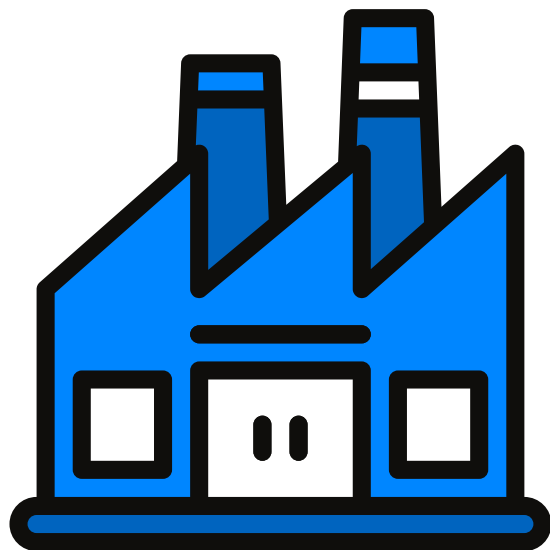
On the Factory Floor, Time is Money

***Fact:** your machines only make money for you when they are making parts. That's why reducing equipment downtime is the key to improving your factory's Overall Equipment Effectiveness (OEE).*

In most plants we work with, the primary reason for machine downtime is setup and changeovers. Whenever your operators are changing out jobs, programs, tools, materials, and/or parts, it's likely the machines are at a standstill at some point. And this downtime can be very costly to a company.

Chances are, there's plenty of hidden waste in your setup and changeover processes. Conducting a SMED event brings this hidden waste to light, so you can eliminate it out of your processes.

In our experience, changeovers typically take around 2.5-10% of most manufacturers' available time. Do the math—it's likely that you can **save several thousands of dollars per year** by holding a SMED event and following through with your findings.



A Brief History of SMED

The principle of SMED was articulated by Shigeo Shingo, a Japanese industrial engineer who operated in the second half of the 20th century. Shingo was an expert on the famous Toyota Production System (TPS), a precursor of the lean manufacturing philosophy.

Literally, SMED stands for “**Single Minute Exchange of Die.**” “Single-Minute” really refers to “single digit minutes”—i.e., **taking less than 10 minutes.**

The literal idea was to change out a part in under 10 minutes. Today, it means stripping that “exchange”—i.e., changeover time—to the bare minimum.

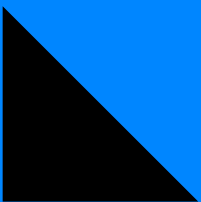



NASCAR pit crews are big proponents of SMED. They employ classic SMED techniques to turn a multi-minute tire change/refueling operation into a 12-second pit stop. Their secret: they follow a standardized, optimized process—and you can, too.



The literal idea was to change out a part in under 10 minutes.

Today, it means stripping that “exchange”—i.e., changeover time—to the bare minimum.



Step 1: Plan and Schedule Your SMED Event

Your changeover times will be reduced with studying your changeover process, breaking it down into steps, and then using three specific SMED techniques to eliminate and/or shorten each step. So, your first step is to assemble your team, which is typically composed of 5-7 employees from different disciplines across your company.

Ensuring your team has horizontal and vertical diversity is important - perspectives from different departments and organizational levels will bring about the best ideas and collaboration. In manufacturing, it's good to include team members from the following areas:

- **Facilitator:** This role should belong to someone who is experienced in facilitating and remaining impartial.
- **Operators:** We can't stress this one enough! You must include someone who will eventually adopt the new process. If you do not have this person on your SMED team, it can affect the feasibility and sustainability of the project. Ensure this person actually works on the machines being studied.
- **Area Supervisors/Managers/Team Leads:** This person will also help with sustainability.

