

A man in a light blue shirt and dark tie stands on the right, gesturing with his hands while presenting to a group of four women seated at a long table on the left. The women are looking towards the man. The background is a bright, modern office space with large windows and a whiteboard.

10 Steps to become a Lean Enterprise

Lean Expert Training Course

Step 5

Reduce Changeover Times

Part 5

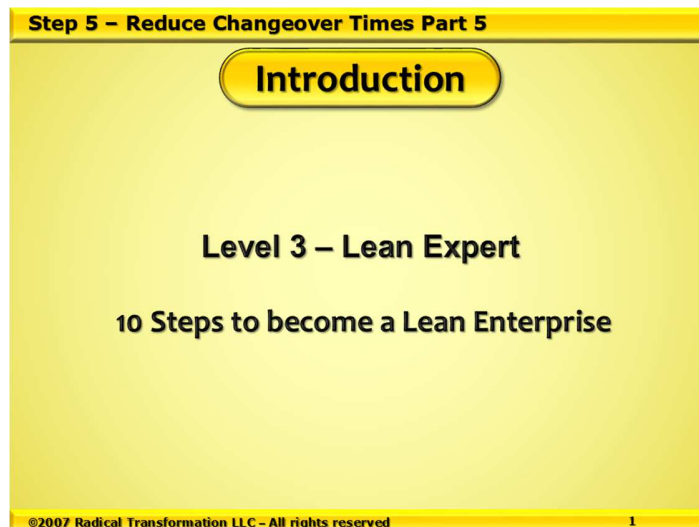
Lean Expert Course Workbook - Step 5 Reduce Changeover Times Part 5

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Please note that some of the screens in the online course have been omitted from this workbook. This is to protect any proprietary information that may be included in the pictures.

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Welcome

We would like to welcome you back to our next module in this online training course.

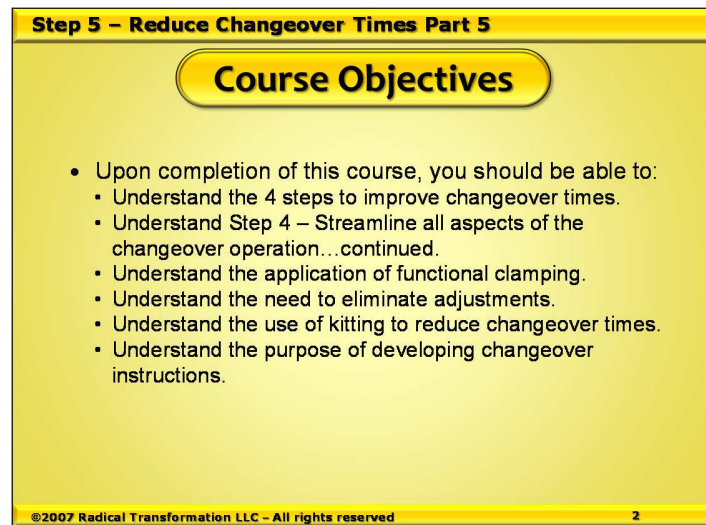
This training module is called "Step 5 – Reduce Changeover Times Part 5."

This module is a continuation of our Lean Expert online course series called "10 steps to become a Lean Enterprise."

This program has been specifically designed to demonstrate our step by step methodology that will allow any organization to become a Lean Enterprise.

Let's continue your lean journey!

Lean Expert Course Workbook - Step 5 Reduce Changeover Times Part 5



Step 5 – Reduce Changeover Times Part 5

Course Objectives

- Upon completion of this course, you should be able to:
 - Understand the 4 steps to improve changeover times.
 - Understand Step 4 – Streamline all aspects of the changeover operation...continued.
 - Understand the application of functional clamping.
 - Understand the need to eliminate adjustments.
 - Understand the use of kitting to reduce changeover times.
 - Understand the purpose of developing changeover instructions.

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Course Objectives

Here are the course objectives for Step 5 – Reduce Changeover Times Part 5.

We specially designed this course to give the information you need to get a full understanding of each step required to become a Lean Enterprise.

Upon completion of this course, you should be able to:

- Understand the 4 steps to improve changeover times.
- Understand Step 4–Streamline all aspects of the changeover operation...continued from Part 4.
- Understand the application of functional clamping.
- Understand the need to eliminate adjustments.
- Understand the use of kitting to reduce changeover times.
- Understand the purpose of developing changeover instructions.

