

# The Poka-Yoke System

## Is Zero Defects a Reality?

Poka Yoke

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Slide 1

This Course has the following outline:

Introduction:

Section One “Shingo’s Manufacturing Structure”

The main point to consider throughout Section One is to be able to recognize waste, determine where waste occurs.

Section Two

## We have Quality Problems!

In American manufacturing, this statement leads to an unsatisfactory resolution to the problem. “We have Quality Problems” shifts the concerns from the undetermined true source (operation & process) to an area where the root cause never occurred (Quality Control) and the true cause is addressed and corrected through high cost inspection methods.

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It has been my experience that...

When difficulties in product arise, Quality Control usually finds it, analyses it, and reports the results to management. This process is fine, it is Quality's Job to do this. What ends up happening in some situations is Quality ends up owning the Problem. The use of Statistic helps to keep the Problem alive.

Although SPC is a good tool for identifying problems it does very little to prevent them from happening. We see week after week of process and product monitoring with small improvements being made but not major jumps. What could be missing.

What we see happening is a Fire. Quality Confirms the Fire, monitors its progress and everyone tries to put out the fires. Juran termed this sporadic problem Solving. we use containment practices, but what truly ends up happening, is we all stand around and watches it burn.

## We Have Quality ~~Problem!~~

If we review the manufacturing structure and the functioning elements to which the product is going to be exposed to, we will be able to determine possible root causes to the problems prior to production. This is known as Quality Planning and if done properly can eliminate the need for the Quality Control.

(Man, Material, Machine, Method, or Measurement)

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This is more in line with what Juran termed Chronic Problem Solving. We need to change the present situation and use a team approach. Quality is not the means to the end, it is simply a point in the process. To find the real problem, we need the Process and Operation Experts, we must look at the whole manufacturing structure and develop a team focus. (this is the APQP class)

# Section One

## Shingo And The Manufacturing Structure

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# Poka Yoke Defined

Shigeo Shingo defines Poka Yoke as:

- ◆ Poka
  - “Inadvertent Mistake That Anyone Can Make”
- ◆ Yoke
  - “To Prevent or Proof”

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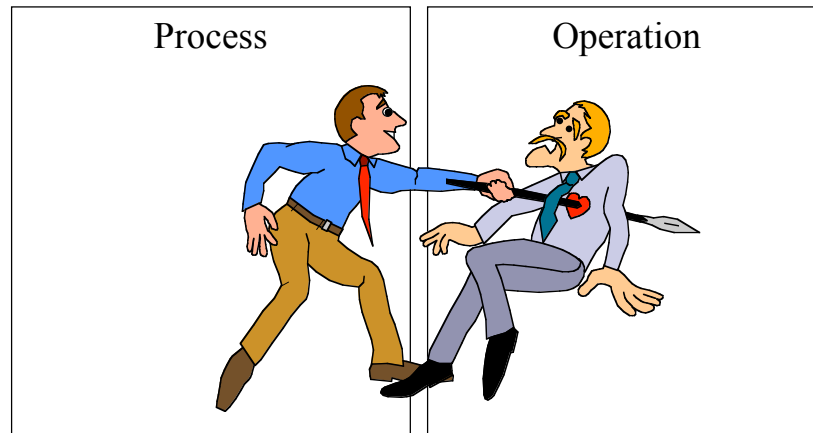
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Shigeo Shingo, a Japanese Industrial Engineer, contributed many concepts to modern Management and Manufacturing practices. Some of these included the creation of:

- Zero Quality Control “Shipping No defects”
- Sequence Inspection “Checking previous work, Prior to starting your task”
- Source Inspection “Checking ones own work”
- Poka Yoke “Mistake Proofing”
- SMED (Single Minute Exchanges of Dies)

Although he did not create the concepts of Sequence and Source Inspection, Shingo developed a structure of knowing which to use when.

Manufacturing is a network of two structures.  
Problems Occur When They Disagree!



