Balancing Mixed Model Value Streams

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Hypertherm Incorporated

Hypertherm®
SHAPING POSSIBILITY™

This Session

- Targeted to organizations who have lean, flow based value streams
- Provide a roadmap for optimizing flow in an already mature process
- Give examples of flow disruption in Hypertherm's Powermax Assembly Value Stream, and how to engage partners in eliminating barriers to flow

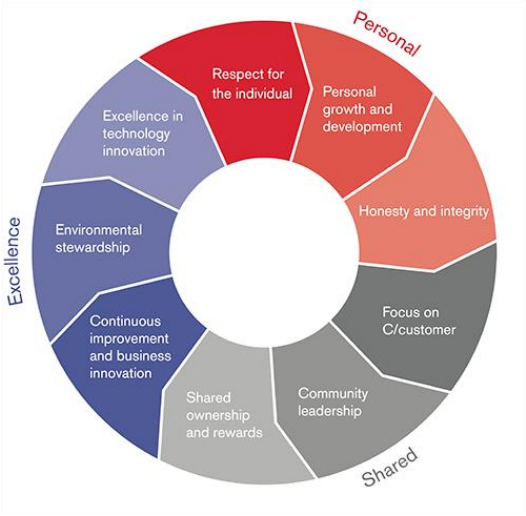
Purpose-driven Excellence

Hypertherm HOPE Foundation

VPP Voluntary Protection Programs An OSHA Cooperative Program

U.S. Green Building Council LEED GOLD USGBC

WORK LIKE AN OWNER
HSOP GSV P
THINK LIKE A CUSTOMER



	Waste	Energy efficiency	CO_2 Carbon impacts
Our products	100% All of our new products are reusable, recyclable, or properly reclaimed at the end of their useful life	20% ↑ Improve the energy efficiency of our product portfolio by 20%	20% ↓ Decrease the carbon impact of our products in use across the globe by 20%
Our logistics	30% ↓ The volume and weight of the packaging of our products is reduced by 30% and recyclable	Greener Cuts	50% ↓ Decrease the carbon impact of our global logistics network by 50%
Our business operations	0 ZERO WASTE We produce no landfill waste and no unnecessary water waste	30% ↑ Improve the energy efficiency of our global business operations by 30%	50% ↓ Decrease the carbon impact from our global business operations by 50%

Hypertherm Incorporated

- Founded in 1968, located in Hanover, New Hampshire
- Privately owned (ESOP)
- 1400 Associates world-wide, 1200 in New Hampshire
- 13 Facilities, 500,000 square feet mixed manufacturing, R&D, office

71 Heater Road, opened 2012

21 Great Hollow Road, opened 1970

Light Industrial Systems Business Unit

- Designs and Manufactures portable air plasma power supplies and torches
- Employs 100+ associates
  - 96% associates would give extra effort to help the company
  - Where 100% of associates contribute continuous improvements
- Began our lean journey in 1996

Light Industrial Systems Value Streams

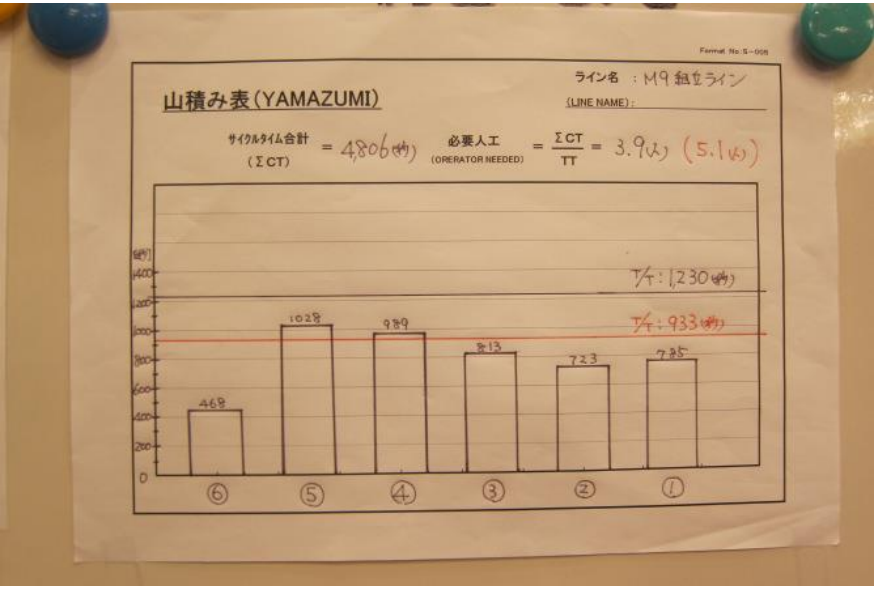
- Each Value Stream consisting of three work cells (Power Supply Assembly, Power Supply Test, System Configuration)

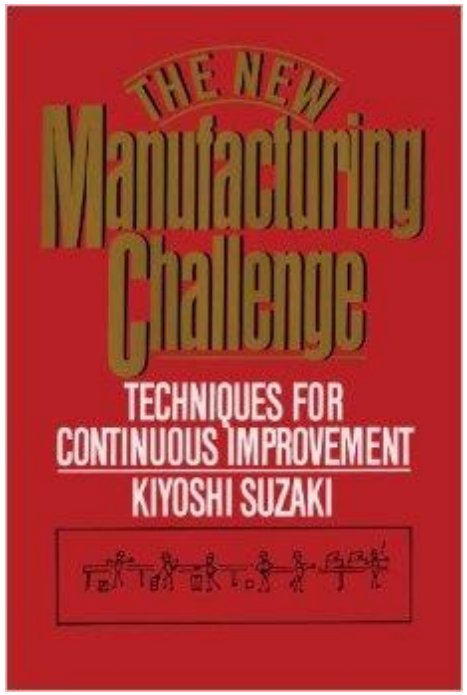
Each Value Stream:

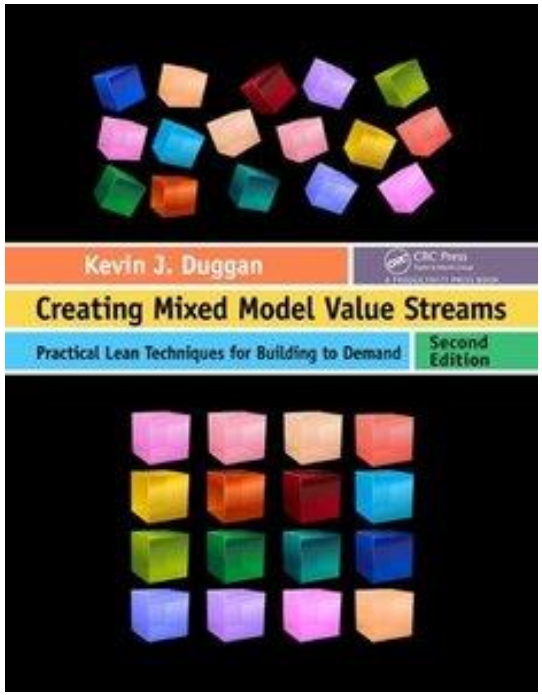
- Cycle Time: 5 – 7 Minutes per Workstation
- Single piece flow through entire operation
- Shared System Test:
  - 12 minute functional test
  - 30 minute burn in
  - Multiple test bays per value stream
- Total Lead Time Ladder: 1.8 – 2.5 hours