-
- **Engineers from different disciplines:** It's ideal to have an engineer from both design and manufacturing.
 - **Maintenance:** This person can help build any tools, jigs, or guards that might be needed as a result of the event.
 - **Supply Chain:** This person will act as the voice of the customer and/or will help source any needed supplies.
 - **Finance:** You will need a financial point of view to help keep the cost of the project under control

Another thing to consider: SMED events take about 4 to 5 days to complete, so make sure everyone on your team is booked and available to help while the event is taking place.

Step 2: Train Your SMED Team

Before you hold your event, your team members need to be trained on the basics of SMED. (Feel free to use this guide if you like.)



One key lesson: each step of your mapped changeover process will fall into one of two categories:

External activities: Those which can be performed while the machine is running its prior job—i.e. activities that can take place externally (off the machine).

Internal activities: Those which can only be handled once the prior job is finished and the machine is turned off—i.e., activities that must take place internally (on the machine). The more external activities in your changeover process, the more time-efficient it will be.

Often, steps that can be performed externally—while the old job is still running—are treated as internal activities—that is, they aren't performed until the machine is off. The objective of SMED is to reduce your internal activities to the bare minimum.

External activities:

can be performed while
the machine is running

Internal activities:

can only be performed
when the machine is off

Step 3: Map Your Current Changeover Process

Your team's first responsibility is to analyze the current changeover process, documenting each activity and timing how much time it takes to complete. (By the way, total changeover time is measured from the last "good part" of the current run to the first "good part" of the next run).

Make sure to clearly indicate which steps are currently being done internally vs. externally after mapping it out. Your documentation may look something like the table below. The original changeover time is 120 minutes and all of these activities are being performed after the original job runs out and while the machine is idle.

Current Changeover Process

Changeover Steps	Original Changeover Time (min)
Power down and remove unused raw material	20
Do paperwork for old job	10
Get new work order & tooling	10
Take old tooling out and put new in	15
Order new raw material and wait for it to come	15
Put new raw material in	5
Manual adjustment	25
Program & final adjustments	5
First piece inspection	15

Total: 120 minutes

Step 4: Analyze Each Step in Your Changeover Process

In order to reduce as much internal changeover time as possible, your team will analyze each step of the process, labeling which activities are internal and external.

Then determine which of these three SMED techniques to apply:

1

Extract: Here you'll remove steps that can be done externally but are currently done internally within the changeover process.

2

Convert: This means converting steps that are currently internal but could be conducted externally (or partially externally) with some adjustments.

3

Streamline: This process looks for ways to complete internal steps in a shorter amount of time.

Now, your team is ready to get to work!

Step 5: Extract Steps

Often, manufacturers can reduce their changeover time by 30-50% simply through extraction alone. Your team should ask: what steps can operators be performing while the prior job is still running? **Common extraction activities include:**

- **Retrieval:** of parts, tools, materials, instructions, paperwork, etc.
- **Inspection:** of parts, tools, and/or materials.
- **Cleaning:** of parts that can be performed while the machine is running.
- **Quality checks:** for the prior production run.

For example, operators can complete the paperwork for the prior job while it's still running, as well as collect the next work order and tooling. Using our example, you can see we changed the order the steps are performed to minimize the amount of time the machine is off. Extraction reduces a 2 hour changeover time to 70 minutes—a 42% reduction in changeover time!

Extract

Changeover Steps	Original Changeover Time (min)	Time After Extracting (min)
Do paperwork for old job	10	0
Get new work order & tooling	10	0
Order new raw material & wait for it	15	0
Power down & remove unused material	20	20
Take old tooling out and put new in	15	15
Put new raw material in	5	5
Manual adjustment	25	25
Program & final adjustments	5	5
First piece inspection	15	0

Total: 70 minutes

Step 6: Convert Steps from Internal to External

Conversion is more complex than extraction. Often, it means breaking down a given step into multiple parts—some which can be performed externally, but some which still must be performed internally. **Common conversion activities include:**

- **Advance preparation:** such as preheating dies or otherwise preparing parts in advance.
- **Using duplicate jigs:** to perform adjustments in advance of the changeover.
- **Modularizing equipment:** such as replacing a printer instead of adjusting the print head, so the printer can be configured for a new part in advance of the changeover.
- **Modifying equipment:** such as adding guarding, so parts of the machine can be cleaned safely while the prior job is still running.