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To obtain the proper base of Shingo's work, we must adopt the Japanese mind set of manufacturing which differs (Thank GOD) from Frederick W. Taylor.

Japanese view manufacturing as a network consisting of two interrelated structures.

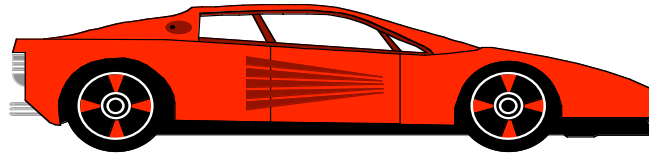
The Process Structure: the flow by which raw materials are converted into finished goods. Within the process structure, there are four categories to which a process goes through.

The Operation Structure: the actions performed on materials. Three categories can be occurring within the operation structure. Preparation and After Preparation adjustments, Principal Operations, Marginal Allowances.

# Operation & Process

## Operation

Some People Know How to Drive a Car! Driving is an Operation.



## Process

Some People Know How to Repair a Car! Repairing is a Process.



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Most People Know How to Drive a Car!

◆Abilities and Tasks differs:

- Race car driver
- Truck Driver
- Sunday Driver

◆Abilities and Task Differ:

- Designers
- Repairers
- Builders

## Categories of the Process Function

**A Process is the flow by which raw materials are converted into finished goods.**

**Processes fall into one of the following categories:**

- ◆ **Work:** assembly, disassembly, alter shape or quality
- ◆ **Inspection:** comparison with a standard
- ◆ **Transportation:** a change of location
- ◆ **Delay:** time during which no work, transportation or inspection takes place
  - **Process Delays :** Lot does not move until last item finished in process
  - **Lot Delays:** lot delayed in order to maintain 100, 99, 98 ... 2,1,0

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## Categories of the Operation Function

**An Operation is the actions performed on material within the process.**

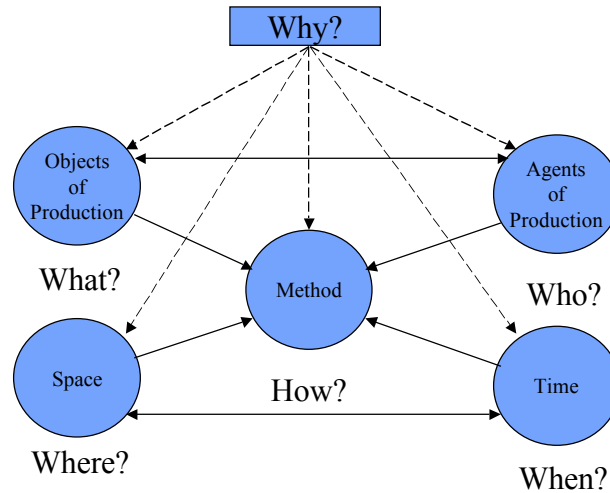
**Operations fall into one of the following categories:**

- ◆ **Preparation/Adjustments Phase:**(setup, tool change, Adjustments)
- ◆ **Principal Operations Phase:** Operations repeated in each cycle (Hole Punch, Drill, Sheer)
  - Main Operations (Stamping, Cutting)
  - Incidental Operations (movement of press, movement of people)
- ◆ **Marginal Allowances:**
  - Fatigue
  - Hygiene (wash hands, etc.)
  - Operations (shut-down to produce rush order, meetings)
  - Work place (breaks, cleaning, maintenance)