Classic Line Balancing

Graph Cycle Time versus takt (Operator Balance Chart or Yamazumi Chart)







Our Dilemma

- Some days, exceeding target; other days, missing target

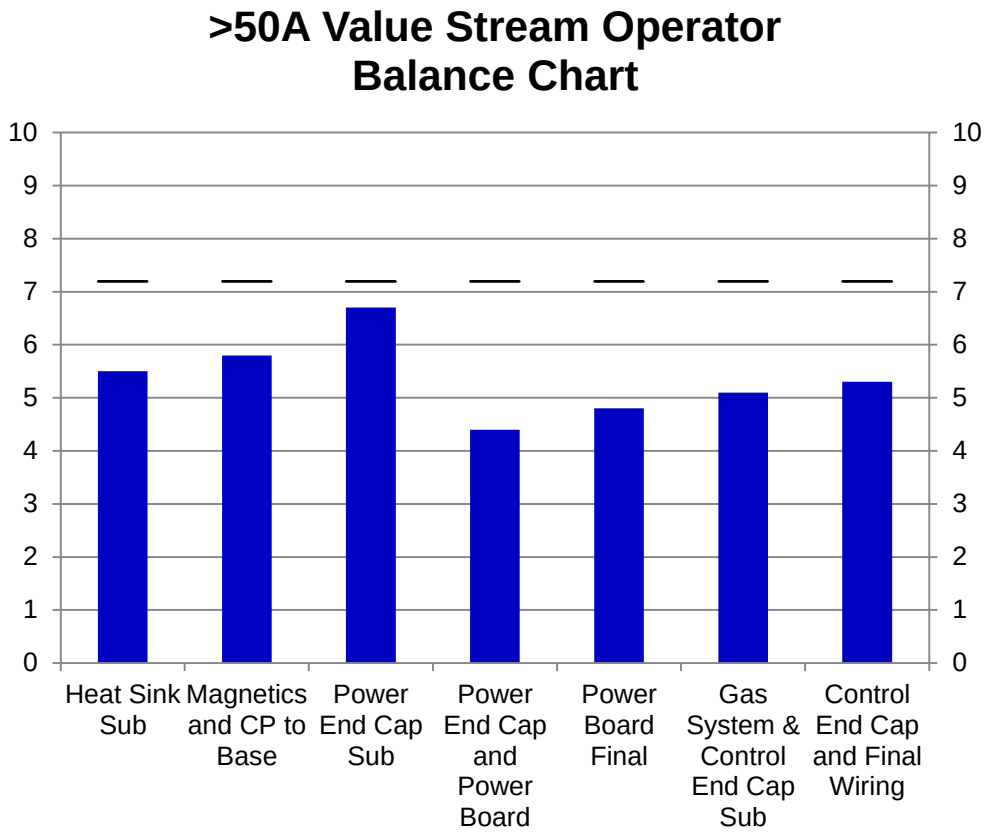
Ask the team…

- First Shift point kaizen reallocated 45 second of work from Power End Cap Station to the Magnetics Station.
- Second Shift reallocates it back to the Power End Cap Station.
- First Shift associates begin to disagree if Power End Cap Station is really the bottleneck.

Who is right???

Go to GEMBA

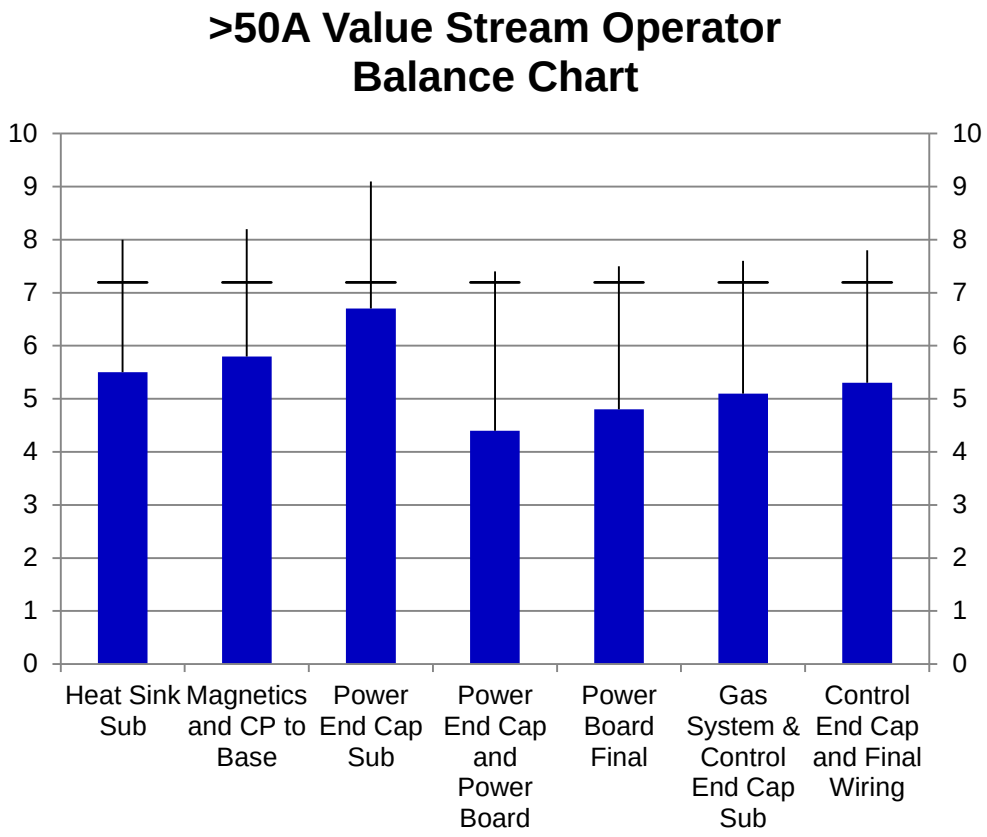
- Lets go see…
- Observe…
  Measure… and…
- What problem???