For example, operators can collect the bins they'll need to remove unused raw materials while the prior job is running, although they can't remove the materials until the machine is off.

Using our example, conversion further reduces changeover time by another 37 minutes, to 22 minutes, for a total 82% reduction in changeover time.

Convert

Changeover Steps	Original Changeover Time (min)	Time After Extracting (min)	Time After Converting (min)
Do paperwork for old job	10	0	0
Get new work order & tooling	10	0	0
Order new raw material & wait for it	15	0	0
Power down & remove unused material	20	20	5
Take old tooling out and put new in	15	15	2
Put new raw material in	5	5	5
Manual adjustment	25	25	5
Program & final adjustments	5	5	5
First piece inspection	15	0	0

Total: 22 minutes

Step 7: Streamline Remaining Internal Steps

Streamlining is typically the most complex step. It may require the most engineering. **Common conversion activities include:**

- **Changing releases:** such as replacing bolts with quick-release clamps.
- **Eliminating adjustments:** by using standardized numerical settings for parts, converting adjustments to multiple fixed settings, or using shims to standardize die size.
- **Eliminating motion:** by reorganizing the workspace.
- **Eliminating wait time:** by making the first article inspection a high QA priority.
- **Standardizing hardware:** so fewer tools are needed.
- **Creating parallel operations:** by bringing in a second operator for certain steps of the changeover process.
- **Mechanizing:** this is generally considered a last resort.

For example, by bringing in a second operator to load in new raw materials while the first operator programs in the new job streamlines the changeover process.

Using our example, streamlining further reduces changeover time by another 11 minutes, to 11 minutes, for a total 91% reduction in changeover time.

Streamline

Changeover Steps	Original Time (min)	Time After Extracting (min)	Time After Converting (min)	Time After Streamlining (min)
Do paperwork for old job	10	0	0	0
Get new work order & tooling	10	0	0	0
Order new raw material & wait for it	15	0	0	0
Power down & remove unused material	20	20	5	3
Take old tooling out and put new in	15	15	5	1
Put new raw material in	5	5	5	3
Manual adjustment	25	25	5	2
Program & final adjustments	5	5	5	2
First piece inspection	15	0	0	0

Total: 11 minutes

Step 8: Document Your Results—and Present Them to Your Organization

Once your team has finished extracting, converting and streamlining the steps of your changeover process, it's time to document your revised changeover process and the results. It's also time to present your findings to the organization, so the new process can be adopted across other machines.

For example, our sample SMED event resulted in the following time and step savings:

11 MIN.

New total
changeover time

109 MIN.

Time saved on initial
changeover process

91%

Percent of
time saved overall

Create a project plan with clear owners and due dates to ensure followthrough on the activities.

The owner of the event will be responsible for organizing the final steps.

Common tools used to document results:

- Before and after bar chart of time spent at each step
- Standard work combination sheet
- Spaghetti diagram
- 5S checklist

Example Report Out Agenda:

- Project Charter Summary
- Initial State Summary
- SMED Event Summary
- Current State Summary
- Final Tasks and Owners
- Sustainment Plan - Auditing Schedule
- Next Step - Action Plan

Step 9: Finish Up and Track Your Results

It's unlikely that all of the tasks will get done during the SMED event, and that's okay! After the event, there may be some outstanding activities to finish up such as:

- Implementing a 5S checklist
- Creating more jigs/tools
- Ordering setup carts or other tools/materials
- Finishing standard work
- Training operators