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## 5 Elements of Production



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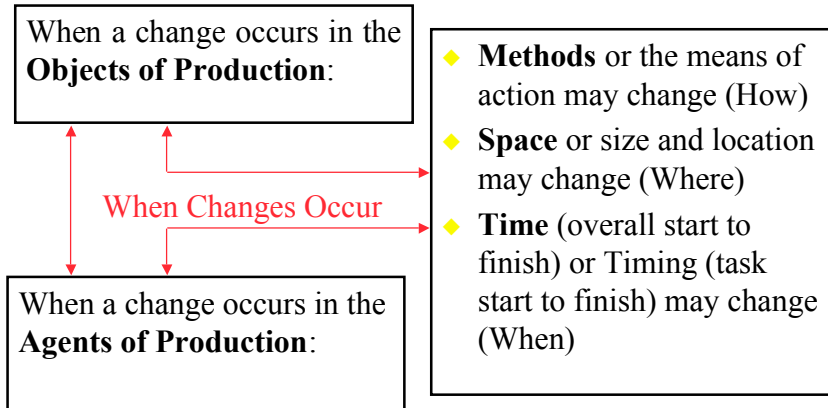
- **Objects of Production:** The Product  
*Materials, Semifinished & Finished Goods*
- **Agent of Production:** The people in charge of Product, The Machines, Tools, and other equipment assisting them.  
*Man, Machines, Tools, Jigs, Gaging*
- **Methods:** Means by which actions are performed  
*Work Instructions, Procedures, Manuals*
- **Space:** Where actions are performed and the locations to and from which objects are transported.  
*Processing system, Balanced Load and Capacity, Processing Condition*
- **Time:** The timing of work or how long action take.  
*Time and Timing*

## Defining The 5 Elements

- ◆ **Objects of Production:** Materials: Raw, Finished, Semifinished, in-process
- ◆ **Agents of Production:** People, Machines, Tools, Jigs, Machine Tools, Incidental Devices, Inspection Equipment, The Environment, etc.
- ◆ **Methods:** Processing System, Load & Capacity Balance, Processing Conditions
- ◆ **Space:** Left to Right, Front to Back, Top to Bottom
- ◆ **Time:** Process Time, Production Time, Task Time

## Changes in the Elements

When Changes Occur, Balance Must be Achieved Again






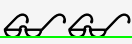

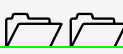






















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# 4 Process Phenomena's

Delays

	Process	Work	Inspection	Transprotation	Storage
<b>Operation</b>					
Planning, Prepaton. & Adjustment Operations (setup Operations)					
<b>Principal Operations</b>					
Main					
Incidental					
<b>Marqin Allowances</b>					
Fatigue					
Hvciene					
Operations					
Workolace					

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## Shigeo's Five Questions

**A Problem (or Delay) Occurs ask**

- ◆ Why? Describe.
- ◆ Why? Describe.
- ◆ Why? Describe.
- ◆ Why? Describe.
- ◆ Why? Response!

# Section Two

Is There a Difference Between An Error and A Defects?

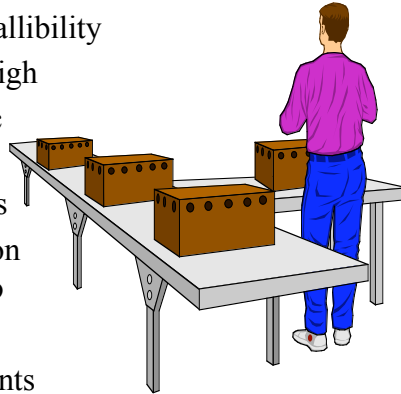


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## Reasons Why We Don't Need Poka Yoke

- ◆ Workers Possess Divine Infallibility
- ◆ Implementation Costs are High
- ◆ The World is not a Dynamic Environment
- ◆ It is Cheaper to Hire Sorters
- ◆ Quality Control & Production Would Have Nothing To Do
- ◆ We are All Too Busy
- ◆ We use SPC for Improvements



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## Separating Error From Defect

- ◆ Humans Make Errors (Cause), Defects Arise Because Errors Are Made (Effect).
- ◆ It is Impossible to Eliminate Errors From Tasks Performed by Humans.
- ◆ Errors Will Not Turn into Defects if Feedback and Action Takes Place at The Error Stage.
- ◆ Changing Occurrences can reduce Reoccurrence