New Tool: Operator Balance Charts with Variability

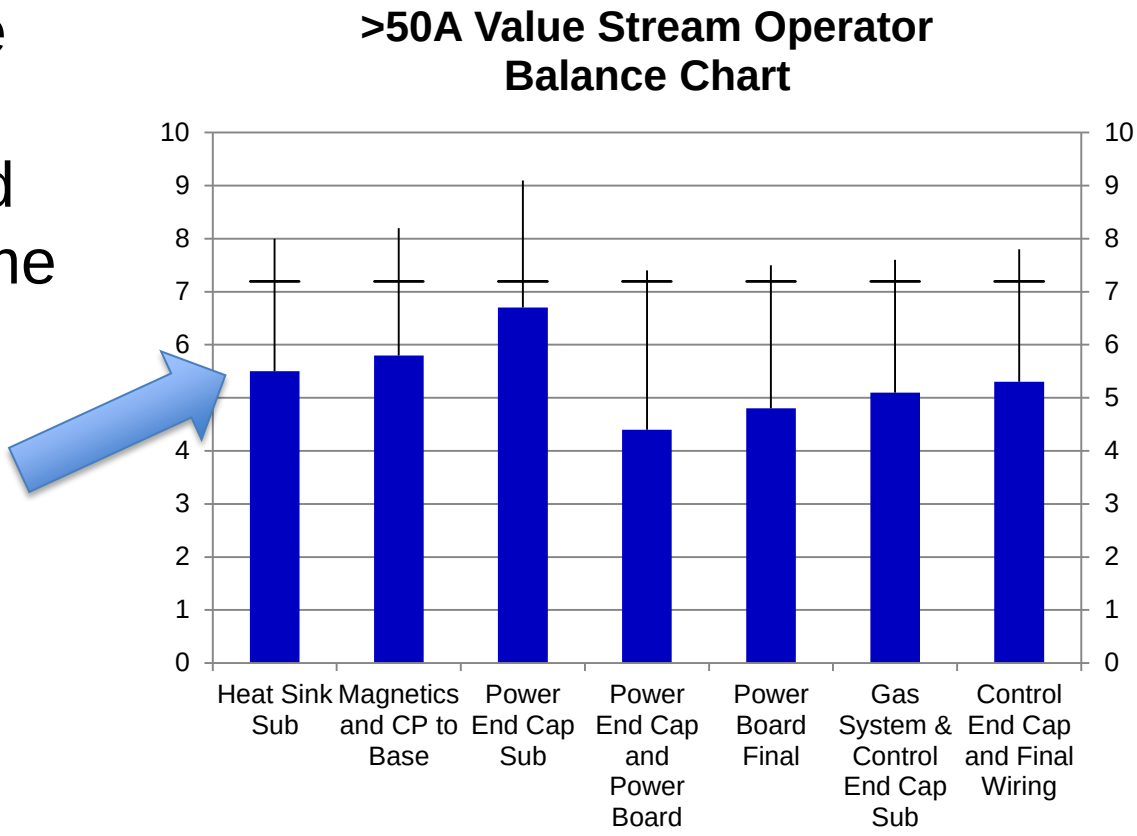
Measure both the best achievable cycle time and the variability

Plot both to understand the likelihood an operation will achieve takt



New Tool: Operator Balance Charts with Variability

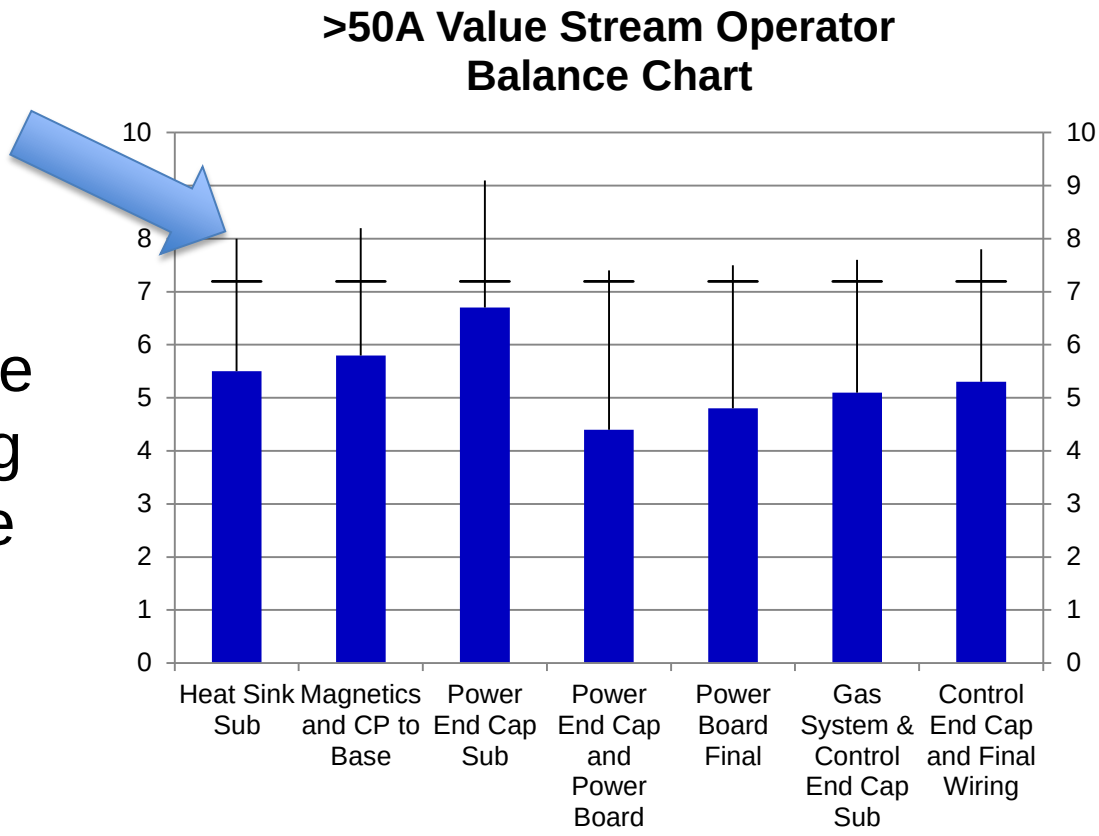
The height of the cycle time bar is the fastest (achievable) measured cycle time from the Time Observation Sheet



New Tool: Operator Balance Charts with Variability

A second bar should be created for the longest measured cycle time

The long bar will give the reader an understanding of the variability of in the process.



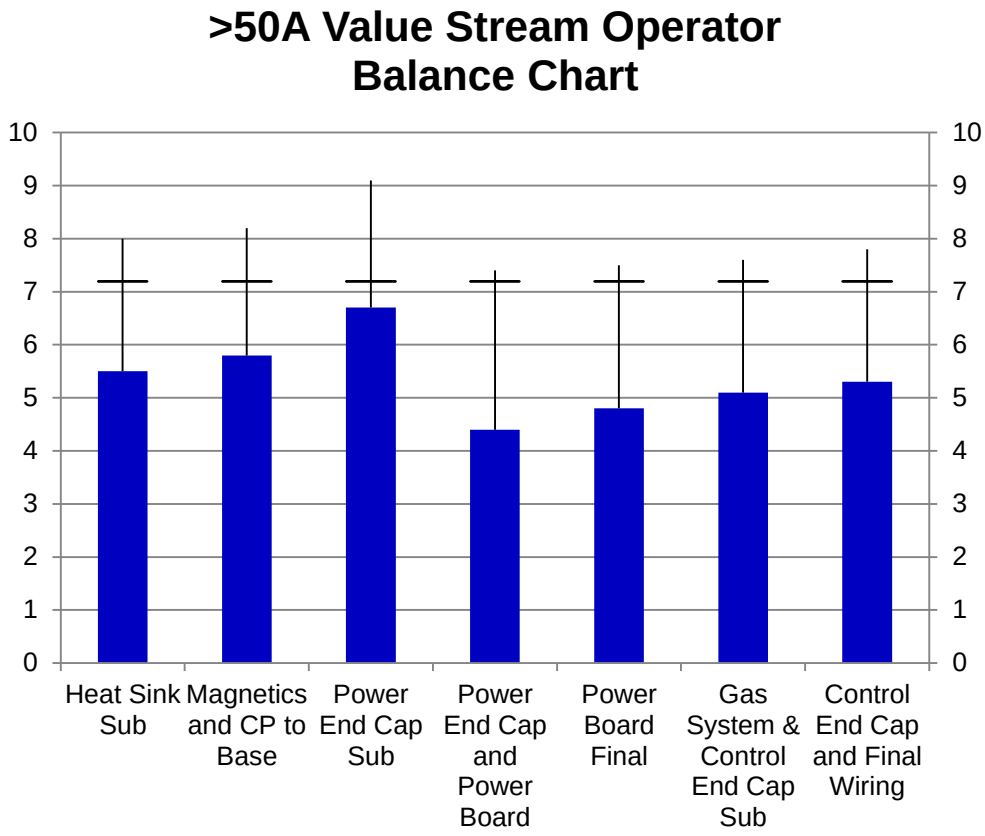
Conclusions from the Operator Balance Charts

- Each Process Sequence is engineered to meet takt

however

- Each Process Sequence has an unacceptable level of variability

- ***Variability is creating the line imbalance***



The Goal

Eliminate Variability

Create a standard that can be achieved (easily and without burden) by everyone.

