Quick Changeover
Single Minute Exchange of Dies
Outline

- Changeover and Changeover Time
- Traditional Setup
- SMED
- SMED Process Steps
- Ideas for Improvement
Changeover Defined

- Changeover is the total process of converting a machine or line from running one product to another
Changeover Time Defined

- Changeover time is the total elapsed time between the last unit of good production of the previous run, at normal line efficiency, to the first unit of good production of the succeeding run, at full line efficiency.
Traditional approach

- Setup is given and fixed
- Therefore,
  - Use highly skilled setup personnel
  - Minimize product variety
  - Combine lots
  - Make large batches
Another way

- Setups CAN be improved!
- Small lot production REQUIRES short setups
- Setup time reduction of 90% and more is common
Benefits of setup reduction

- Better quality
- Lower cost
  - Less inventory
- Better flexibility
- Better worker utilization
- Shorter lead time and more capacity
- Less process variability
Classification of setup activities

- Type 1
  - Gathering, preparing, and returning tools, fixtures, etc.
- Type 2
  - Removing previous setup, mounting next setup on machine
- Type 3
  - Measuring, calibrating, adjusting
- Type 4
  - Producing test pieces, further adjustment until parts are good
What is SMED?

- Single Minute Exchange of Dies is changing process tooling in 9 minutes or less.
- The process was developed by Shigeo Shingo at Mazda, Mitsubishi and Toyota in the 1950’s and 1960’s.
  - Separate internal and external activities.
  - Convert internal activities to external activities.
  - Streamline all activities.
Single Minute Exchange of Dies

- Internal set-up activities.
  Elements in the changeover which can only be done when the machine is stopped.
- External set-up activities.
  Elements that can be performed when the machine is running.
Why SMED?

- Reduced inventories.
- Improved productivity.
- Higher quality levels.
- Increased safety.
- Improved flexibility.
- Reduction in throughput time.
- Improve operator capabilities.
- Lower manufacturing costs.
SMED Methodology

- Identify internal and external steps
- Convert internal steps to external
- Improve all aspects of the setup operation
- Abolish setup
The SMED Process

- Preliminary Stage – Observe and record.
- Stage 1 – Separate internal and external activities.
- Stage 2 – Convert internal activities to external activities.
- Stage 3 – Streamline all activities.
- Stage 4 – Document internal and external procedures.
Preliminary Stage

Observe and record
- Team-work
  - Recorder
    - Overall duration (from last product to first good product).
    - Describe the change (from what to what?).
    - Record the equipment used.
  - Timers
    - Time each step
  - Fact collectors
    - Breakdown the steps into actions – as much detail as possible.
Stage 1

Separate internal and external activities.
- Study each internal step and ask if it could be external.
- Common issues:
  - Dies in remote storage racks.
  - Spanners not available.
  - Raw material checks.
  - Lifting equipment not available.
Stage 2

Convert internal to external.
- Ask why the remaining internal steps can’t be external.
- Re-examine the true function of each step.
- Common issues:
  - Cold dies – using material to heat the dies.
  - Imaginary center lines and reference planes.
  - No record of settings.
Stage 3

Streamline all activities.
- Analyze the elements (facts), and discuss all possible ways of improving the step.
- Study the external activities as well as the internal activities.
- Common issues:
  - Fastenings – Are bolts needed? If so remember that only the last turn tightens a nut or bolt.
  - Standardize bolt heads.
  - Standardize die heights.
Stage 4

Document the procedures.

- Write down the new internal and external procedures.
- Fill in an action sheet to ensure that the new procedures can be achieved.
- Review the whole activity to determine “What went well?”, “What went badly?” and three changes that the team would make before the next SMED activity.
## The SMED System - Results

<table>
<thead>
<tr>
<th>Company</th>
<th>Machine</th>
<th>Before improvement</th>
<th>After improvement</th>
<th>Red’n</th>
</tr>
</thead>
<tbody>
<tr>
<td>T Manufacturing¹</td>
<td>80t single shot press</td>
<td>4 hours 0 mins</td>
<td>4 mins 18 sec</td>
<td>98%</td>
</tr>
<tr>
<td>S Metals¹</td>
<td>100t single shot press</td>
<td>40 mins</td>
<td>2 mins 26 sec</td>
<td>94%</td>
</tr>
<tr>
<td>H Press¹</td>
<td>30t single shot press</td>
<td>50 mins</td>
<td>48 sec</td>
<td>98%</td>
</tr>
<tr>
<td>TT Industries¹</td>
<td>50 oz injection moulding m/c</td>
<td>1 hour 10 mins</td>
<td>7 mins 36 sec</td>
<td>89%</td>
</tr>
<tr>
<td>Expanded Metal Co.</td>
<td>4’6” lath press</td>
<td>4 hours 30 mins</td>
<td>11 mins (note: NOT SMED)</td>
<td>96%</td>
</tr>
<tr>
<td>S Engineering</td>
<td>Machining Centre</td>
<td>139 minutes</td>
<td>59 mins 29 secs</td>
<td>57%   *</td>
</tr>
<tr>
<td>AM Bottlers</td>
<td>Bottling plant</td>
<td>32 mins 43 secs</td>
<td>23 mins 33 secs</td>
<td>28%   *</td>
</tr>
<tr>
<td>E Finishing</td>
<td>Paint Plant</td>
<td>56 mins 26 secs</td>
<td>23 mins 12 secs</td>
<td>59%   *</td>
</tr>
</tbody>
</table>

* After one SMED exercise

Ref 1: Modern Approaches to manufacturing improvement – the Shingo System, Shigeo Shingo, ISBN: 091529964x