Now we are going to work through each course objective.

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Step 5 – Reduce Changeover Times Part 5

Steps to Reduce Changeovers

1. Document and record a changeover to identify the activities.
2. Separate activities into internal and external elements.
3. Convert internal elements into external elements.
4. Streamline all aspects of the changeover process.

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Four Steps to Reduce Changeovers

These are the four steps to reducing changeover times.

In the following training modules of Step 5 – Reducing Changeover times, we will discuss these four steps in detail.

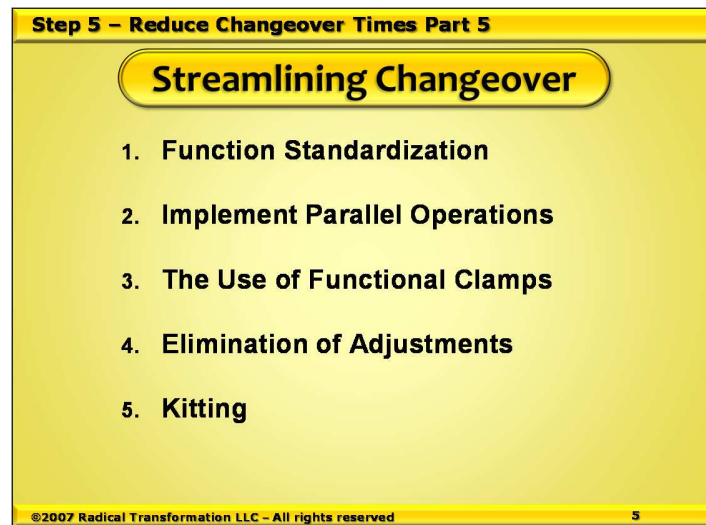
The four steps are:

1. Document and record a changeover to identify the activities.
2. Separate activities into internal and external elements.
3. Convert internal elements into external elements.
4. Streamline all aspects of the changeover process.

Each of these steps is a critical element of reducing changeovers.

Each step must be performed in the prescribed order.

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Step 4 - Streamlining Changeover.

We will continue to look at the changeover process.

These will help to streamline the changeover activities.

In this screen, you see the five processes, which are:

1. Function Standardization – this was completed in Part 4.
2. Implement Parallel Operations – this was completed in Part 4.
3. The Use of Functional Clamps.
4. Elimination of Adjustments.
5. Kitting.

We have already discussed items 1 and 2 in Step 5 Reduce Changeover Times Part 4.

We are going to look at activities 3, 4, and 5 out of the five procedures in the following screens of this training module.

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Step 5 – Reduce Changeover Times Part 5

The Use of Functional Clamps

Definition:

- A functional clamp is an attachment device to hold objects in place with minimal effort.
- Their purpose is to reduce time securing tooling, equipment, etc.
- There are several examples of functional clamp on the following slides.

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The Use of Functional Clamps

We will start by asking the question:

What is a functional clamp?

A functional clamp is an attachment device used to hold objects in place with minimal effort.

How does this apply to reducing changeover times?

A functional clamp device is the common method used to hold the tooling in place while the machine is running.

There are many types of functional clamps, and we will discuss some of these in the following screens.

The amount of time taken during the removal and replacement process will be influenced by the type of holding device used.

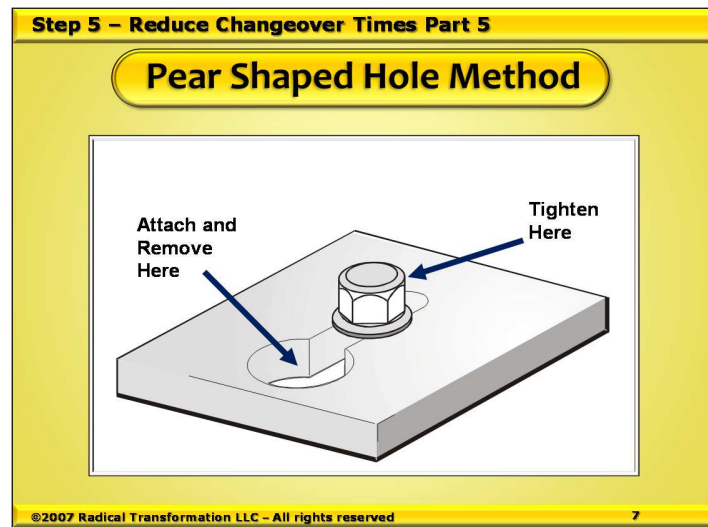
Using the right clamp will reduce the changeover time.