Sources of Variability

Person to Person

- Differences between people performing the same task

Within Person

- Differences by the same person performing the same task

Model to Model

- Differences between models

Errors

- Abnormal events that add time to the cycle

Techniques for Reducing Variability

Person to Person Variation

- Engineer out required strength
- Reduce the need for manual dexterity
- Reduce the need for mental acuity
- Determine the best work sequence, and engineer the process so that it can only be performed in that way

Within Person Variation

- Insure critical dimensions and characteristics of supplied components are repeatable
- Reduce the need for manual dexterity
- Reduce the need for mental acuity

Techniques for Reducing Variability

Model to Model Variation

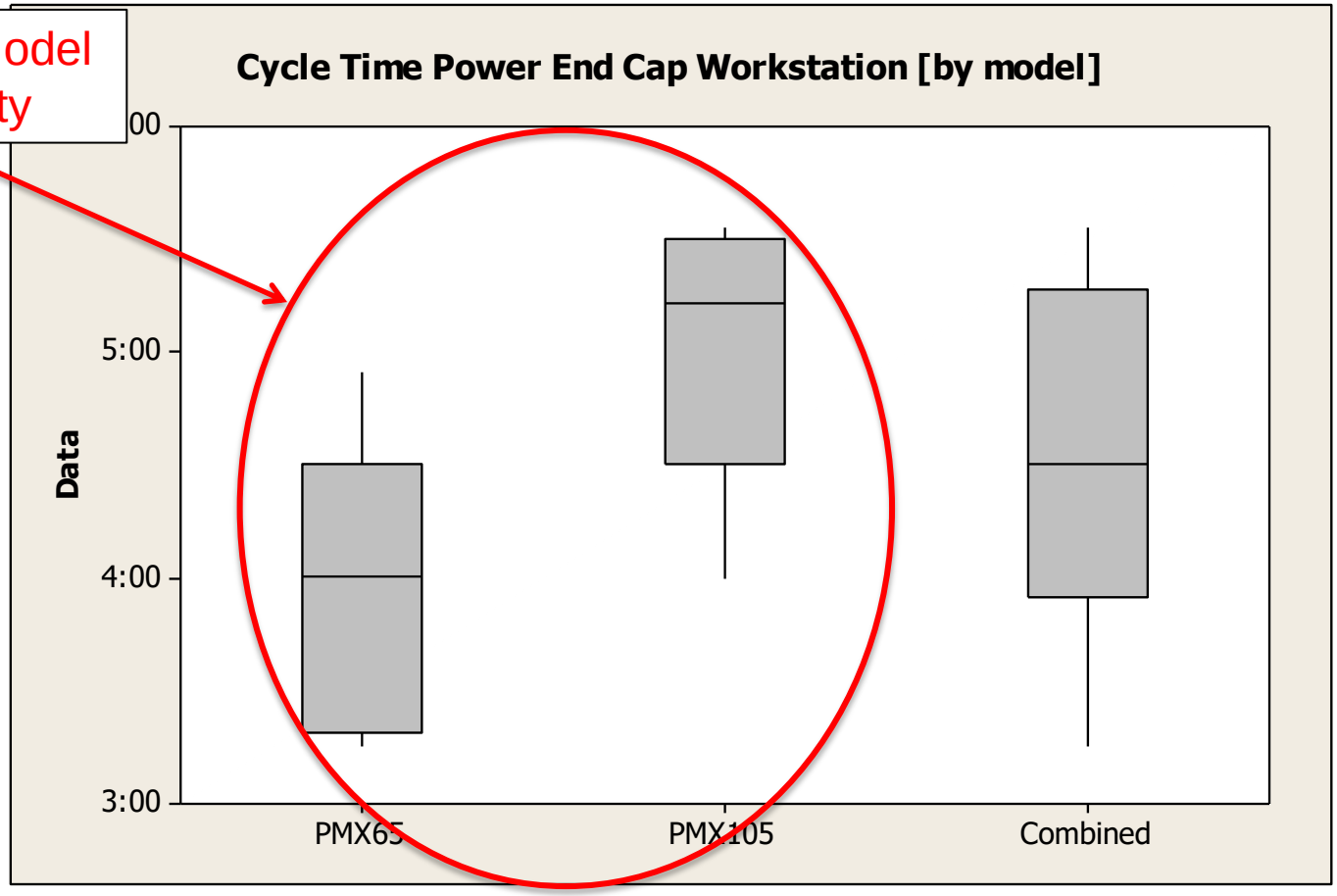
- Create design and part consistency between different models running in a mixed model value stream (reduce decisions)

Variation due to Errors

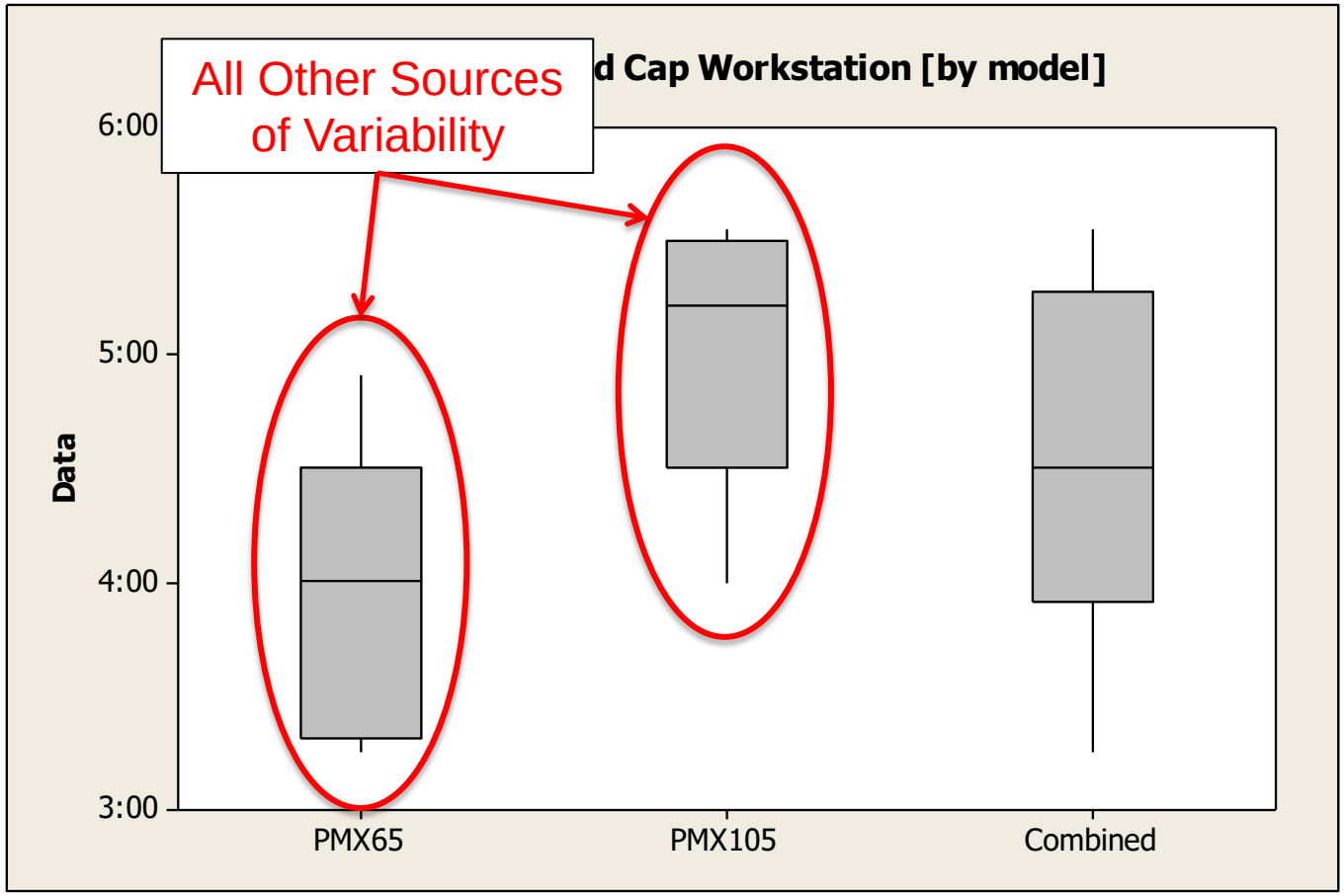
- Eliminate the possibility for generating the error
- Have the process provide feedback that the operation is being performed correctly (Source Inspection)
- Provide easy to use templates to check your work (Self Inspection)