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- ◆ Humans Make Errors (Cause), Defects Arise Because Errors Are Made (Effect).
- ◆ It is Impossible to Eliminate Defects From Tasks Performed by Humans.
- ◆ Yet Errors Will Not Turn into Defects if Feedback and Action Takes Place at The Error Stage.
- ◆ The Difference Between Occurrence and Reoccurrence
  - The Paint Story “What Did You Learn”
  - The Hammer Story “Hurts More The Second Time”
  - My Brother & His Stuck Car
- ◆ The Paint Bucket was an Occurrence, I Bring the Paint Can Down with ME.
- ◆ The Hammer is an on going Reoccurrence, I need to Buy an Automatic Nail Gun.
- ◆ My Brother is another story.

# Causes of Defects

## ◆ **Process Defects**

- Process Failure
  - ◆ Operational or Procedure Failures
- Process Error
  - ◆ Incorrect or Imprecise

## ◆ **Product Defects**

- Incomplete Product
- Substandard Product

## Levels of Defects

- ◆ **Level 1:** Defects Shipped out of Factory (Taylor Methods)
- ◆ **Level 2:** Defects Kept within Factory (Sheward Methods)
- ◆ **Level 3:** Defects Reduced (Juran/Demming Methods)
- ◆ **Level 4:** Defects Kept within Production Stage (Juran/Demming Methods)
- ◆ **Level 5:** Defects Not Produced (Shingo Methods)

## Section Three



### **Inspection**

Taylor's Plan

Shewhart, Demming & Juran's Plan

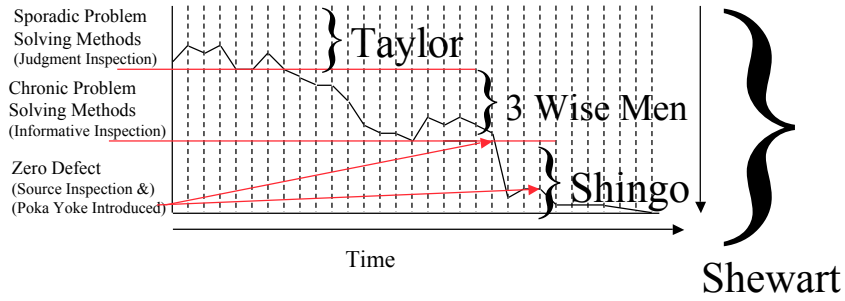
Shingo's Plan

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# Inspection Philosophies

Kaizen  
Continuous Improvement



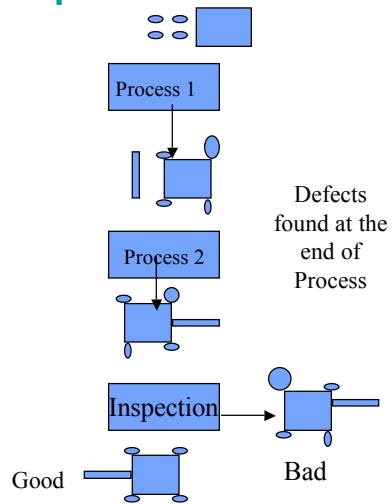
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## 3 Methods of Inspection

- ◆ Judgment Inspection (Taylor's)
  - › Inspection That Discovers Defects
- ◆ Informative Inspection (Shewhart's)
  - › Inspection That Reduces Defects
- ◆ Source Inspection (Shingo's)
  - › Inspection That Eliminates Defects

# Judgment Inspection

- ◆ Attribute Inspection of Product Which Discovers Defects at the end of the process.
  - Rework Costs
  - Process Costs of Nonconformities
  - Scrap Costs
  - No Information about Process