However, if the wrong device is used it will increase the amount of time to setup the machine.

The purpose of a functional clamping device is to reduce the amount of time needed to secure the tooling, equipment, etc.

There are several examples of functional clamps on the following screens.

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Pear Shaped Hole Method

This type of clamp is an example of an effective, quick method to remove and replace standardized tooling.

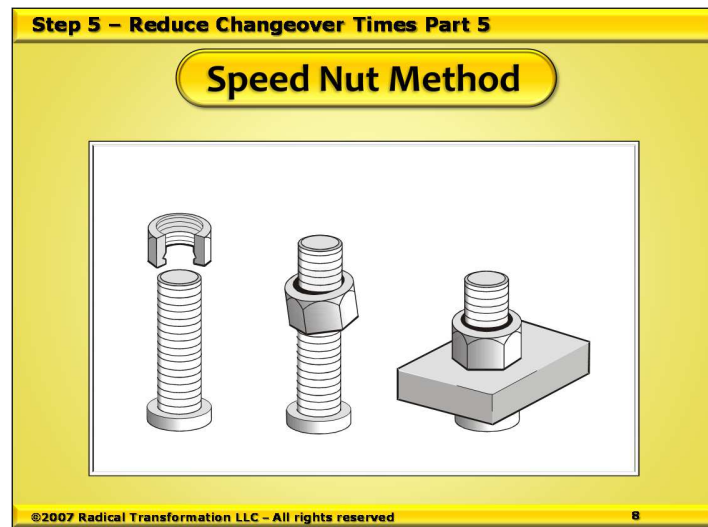
The pear shaped hole allows the clamp plate to fit over the nut and then slide along the body of the bolt or stud.

The nut is tightened against the clamp plate to secure the tooling.

The advantages of this type of clamping device are:

- It can be standardized to use one nut size and wrench.
- It can be hand tightened with a final turn of the nut with a wrench to tighten the device.
- It is easy to assemble, locate into position, and remove.

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Speed Nut Method

In this screen you see a picture of a speed nut being used with a clamp plate.

The nut can be easily moved up and down the bolt and tightened by hand or a wrench.

A speed nut is a type of locknut with two sheet metal prongs that act as one thread.

They are made from spring steel.

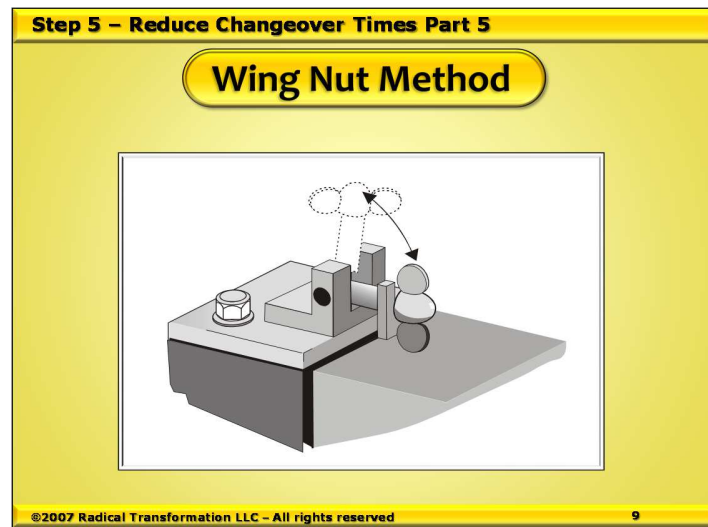
The fastener serves the functions of both a lock washer and a nut.

As the fastener is tightened, the prongs are drawn inward until they exert pressure on the thread.

When the fastener is tightened, the base of the nut deforms and applies a force to the fastener.

This locks it and stops it from vibrating loose.

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Wing Nut Method.