Example:
Power End Cap Kaizen

Model to Model Variability



Example:
Power End Cap Kaizen



What We Discovered

- The process required ***undue strength***, skill, and knowledge
- There were ***technique differences*** between team members
- Best practice was not agreed to, or even known
- ***Errors*** forced associates to ***repeat tasks***
- Parts with the same design function had ***different forms and fit***

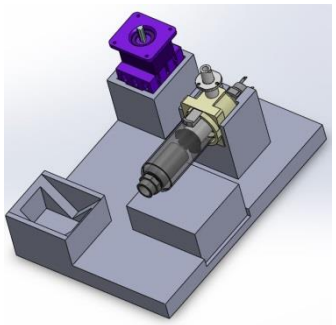
Example:
Power End Cap Kaizen

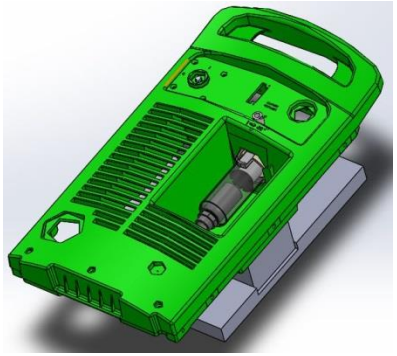
Original Method

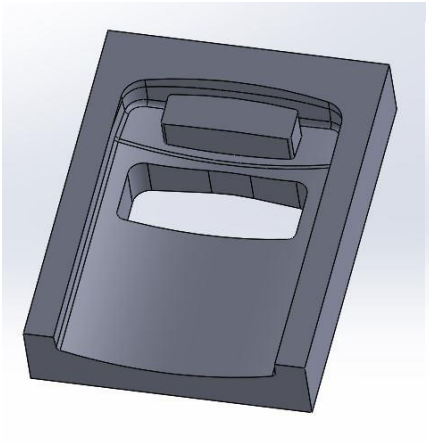
Person to Person Variability

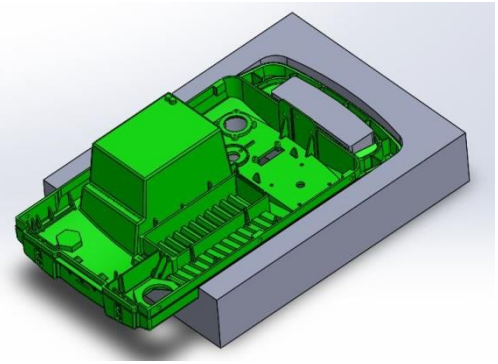
Example:
Power End Cap Kaizen

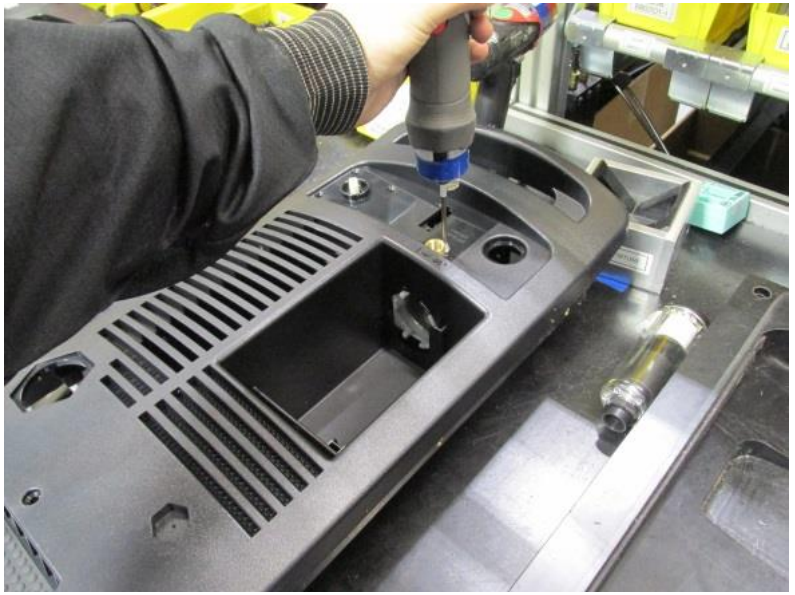
New Method











Person to Person Variability

Example: Power End Cap Kaizen