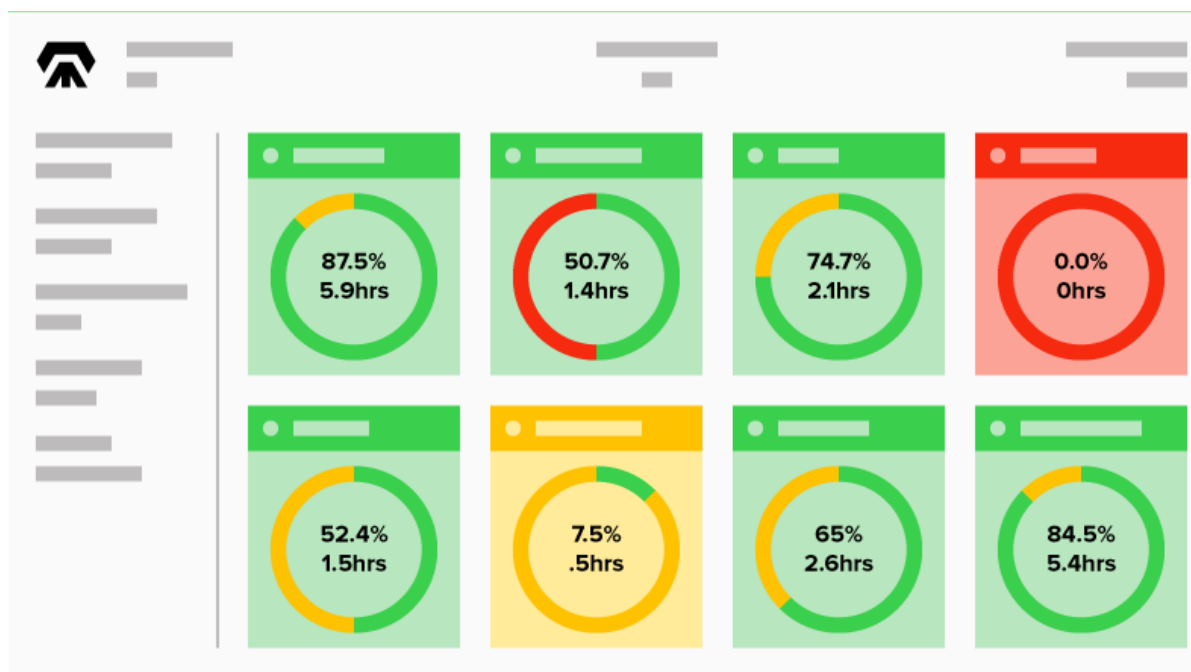
Once all the improvements have been implemented factory-wide, you'll want to track your progress—say, by scheduling regular audits—to ensure the new process is followed and that you're realizing the projected time savings. The rule of thumb is that actions become habits after 30 days - ensure the audits occur every day for 30 days to build these habits and reduce auditing to 1x per month afterwards.

Ensure audits of the setup process occur every day for 30 days to build a habit and reduce auditing to 1x per month afterwards.

Ways Amper Can Help You Get More from SMED

Amper is the simplest real-time OEE tracking and analytics tool designed for manufacturers of all sizes.

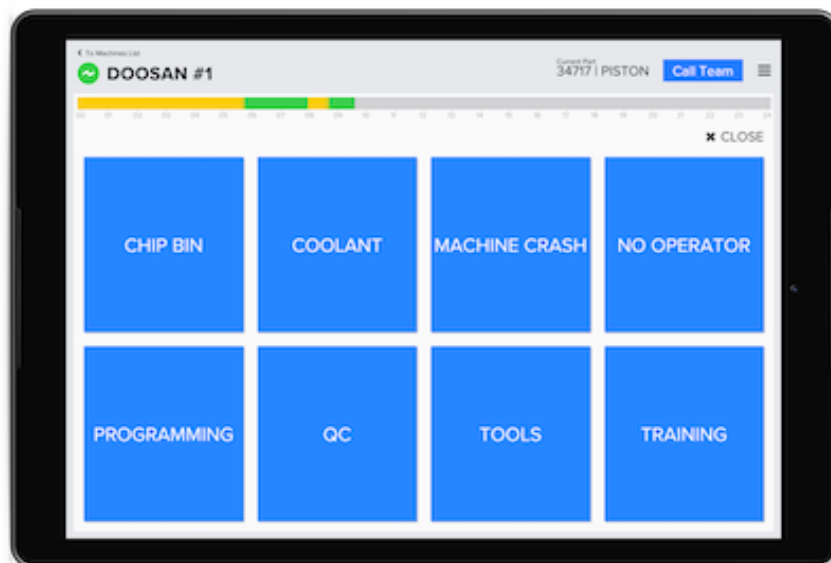
If you're an Amper customer—or if you become one—you can use your Amper system before and after your SMED event to streamline your workload and track your results.



