SETUP REDUCTION / QUICK CHANGEOVER
Setup Time Drives Batch Size:

The Economic Order Quantities (EOQ) model determines the most economic lot/batch size for a production run.
Setup Reduction or Quick Changeover

- **Definition:** Minimizing the time from last good piece of the current product run to first good piece of the next (different) product run.

- **STEPS IN A CHANGEOVER:** (1) Preparation; (2) Remove/Install Tooling; (3) Change Machine Settings; (4) Make Trial Pieces & Adjust.

Percent of time of changeover

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation, after-process adjustment, checking, return to storage of parts, tools, fixtures</td>
<td>50%</td>
</tr>
<tr>
<td>Removing parts, blades, jigs, etc.; mounting same for next lot</td>
<td>30%</td>
</tr>
<tr>
<td>Machine settings, measurements</td>
<td>15%</td>
</tr>
<tr>
<td>Making trial pieces and adjusting</td>
<td>5%</td>
</tr>
</tbody>
</table>

Principles for Implementing Lean Manufacturing
Quick Changeover: Visual Controls
Quick Changeover

Clearly labeled cutter size and style

All regular router cuts needed in this workcell stored at router table.
Three Stages of Quick Changeover

1. Separate Internal and External Setup
2. Convert Internal Setup to External Setup
3. Streamline Internal and External Elements

Setup Reduction

Principles for Implementing Lean Manufacturing
Stage 1: Separate Internal and External Setup

- Separate Internal and External Setup
- Convert Internal Setup to External Setup
- Streamline Internal and External Elements

Setup Reduction

- Develop and implement changeover checklists.
- Perform function checks on parts and tools before changeover
- Isolate transportation of tools, parts, and materials.

Principles for Implementing Lean Manufacturing
Stage 2: Convert Internal Setup to External Setup

Separate Internal and External Setup

Convert Internal Setup to External Setup

Streamline Internal and External Elements

Setup Reduction

- Prepare operating conditions in advance
- Standardize functions
- Use intermediary jigs
Stage 3: Streamline Internal and External Elements

- Separate Internal and External Setup
  - Implement parallel operations
  - Eliminate the need for adjustments
  - Use functional clamps
  - Mechanize functions
- Convert Internal Setup to External Setup
- Streamline Internal and External Elements

Setup Reduction
Transition Steps to Quick Changeover

<table>
<thead>
<tr>
<th>Preliminary</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal and External Setup not</td>
<td>Separate Internal and External</td>
<td>Convert Internal Setup to External Setup</td>
<td>Streamline all aspects of Setup operations</td>
</tr>
<tr>
<td>differentiated</td>
<td>Setup</td>
<td>Setup</td>
<td>operations</td>
</tr>
</tbody>
</table>

- **Ext**: External
- **Int**: Internal

**Process Walk Analysis**

**Preparation Standardization Jigs**

**Management of parts and tools**

**Parallel operations**

**Clamps**

**Less adjustments**

**Mechanization**
No/Low Cost Solution: Positioning Pins
No/Lo Solution: One-Turn Methods

Pear-Shaped Hole Method

- **Tighten Here**
- **Attach and Remove Here**
# Other Functional Clamps

<table>
<thead>
<tr>
<th>Reduce number of screws</th>
<th>C-washer method</th>
</tr>
</thead>
<tbody>
<tr>
<td>10⇒4 fixed screw sites</td>
<td>Don’t remove the C-washer!</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toggle clamp</th>
<th>( \mu )-slot method</th>
</tr>
</thead>
<tbody>
<tr>
<td>can apply pressures of over 500 kg</td>
<td>fixture</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variation of pear-shaped hole method</th>
<th>Magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>bushing cap</td>
<td>contact with workpiece</td>
</tr>
</tbody>
</table>

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**Principles for Implementing Lean Manufacturing**