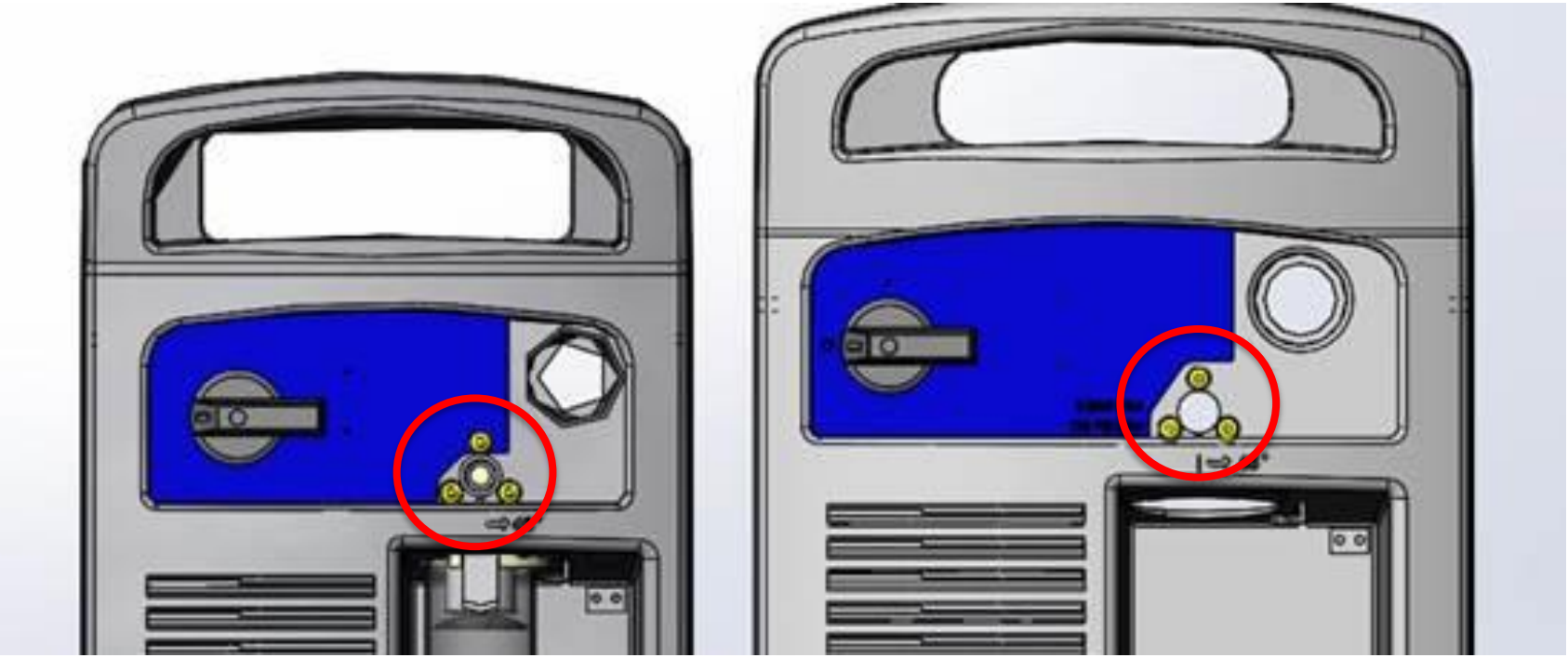
Part Consolidation

- Design Engineering standardized to a universal Wire group (down from 4)
- Supplier partner suggested a flanged-nut in place of a strain relief (eliminating 4 varieties of strain reliefs)

Within Person Variability

Example:
Power End Cap Kaizen

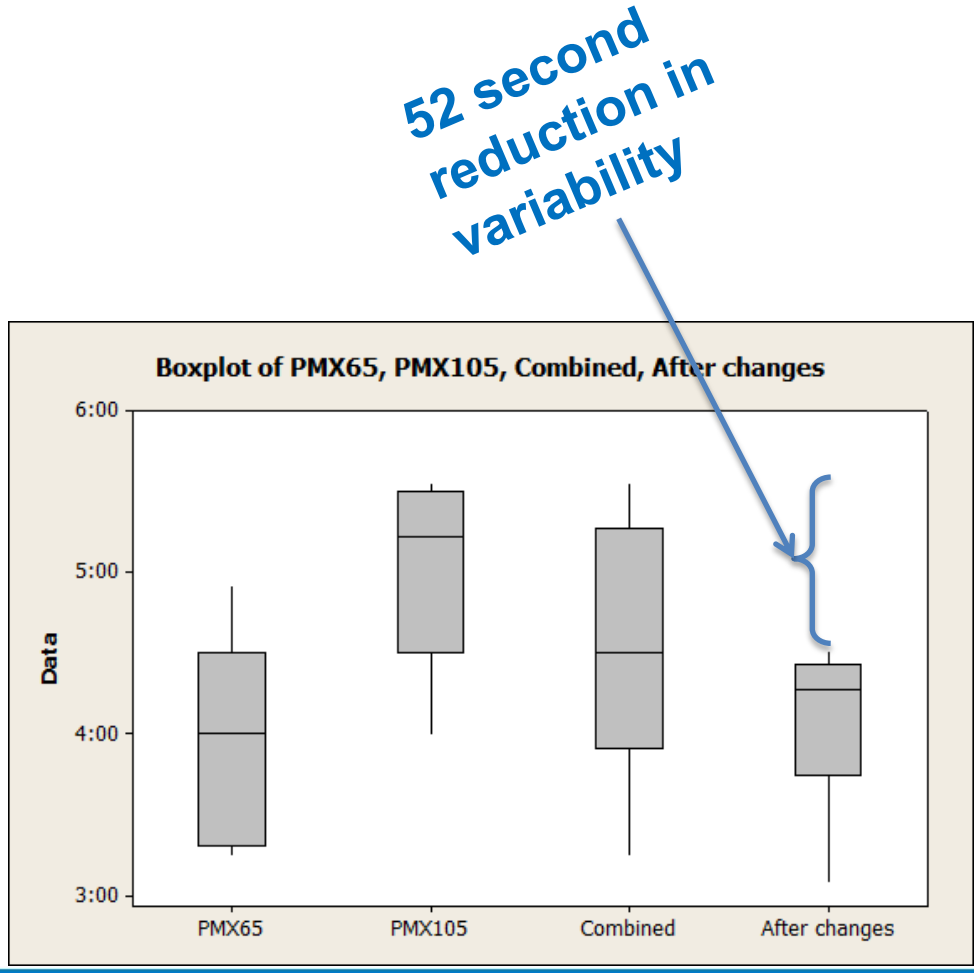
Standardize Design



Model to Model and Variability from Error

Results: Power End Cap Kaizen

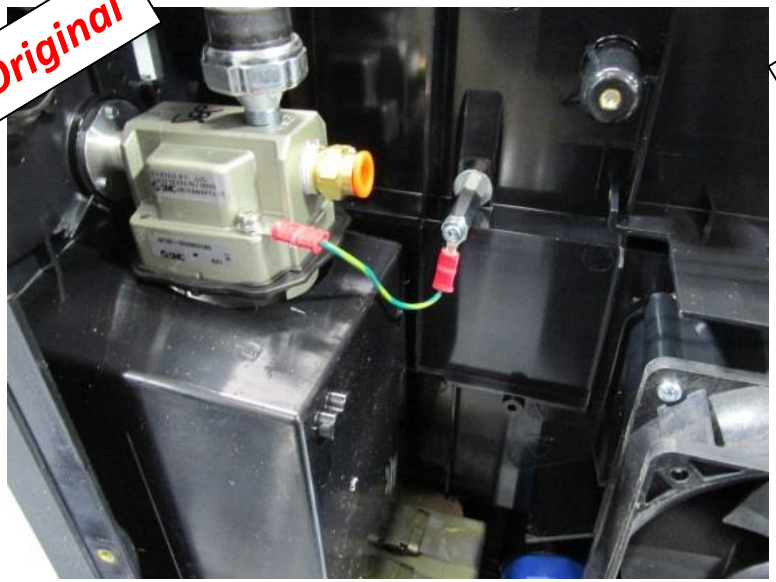
- 37% reduction in cycle time variability (138 second difference to 86 seconds)
- 38.5% reduction in part bins at workstation (39 to 24)
- 61% reduction in tools (18 to 7)
- 36% reduction in floor space (150” wide to 96”)



Point Kaizen: Ground Wire Consolidation

Worked with Design Engineering to consolidate from three models to one universal ground wire.