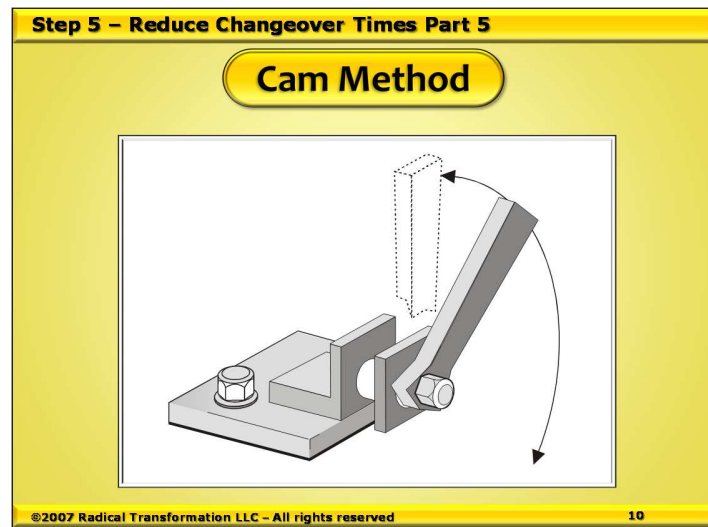
In this screen, you see a picture of a clamping device using a wing nut to secure it.

It is a very simple device and works well in many situations where a low amount of torque is required.

It would be used for holding small tools that do not require much clamping force to hold them in place.

The device is designed to be tightened by hand.

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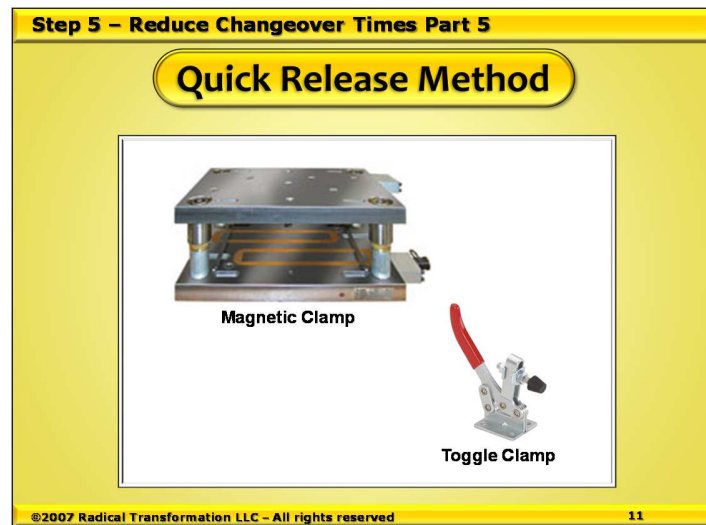
Cam Method.

In this screen, you see a picture of a clamping device that is using a cam mechanism to tighten it.

The cam is turned and the weight applies torque to the clamp, holding the tooling in place.

This device would be used with small to medium sized tools.

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Quick Release Method.

In this screen, you see two examples of quick release clamping devices.

One is a modern design using a magnetic system to hold the tooling in place.

The other is a simple but effective toggle clamp.

Several of these can be used to secure a device in its position.

There are many different types of quick release systems.

Some companies use electrical, hydraulics, or pneumatics to power their quick release devices.

Quick release technology has improved the removal and replacement procedure and reduced the changeover times.

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Step 5 - Reduce Changeover Times Part 5

Elimination of Adjustments

- Adjustments and test runs account for up to 50% of changeover time.
- Adjustments are caused by inaccurate centering, dimensioning, etc.
- To eliminate them we must improve the earlier stages of the internal changeover activities.

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Elimination of Adjustments

The adjustment during a setup and test runs account for 50% of the total changeover time.

Therefore, it is critical for companies to try to find ways to improve them.

Adjustments are caused by inaccurate centering, dimensioning, etc. in the internal changeover procedure.

To eliminate these issues, an organization must take a step back and improve the earlier stages of their internal changeover activities.

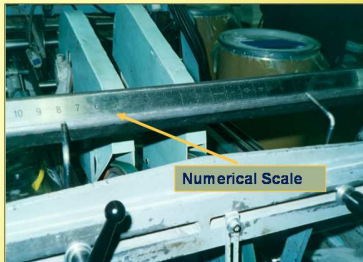
We will discuss some of the methods for achieving this in the following screens.

