Introducing Process Improvement
To New Employees

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Meet the Presenters

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First day on the job…
<table>
<thead>
<tr>
<th>No.</th>
<th>Operation</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remove parts from tool</td>
<td>Remove cavities 3 &amp; 4 from the mould tool. Place parts onto left side of bench (Fig 1)</td>
</tr>
<tr>
<td>2</td>
<td>Remove the spiking frame from the upper tool</td>
<td>Remove the waste then place the frame onto the bench. Ensure frame handle is pointing away from you and spikes are pointing upwards.</td>
</tr>
<tr>
<td>3</td>
<td>Fold waste and place onto to stand</td>
<td>Fold the waste from the frame and place it onto the granulator cooling stand, using it to push the existing waste into the granulator (Fig 2).</td>
</tr>
<tr>
<td>4</td>
<td>Remove the spiked frame from the underneath bench</td>
<td>Remove the spiked frame from underneath the bench, place it into the guides on the upper mould tool (Fig 1). Ensure that the handle is pointing towards you is fully located against the sensor.</td>
</tr>
<tr>
<td>5</td>
<td>Place one white &amp; green clip into cavities 3&amp;4</td>
<td>Take one white &amp; green LH clip from the dispenser. Place the green clip into the center clip position and the white into the bottom location on cavity 4. Take one white &amp; green RH clip from the dispenser. Place the green clip into the center clip.</td>
</tr>
</tbody>
</table>

Place rejects in reject container. Record on Process Monitor Sheet. If 3 or more rejects found with same fault call Gap Leader.
Introducing... The 5 Step plan

Learn “What we do” and “What they know”

Understanding Variation + Prevention

Efficiency and Improvement

Meeting Customer Requirements

Inspection
1. Learn “What we do”
Pretend with us...

We make Paddles

Each Paddle has 30 dimples to catch beads

These paddles are designed to capture 7 red beads on each dip into a bucket full of both red and white beads.
We’re all different…
Maybe it doesn’t fit all?

What do they know?

Experience with Quality?

Experience with Manufacturing?

Experience with our products?

What don’t they know?
2. Inspection
“These parts have to be made **to print**”

“We cannot ship non-conforming parts to the customer”

“Let’s make sure all our data is in spec”
In the case of our Red-Bead Paddle Factory...
What do you do with the bad ones?

In manufacturing, how much money is spent/lost each year in the form of waste?

$8 trillion
#1 Contributor to the waste...

We hired you to find and quarantine the defects.

The customer receives all good paddles.

Everyone is happy!
Prevention over Inspection

The principal that the cost of preventing mistakes is generally much less than the cost of finding and correcting them.
3. Understanding Variation

Statistical Process Control (SPC) is the use of statistical tools to monitor production processes in order to prevent defective product.

Organizations that implement an SPC program move beyond the costly quality control method of inspecting for waste.

An SPC program allows manufacturers to identify the possibilities for product flaws early so that they can prevent producing scrap.
Find the Special-Cause Variation

UNDERCONTROLLING

Treating special-cause variation as common-cause
(Failing to make changes when they were necessary)

OVERCONTROLLING

Treating common-cause variation as special-cause
(Making changes when none were necessary)
When is it used?

Answer “yes” to each of the following:

– Do you need to assess the variability in the system?
– Can the data be collected or does a collection of data already exist?
– Is the time order of the data preserved?
– Is the data in variables format?
– Is the data collected in subgroups of one?
Pen and paper!
How is it made?
1. Complete the header information.
2. Record the data.
3. Calculate the moving ranges.
4. Calculate the overall averages.
5. Calculate the control limits.
6. Scale the control chart.
7. Draw the average line and control limits.
8. Plot the values on the control chart.
9. Interpret the control chart.
X-MR Control Chart

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- **Basic rules for interpretation**
  - Any point lying outside the control limits.
  - Run of seven points:
    » Seven or more points in a row above or below the center line.
    » Seven or more points in a row going in one direction, up or down.
  - Any non-random pattern, including the following typical cases:
    » Too close to the average.
    » Too far from the average.
    » Cycles.
Since +/- 3 sigma = 99.73%, each tail of the curve has the remaining 0.135% of data.
Predicting the Future
4. Meeting Customer Requirements

Capable

Capable - Meaning:

Capable: Adjective. The ability to be competent. Being able to do something well.
• Control charts are not designed for comparisons to a specification
• Capability analysis allows you to assess your ability to meet customer needs
• Capability analysis brings together the process limits (+/- 3 sigma) and specification limits

The two voices:
Meeting Specifications

• We need the paddles to catch 7 red beads per dip

  We understand common-cause variation, so…

  • 2 red beads is our minimum acceptable amount

  • 12 red beads is our maximum acceptable amount
The Capability Study!
**Cp and Cpk**

PROCESS CAPABILITY INDICES

\[
C_p = \frac{USL - LSL}{6 \times \sigma}
\]

Summarize process potential to meet two-sided specification limits.

\[
Cpk = \frac{\bar{x} - LSL}{3 \times \sigma}
\]

1. Summarize process potential to meet two-sided specification limits.
2. Cpk is a penalty factor for the process's being off nominal.

I. Process out of control
   - deviation too high
   - average off nominal

II. Process out of control
    - average off nominal
Calculate Capability
What do we learn?

- Calculate $Z_{upper}$ and $Z_{lower}$

  $Z_{upper} = 2.65 \rightarrow 0.0040 \rightarrow 0.4\%$

  $Z_{lower} = 3.16 \rightarrow 0.00079 \rightarrow 0.08\%$

We expect 0.4% + 0.08% of data to be outside the specification limits.
5. Efficiency & Process Improvement

Choose One
Choose One
Describe the Process:

We have a process that is behaving predictably with only common-cause variation present.

Our Cp being ~ 1.00 means that our specification spread is about the same size as our process spread.

Based on these specs, though, our data is not perfectly centered around the target.

Therefore, our process spread bleeds beyond the specification spread. We are incapable of meeting the requirements of our customer.
Option 1:
Reduce sources of variation. Invest energy in the process to find ways to more consistently pull 7 (or nearly 7) red beads.

Option 2:
Loosen the specifications.
Notice what we’re not talking about?

Inspect more parts

Contain the Defects

Hire more inspectors
It’s all about Prevention!
In Summary

- Learn “What we do” and “What they know”
- Inspection
- Understanding Variation + Prevention
- Efficiency and Improvement
- Meeting Customer Requirements
Thank you, Quality Digest!

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