Use Amper to Understand Cost of Setup with Downtime Labeling

Before you put the time and effort into conducting a SMED event, you want to first understand if setup and changeover times are a leading cause of downtime at your factory.

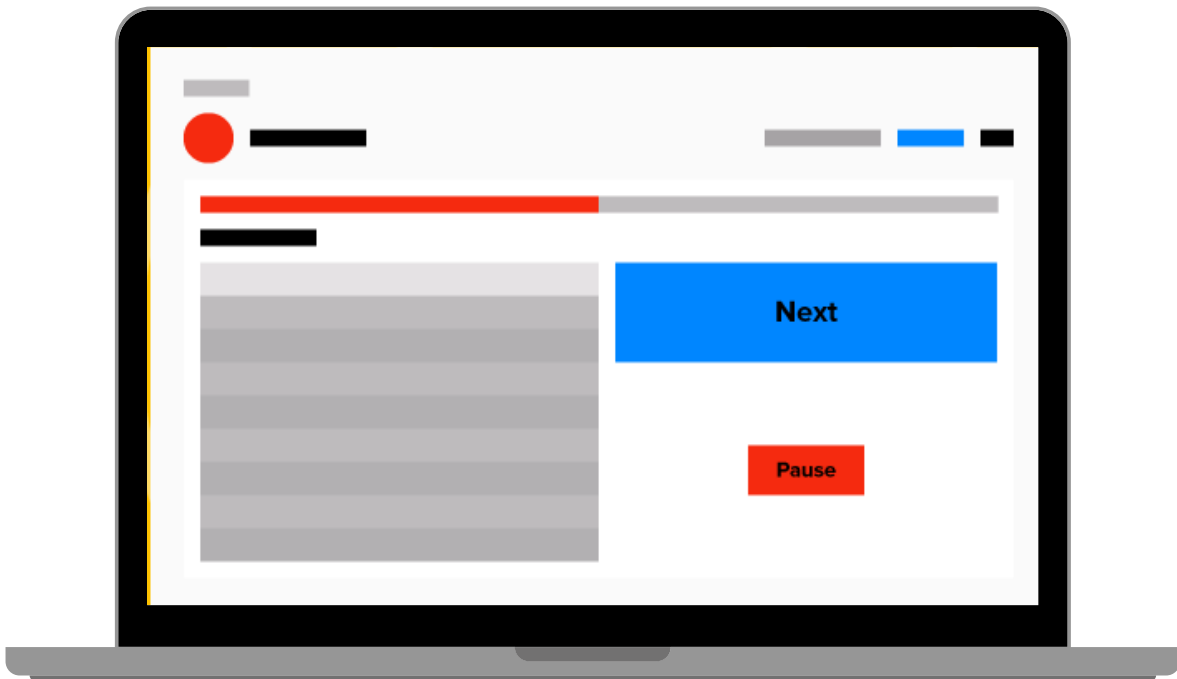
Many of our customers were inspired to conduct a SMED event after they completed a few weeks of downtime labeling with Amper. The data helped them understand just how much time was wasted during the changeover process and justified a SMED event.