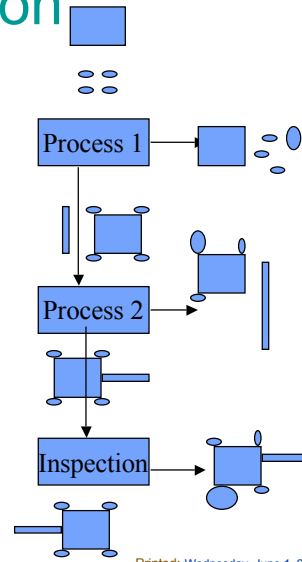


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# SPC Inspection

- ◆ Inspection of product Which Reduces Defects at the end of process using inner process checks.
  - Inspection Costs
  - Delay Costs
  - Extra Equipment Costs
  - + Scrap Cost Reduced
  - + Information (Grading or Variable Data) Gained about Process



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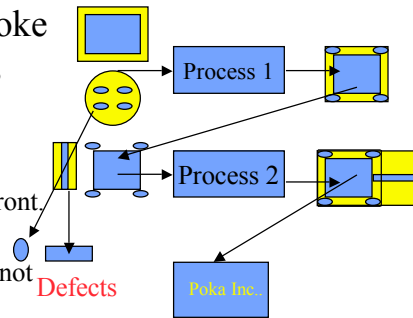
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## Source & Sequential Inspection

- ◆ Inspection Built into the Operation using Poka Yoke Devices to Detect Errors Before They Become Defects.

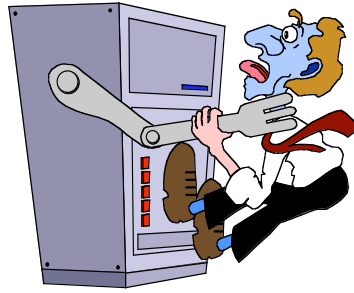
- + Pushes Defect Detection Up-front. Cost Reduced
- + Nonconforming Materials are not processed.
- + Eliminates need for SPC
- Minimal Cost of Poka Yoke Devices
- + Reduces Steps in Process



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## Section Four



## Efficiency & Waste

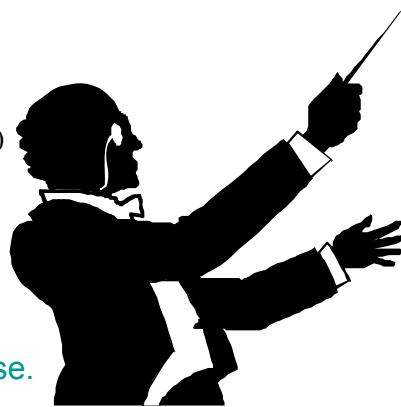
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# Production Efficiency & Waste

- ◆ Melody
  - Flow Production
- ◆ Rhythm
  - Tack Time (Level Production)
- ◆ Harmony
  - Standard Operation Man,  
Machine, Material, Method,  
Measurement

\* Any Element Missing or  
Incomplete We Have Noise.  
(Waste)



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## Types of Waste

- ◆ Stock Inefficiency
- ◆ Excess Stock Parts & Materials
- ◆ Transportation Inefficiencies
- ◆ Inefficient worker movement
- ◆ inefficient results from looking for things
- ◆ Selection inefficient
- ◆ Defective production

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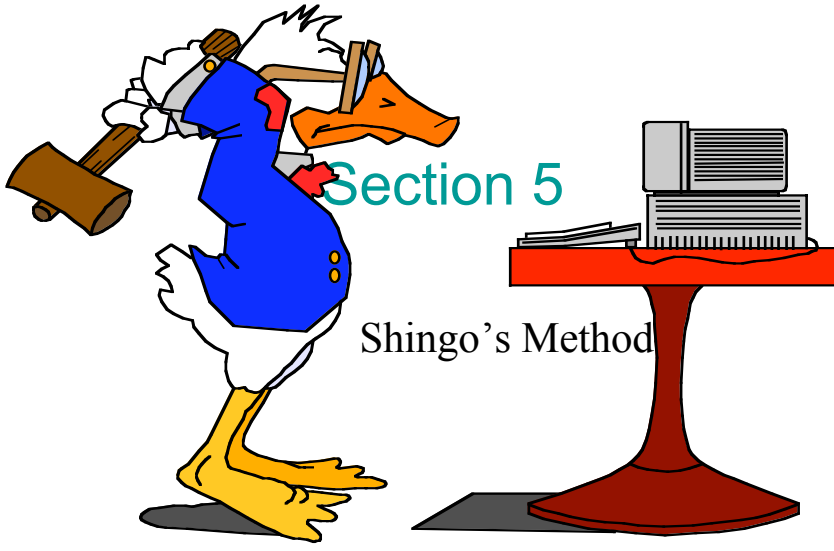
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## Cost Contributing to Waste