Original



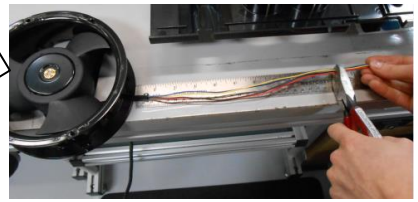
New

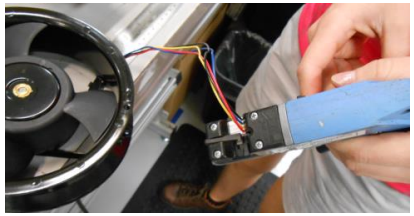
Person to Person and Variability from Error

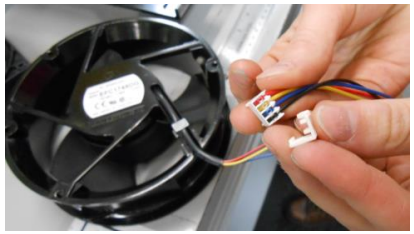
Point Kaizen:
Fan IPC Connector

Worked with supplier to install connector on fan to standardize between models.

Original







New

Model to Model Variability

Point Kaizen: Fan Packaging

Worked with supplier to reduce packaging to eliminate dunnage.

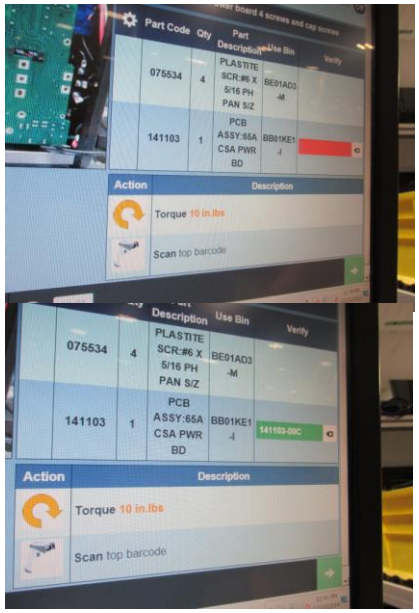
Original

New

Within Person Variability

Point Kaizen: Part Verification

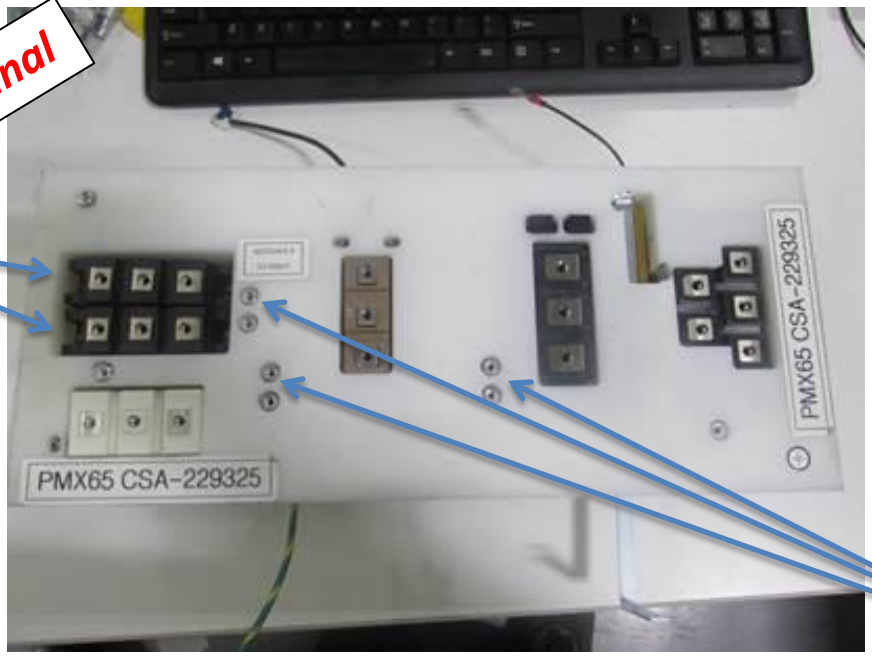
Worked with suppliers to place barcode identifiers on all parts that were unique to an assembly.



Variability from Error

Point Kaizen: Resistor and Diodes

Worked with Test Engineering to develop an inline tool for associates to verify resistor values and diode orientation.



Point Kaizen: Resistor and Diodes

Worked with Test Engineering to develop an inline tool for associates to verify resistor values and diode orientation.

New

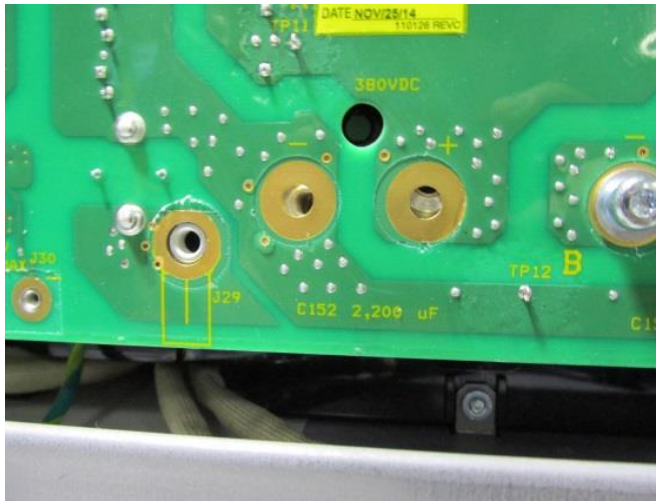
Self Checking

Variability from Error

Point Kaizen: Capacitor Insertion

Worked with Manufacturing Engineering to develop a fixture to aid in insertion and alignment of bulk capacitors into the system.

Original



Person to Person Variability

Point Kaizen: Capacitor Insertion

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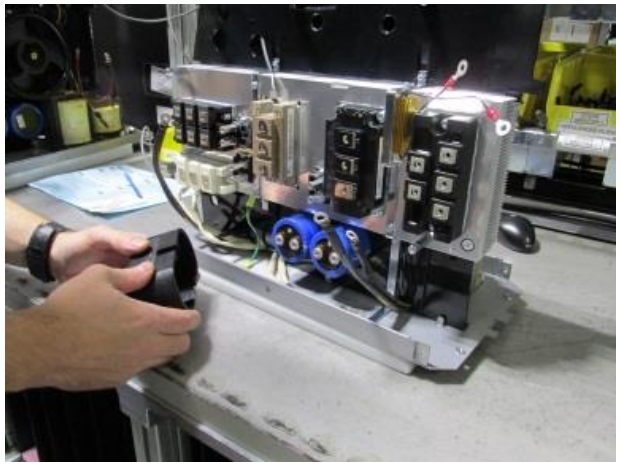


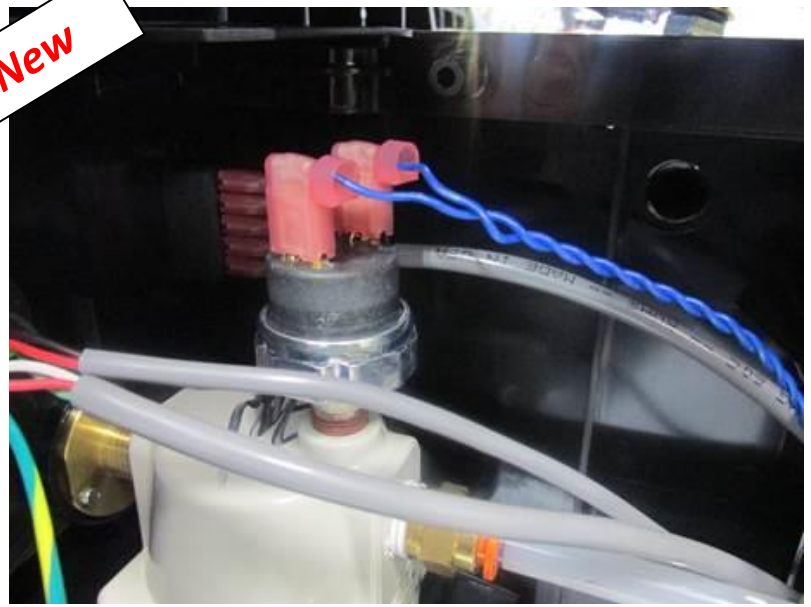
Person to Person Variability

Point Kaizen: Signal Wire Standardization

Worked with Design Engineering to not color code wires where polarity is not required for the function of the system.