Use Amper to Automate Mapping

Using Amper's setup module will save your SMED team several hours of work mapping the changeover process. If you're already using our setup module, your mapping is already done. Your operator just needs to collect your changeover times.

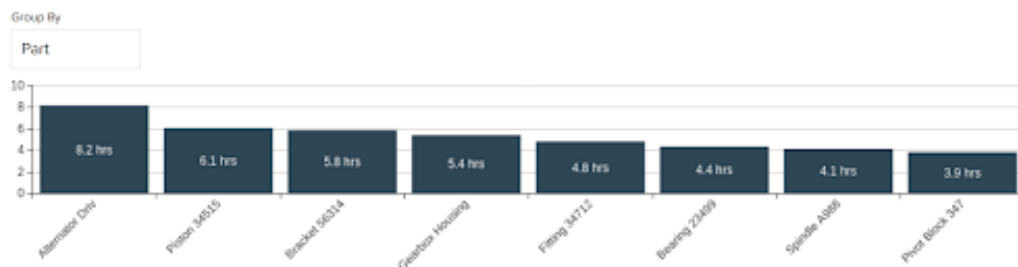
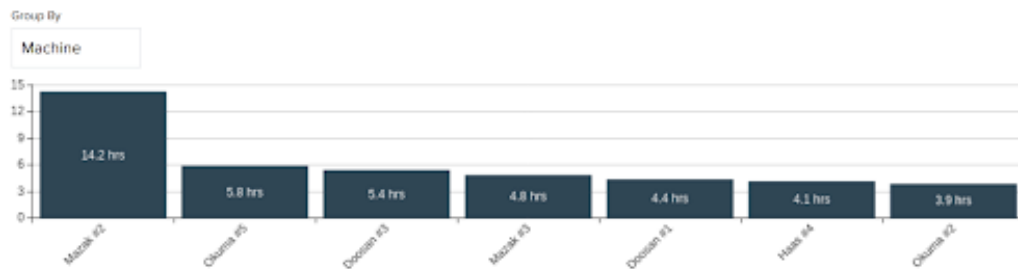
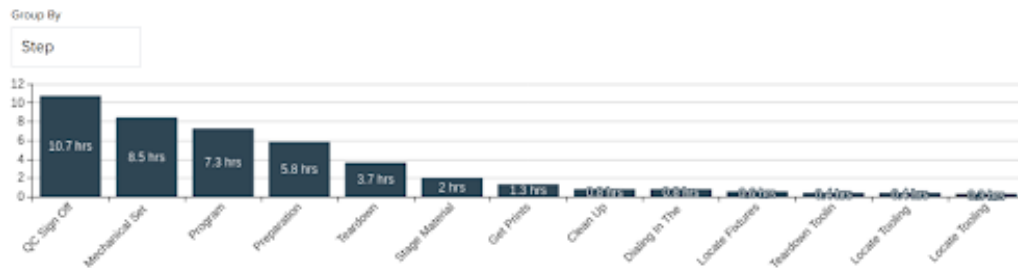
If you aren't using the setup module, why not start? Let us know what your changeover steps are and we'll help you upload them to our system and train your operators in tracking changeover times.



Use Amper to Identify Setup Step Bottlenecks

With Amper's Explorer tool, you can do a pareto analysis of your setup process to understand the 80/20 of your problem steps. Identify what 20% of your steps, take 80% of your operators' time. Once you identify this, you can focus on fixing those steps first.

With Amper, you can also look at setup times by machine group, machine, part, or operator to help you get more specific with your SMED event.



Use Amper to Validate Purchases

You may find that you need to make additional purchases as a result of your SMED exercise. Amper allows you to calculate what your overall savings will be, so you can determine if your proposed purchases are justified and what your payback period will be.

For example, say a conversion step calls for the purchase of setup carts. You know what setup carts will cost. You also know what the new changeover process is saving you in utilization. Therefore, you can measure costs against savings and validate your setup cart purchase.