- ◆ Materials
- ◆ Processing
- ◆ Depreciation
  - ◆ Repairs
- ◆ Transportation
  - ◆ Recalls
- ◆ Replacement
- ◆ Advertising

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Section 5

Shingo's Method

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The image features a cartoon duck wearing a blue jacket and yellow shoes. The duck is holding a hammer in its right hand and has another hammer in its beak. To the right of the duck is a red table with a typewriter on it. The text 'Section 5' is written in green, 'Shingo's Method' in black, and 'Poka Yoke' in black below the duck. In the bottom right corner, there is a small blue text box containing the date and slide number.

## Shingo's Method

A Poka Yoke System uses Poka Yoke Devices Built into Source or Sequential Inspection Methods. Properly Implemented, the System can achieve

- ◆ **Zero Defects**
- ◆ **Zero Waste**
- ◆ **Zero Delays**

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## Poka Yoke Devices, Systems & Inspection

### **Poka Yoke Systems**

#### ◆ **Control Systems**

- Halt the operations, and require feedback and action before process can resume.

#### ◆ **Warning Systems**

- Uses signals to warn the operator that the operations needs feedback and action

(SQC systems have fairly long periods of time between check stages and feedback execution)



## Poka Yoke Devices, Systems & Inspection

### **Poka Yoke Devices**

- ◆ Are built within the the process
- ◆ In General have low cost
- ◆ Have the capacity for 100% Inspection  
(Remember SQC is performed outside the process which add cost, and allows defects to escape the system)

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## Poka Yoke Devices, Systems & Inspection

### Inspection with Poka Yoke

- ◆ Source Inspection (ZQC)
  - built into process
  - leads to a zero defect Systems
- ◆ Self Check Informative Inspections (SQC)
  - built inside or outside immediate process
  - reduces defects to a minimum
- ◆ Successive Check Informative Inspection (SQC)
  - built inside or outside sequential process
  - reduces defects to a minimum

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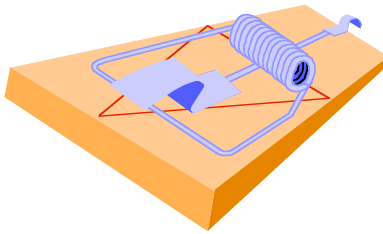
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# Movie “Poka Yoke”

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## Section 6



## Tools For Assessment

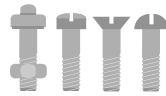
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# Organizing Systems for Zero Defects



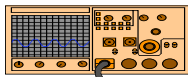
People



Materials



Methods



Machines



Information



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## Questions to Ask About Present Systems

- ◆ Can we take current informative inspection systems with successive checks and improve them to get a system of informative inspections with self-check methods?
- ◆ Can we take current informative inspections with self-check methods and improve them to get source inspection?
- ◆ Since informative inspections tolerate the occurrence of defects, can we take these methods and improve them to get source inspection in which the errors that cause defects are detected and prevented from turning into defects.

## Greensburg GenCorp Line

- ◆ Operation 10 Roll Mill
- ◆ Operation 20 Shuttle
- ◆ Operation 30 Bracket Weldment
- ◆ Operation 40 Rivet on Clip
- ◆ Operation 50 Check & Pack

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