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Step 5 – Reduce Changeover Times Part 5

Fixing Numerical Settings

- Use graduated scales to improve changeovers times.
- Implement visual calibrations to eliminate guesswork



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Fixing Numerical Settings.

Shigeo Shingo writes in his book, A Revolution in Manufacturing: The SMED System:

“The initial step in doing away with adjustments is to make calibrations. When intuition prevails, there is no way for fixed amounts to be represented.

Calibrations overcome this problem. Everyone knows what it means to “set the dial to five,” and the same value can be set the next time”.

What did Shigeo Shingo mean by this statement?

First, we need to define calibration and understand what it is. Here is a definition from Wikipedia:

Calibration is the validation of specific measurement techniques and equipment. At the simplest level, calibration is a comparison between measurements.

The usual method for setting up a machine is to use measurement to align the tooling. The standard equipment for doing this is a tape measure or ruler. These measurements are subject to a person’s ability to read them accurately, and this has the potential for errors. However, if numerical scales are attached to the machine, this would eliminate the need for a tape measure or ruler.

Another method is for the setup person to put a mark on a machine bed to align a tool into position. This is a calibration. It allows the setup team to repeat the same operation time and time again without using any measuring equipment. The combination of fixed numerical scales and calibration settings will deliver the most accurate system for positioning and aligning tooling.

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Step 5 – Reduce Changeover Times Part 5

Positioning Pins

- Quick change pins allow the changeover team to remove and replace parts quickly.
- Aligning tooling takes a considerable amount of time
- Using positioning pins gives instant alignment with zero adjustments.

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Positioning Pins.

The perfect changeover would be to position and align the tooling with zero adjustments.

Is this possible?

How could it be done?

The best method is to use quick change or positioning pins.

These are metal pins that fit into location holes that are drilled into the machine bed or base plate of the tooling.

Quick change pins allow the changeover team to remove and replace parts quickly.

This is very important because aligning sections of the tooling can take a considerable amount of time.

Earlier in this training module we stated that alignments and test runs account for 50% of the total changeover time.

It is a critical issue that must be the focus of any improvement team.

How can we reduce the time for adjustments?

Use positioning pins and push the tooling up against them.

Clamp the tooling into position, run a test part, and the setup is completed.

This achieved the instant alignment of the tooling with zero adjustments.

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The lighting is often dim when working inside large machines.

Aligning tooling using measuring equipment can be even more difficult if the lighting is bad.

Using the positioning pin will help to speed up the changeover process.

On the next screen is a picture demonstrating the use of positioning pins.

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Step 5 – Reduce Changeover Times Part 5

Kitting of Parts and Equipment

- Preparing parts and equipment to be ready for the next changeover is important.
- One improvement method is kitting of parts and equipment on a cart prior to the machine stopping.

The diagram shows a kitting cart with a rotating table on top. Various items are labeled: 'tooling' (a stack of parts), 'tools' (wrenches and sockets), 'materials' (a spool of wire), and 'rags' (a stack of cloths). The cart is on wheels and has a handle on the side.

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Kitting of Parts and Equipment.

Preparing parts and equipment to be ready for the next changeover is an important part of reducing the changeover time.

One improvement method is the kitting of parts and equipment onto a cart prior to the machine stopping.

In this screen, you see an example of a kitting cart.

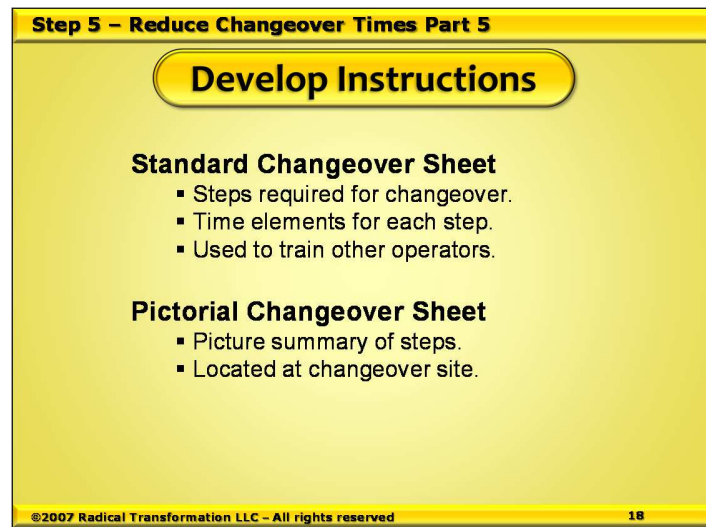
The purpose of the cart is to carry all the items listed in the changeover checklist.

