Introducing Ergonomics to the Product Design Process using 6S

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Agenda

• Who is Cummins?
• DMAIC
• Outputs
Who is Cummins?
Diversified Global Power Leader

• Four Complementary Businesses

Engines

Power Generation

Components

Distribution
Cummins Mission Statement

• Motivating people to act like owners working together.
• Exceeding customer expectations by always being first to market with the best products.
• Partnering with our customers to make sure that they succeed.
• Demanding that everything we do leads to a cleaner, healthier, safer environment.
• Creating wealth for all stakeholders.
CMI

**World Headquarters**
500 Jackson Street
Columbus, Ind., 47201

**Stock Symbol** (traded on NYSE)
CMI

**Founded in**
1919

**Website**
www.cummins.com

**Sales / Earnings**
In 2012, Cummins earned $1.65 billion on revenues of $17.3 billion.

**Fortune 500 Ranking** (2013)
160

**Employees**
Worldwide, approximately 46,000 people.
More than 60 percent of the Company’s employees are located outside the U.S.

**Customers**
The Company’s customers are located in approximately 190 countries and territories that Cummins reaches through a network of more than 600 company-owned and independent distributor locations and approximately 6,500 dealer locations.
Show of hands...
(Electronically)
DMAIC

- Define
- Measure
- Analyze
- Improve
- Control

\[ Y = f(x_1, x_2, \ldots, x_n) \]
Define

- This doesn’t look so bad right? Do we have a problem?
Define

- Ergonomic Injuries still represent the leading cause of injuries at CMI - ~24%
- We found that at least 47% of our ergonomic injuries have some relation to product design
- Currently no ergonomics process for the design/development of new products
Define

• Charter was created with a Y statement that focused on introducing ergonomics into the Product design process
Measure

• Conducted a thorough Voice Of the Customer (VOC) of product engineers/designers from varying backgrounds

• What is a VOC?
Analyze

- Voices: 124
- “Red” statements: 13
- “Blue” Statements: 5
Improve

• The “people have spoken”:
  – An ergonomics checklist should be available
    • Easy to use
    • Provides guidance
    • Quantitative in nature
Improve

• Additional voices identified other important improvement areas:
  – Communication
  – Data
  – Engineering Standard Work
Improve

- Ergonomic checklist for designers was created
  - Covers 10 risk areas
  - Includes accessibility, component weight, force requirements and working postures
  - Provides quantitative values and guidance

- User acceptance survey conducted
  - “speak now or forever hold your peace”
# Checklist Sample

<table>
<thead>
<tr>
<th>Act.</th>
<th>Attribute</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Accessibility</td>
<td>Easy to access with good visibility</td>
<td>Easy to access with poor visibility</td>
<td>Difficult to access with poor visibility</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Part Weight</td>
<td>&lt;10 lbs</td>
<td>10 - 15 lbs</td>
<td>15 - 20 lbs</td>
<td>20 - 30 lbs</td>
<td>&gt;30 lbs</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Repetitions</td>
<td>&lt;10</td>
<td>10 - 20</td>
<td></td>
<td>&gt; 20</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1.4</td>
<td>Manual Force</td>
<td>Minimal amount of manual force is required for assembly</td>
<td>A moderate amount of manual force is required for assembly</td>
<td>Excessive manual force is required for assembly</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Work Height</td>
<td>36&quot; - 48&quot;</td>
<td>32&quot; - 36&quot; or 48&quot; - 52&quot;</td>
<td></td>
<td></td>
<td>&gt;52&quot; or &lt;32&quot;</td>
<td>3</td>
</tr>
<tr>
<td>1.6</td>
<td>Back Posture</td>
<td>Neutral</td>
<td>Bend Over</td>
<td></td>
<td></td>
<td>Squating and Bend Over</td>
<td>1</td>
</tr>
<tr>
<td>1.7</td>
<td>Arm Posture</td>
<td>Thumbs neutral Elbow close to body</td>
<td>Thumbs pronated Elbow close to body</td>
<td>Thumbs neutral Elbow away from body</td>
<td>Thumbs down and elbow close to body or thumbs pronated and elbow away from body</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Control

• Signed, Sealed and Delivered
  – Documentation (work instruction)
  – Training
  – Communication
Outputs

• Created a “grass roots” process for identifying ergonomic issues
• Opened the door for future growth in product design ergonomics
  – “S-Curves”
  – Benchmarking Matrix
• Using 6Sigma helps provide better overall adoption
  – Due diligence
  – Company accepted practice
Questions