Use Amper to Track Your Progress

Once your SMED team has documented your new changeover process, send it to us! We'll adjust the Amper setup module to reflect those changes and measure the difference in setup times before and after the event. We'll help you validate your progress and measure your savings.

Use Amper to Get Notified When Setup is Taking Too Long

Have you ever found out that a machine was still in setup way too late? Have your margins already been shot with that job and now you're just rushing to get it done? Going forward, your operators can automatically time their changeovers for every production run.

Should changeovers exceed your new goal time, the system will automatically alert the designated escalation team so issues can be addressed. This will help you audit your ongoing changeovers, and make real-time decisions to change the outcomes of the day before it's too late.

The Keys to Improving OEE

These days more than ever, manufacturers need to find ways to improve productivity. Conducting a SMED event is a surefire way to reduce waste and downtime and boost productivity. So is implementing Amper's OEE tracking system.

At Amper, our mission is to provide manufacturers with the tools and know-how to run lean and to maximize productivity. Our Customer Success Managers regularly coach our clients through SMED events—just as they coach our clients on getting the most from our machine monitoring system.

Here's what you should know about us. Our solution is the simplest, most affordable system on the market. Forget long, complex integrations—you can self-deploy our equipment on any machine in less than 15 minutes.



For most of our customers, it only takes a few hours to get fully up and running—but wow, does it make a difference. Most Amper customers see an overall utilization improvement of anywhere between 2-10%. Most find the system pays for itself in about two months.

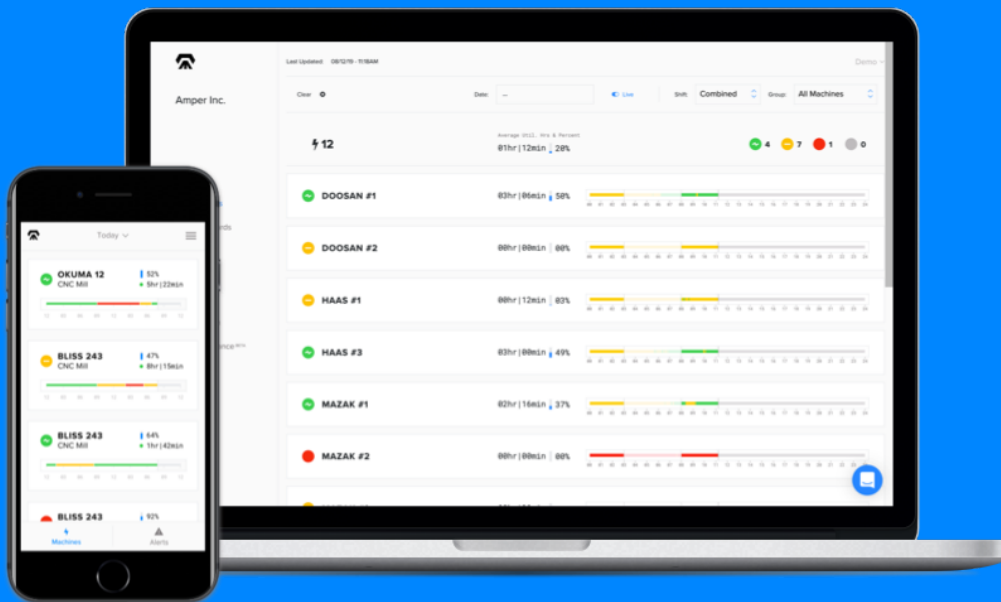
Imagine where you could be in just two months!

If you're interested in maximizing productivity this way, we'd welcome the chance to talk to you. Request a demo on our site: www.amper.xyz.

In the meantime, good luck with your SMED event!



Amper is the simplest real-time OEE tracking and analytics tool to help manufacturers of all sizes improve performance.



Request a demo: www.amper.xyz