This will speed up the changeover preparation process.

The cart is used to move the kitted items to the machine prior to the changeover.

This should eliminate the need for any member of the setup team to have to go and search for items during the internal changeover activities.

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Develop Instructional Sheets.

One of the best methods to sustain any improvements in changeover procedures is to document them.

There are two common methods that are used to capture the process and make it available to everyone. These two methods are:

1. A standard changeover sheet.
2. A pictorial changeover sheet.

Standard changeover sheet:

This is used to document the steps required for the changeover. It would include the details and time elements for each step.

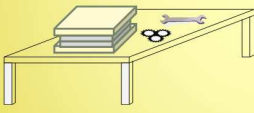
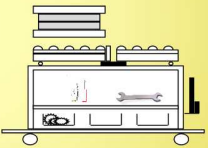
A copy of this document would be placed in the machine area on display for everyone to see. A standard changeover sheet is an excellent tool to train other machine operators or new employees.

Pictorial changeover sheet:

This document uses pictures to demonstrate the changeover process. An improvement team would create a picture summary of each of the steps.

A copy of this document would be placed in the machine area on display for everyone to see.

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Step 5 – Reduce Changeover Times Part 5	
Standard Improvement Sheet	
Improvements	
Production Description Press Brake Changeover	Date 1/1/95
Sketch of Before Condition	Sketch of Improved Condition
	
Result of Improved Condition	
<ul style="list-style-type: none">• Organized Changeover equipment• Eliminated time wasted to find tools• Allowed for Changeover within 27min	
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19	

Standard Improvement Sheet.

In this screen, there is an example of a standard improvement sheet. It is used to document the “before” and “after” conditions of a process.

An employee would draw how the process looked before any changes were started.

Next, they would draw the improved process after the changes were completed.

In the example on the screen, the setup team used a standard four-legged worktable to support the tooling.

They did all the necessary work on the tooling while it was sitting on the table.

One of the machine operators came up with an idea about using a cart to transport the equipment, materials, and tooling.

The improvement team estimated this would cut out some of the travel and reduce the changeover time.

A standard improvement sheet was used to document the implementation of the cart into the changeover process.

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Step 5 – Reduce Changeover Times Part 5

Standard Material Sheet

Changeover PART: Box Assy PROJECT: Model 100 REV: A PAGE 1

☐ Qat check for this question

Check contour

0.75 gap

3

2

1

3	Sheet metal blank P/N 01001	1
2	Brake die set	1
1	Changeover Cart	1
Part	Mat for this Changeover	Qty
Changeover MATL		

1

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Standard Material Sheet.

In this screen, there is an example of a standard material sheet.

This is used to document the tooling and material information for the changeover.

You can see the press tooling in the center of the screen.

It is defining the dimensions of the gap in the tooling.

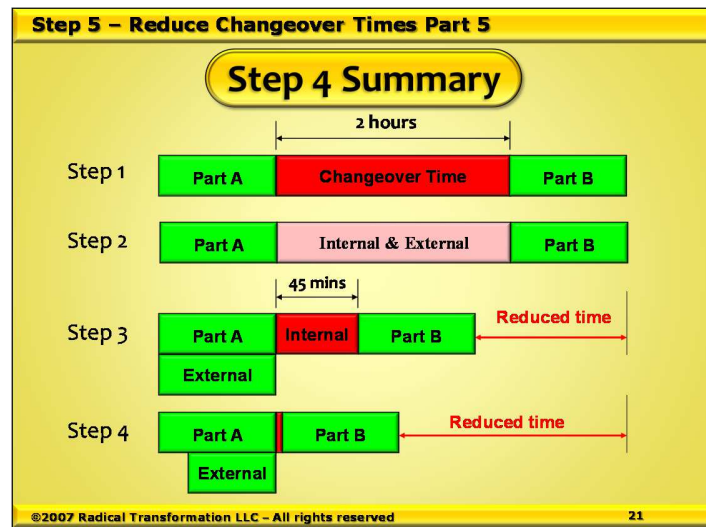
This will make it easier for the person who is responsible for the changeover to know what the correct gap requirements are to produce this particular product.