Original

New



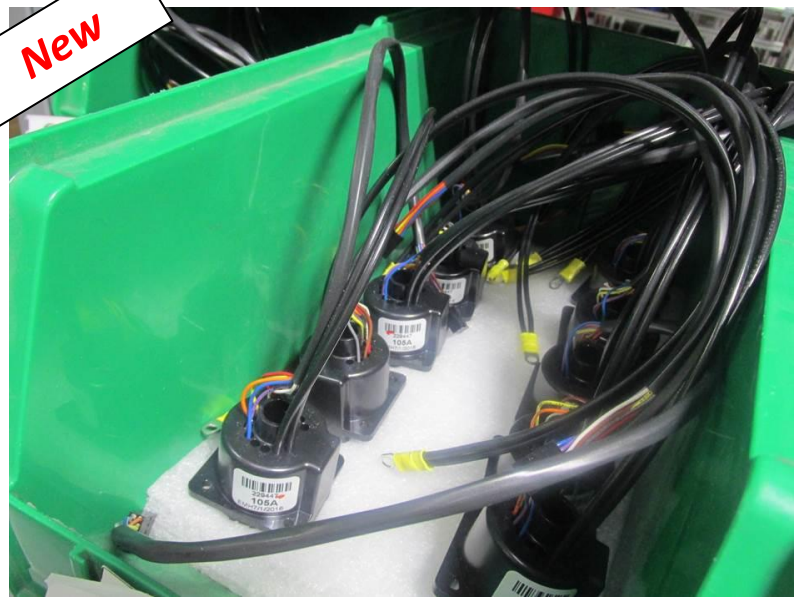
Variability from Errors

Point Kaizen: Supplier Packaging

Worked with Suppliers to develop returnable, zero waste packaging.

Original

New

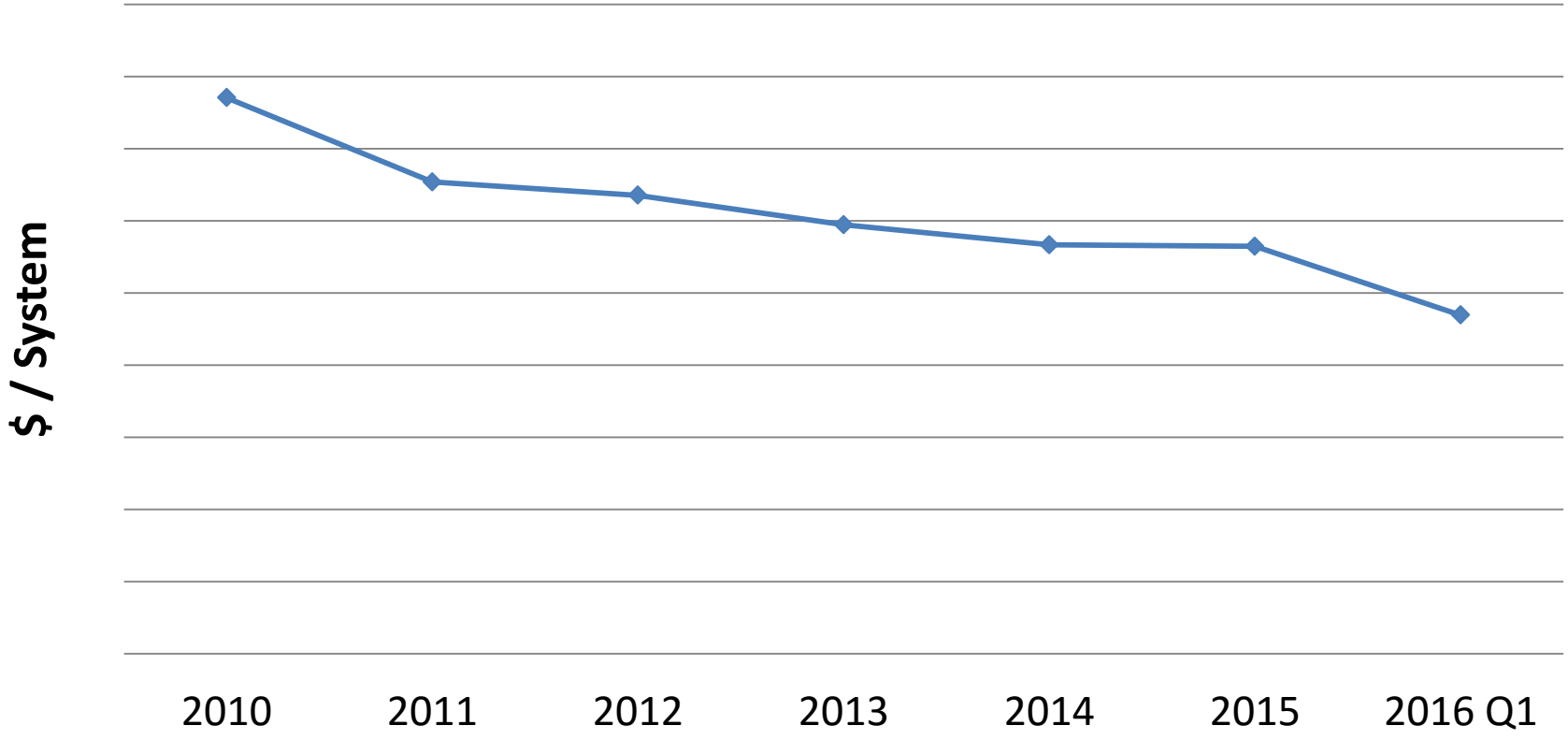


Within Person Variability

Results

Direct Labor $ per System

40% Reduction since 2010



Results

Hypertherm Associates

- Are engaged in the work they perform
- Are willing to give extra effort
- Are willing to try new things for the betterment of the business

CEB Survey Question	LIS Operations Team	CEB Global 90th Percentile
I am willing to give extra effort to help Hypertherm meet its goals.	96%	83%
I understand how my work projects or assignments are connected to Hypertherm's overall strategy.	85%	78%
On my direct team, we are continually improving the quality of work we do.	83%	77%
On my direct team, we fix problems so that they don't happen again.	83%	74%
Hypertherm accepts mistakes in the process of trying new things.	83%	61%
I feel encouraged to come up with new and better ways of doing things.	80%	70%

Questions

Thank You!

Your opinion is important to us!
Please take a moment to complete the survey using the conference mobile app.

Session: TP/16
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