In the lower left hand corner of the sheet there is information about the material and equipment to produce the part.

The purpose of this sheet is to standardize the process and ensure the best practices are documented to instruct the setup team about the changeover.

We will discuss the use of standard documents in Step 8 – Standardized Work.

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Step 4 Summary.

At the end of Step 4, the changeover activities have been streamlined to improve the changeover process.

This means the overall changeover time will have been reduced even further.

In this screen, the graphic for Step 4 demonstrates what the changeover process would look like after the previous three levels of improvement.

It is a continuous activity to improve a process.

It does not happen all at once; it occurs over time.

The amount of time it will take will depend upon the leadership team following through with one important factor:

Their level of commitment towards staying totally focused on the identification and elimination of waste.

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Step 5 – Reduce Changeover Times Part 5

Ten Rules for Changeover Reduction

1. Standardize, standardize, standardize
2. Clean and organize work area
3. Maintain documentation
4. Eliminate unnecessary adjustments
5. Provide calibration for all adjustments
6. Eliminate threaded fasteners and tools
7. Utilize common connections
8. Use visual aids to avoid confusion
9. Improve handling and storage
10. Keep on improving it!!!

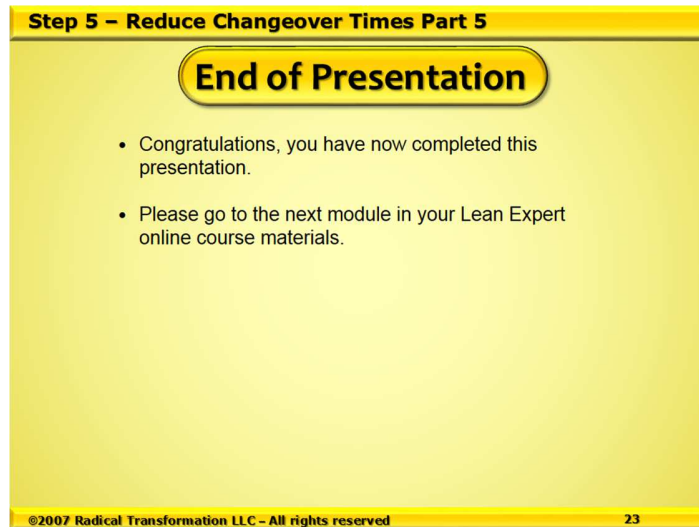
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Ten Rules for Changeover Reduction.

Here is a list of ten easy rules for changeover reduction:

1. Standardize, standardize, standardize.
2. Clean and organize the work area.
3. Maintain and update documentation.
4. Eliminate unnecessary adjustments.
5. Provide calibration for all adjustments.
6. Eliminate threaded fasteners and tools.
7. Utilize common connections.
8. Use visual aids to avoid confusion.
9. Improve handling and storage.
10. Keep on improving it!!!

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End of Presentation

Congratulations, you have now completed this presentation.

Please go to the next training module in your Lean Expert online course materials.

Lean Expert Course Workbook - Step 5 Reduce Changeover Times Part 5

Reference Materials

1. **Quick Changeovers for Operators: The SMEDSystem.**
By: Productivity Press Development Team. Published by Productivity Press 1996.
2. **Quick Changeover Simplified -The Manager's Guide to Improving Profits with SMED.**
By Fletcher Birmingham and Jim Jelinek. Published by Productivity Press 2007.
3. **Kaizen for Quick Changeover: Going Beyond SMED.**
By Keisuke Arai and Kenichi Sekine. Published by Productivity Press 2006.

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Documents List

1. Quick Changeover Analysis Sheet

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Name:		Dept:	Date:
Machine/Equipment #:		Product #:	Prod Desc:

All Work Elements	Time	External Elements	Time	Internal Elements	Time	Reduce/Eliminate	Time
Total Minutes Total Hours		Total Minutes Total Hours		Total Minutes Total Hours		Total Minutes Total Hours	