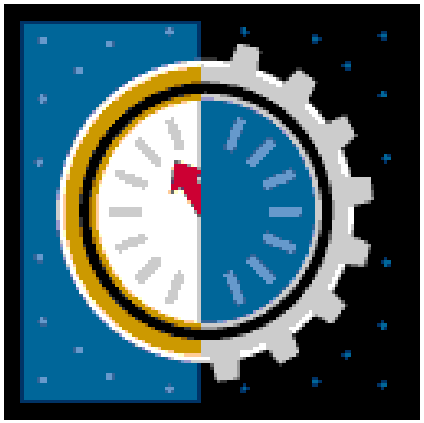
ZERO DEFECT

EMP-5179: Module #7

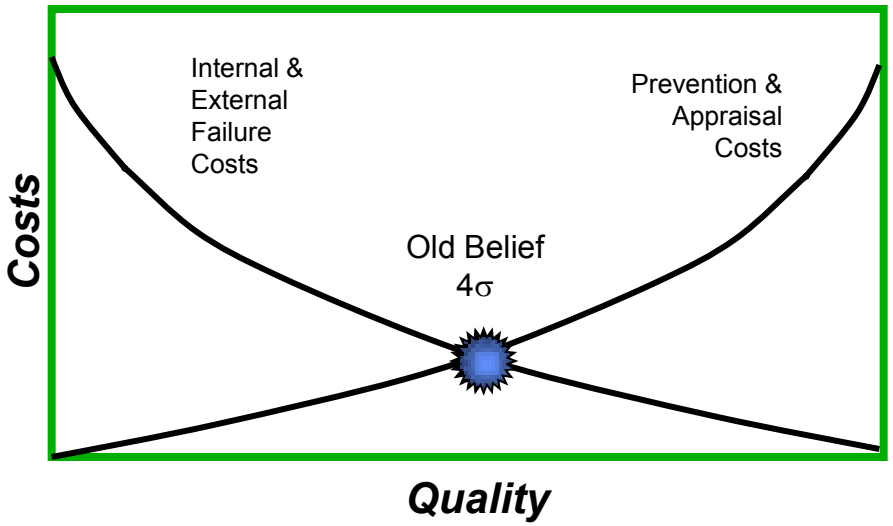
- **Zero Defect Quality (ZDQ)**
- Mistake Proofing (Poka-Yoke)
- 5S & Waste
- Relations with Suppliers

What is a Zero Defect Quality System (ZDQ)?

- A quality concept to manufacture ZERO defects & elimination of waste associated with defects!
- Based on a discipline that defects are preventable.
- No finger-pointing - operators and machines will sometimes make mistakes.
- Find ways to keep errors from becoming defects!
- Maintain Customer Satisfaction & Loyalty
  - *Happy Customers mean more sales!*



Cost of Quality

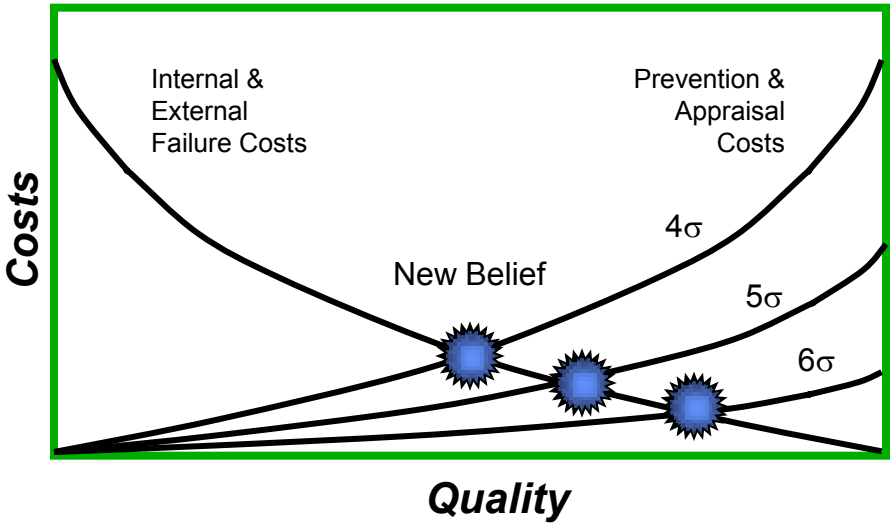


Old Belief

High Quality = High Cost

New Belief

High Quality = Low Cost

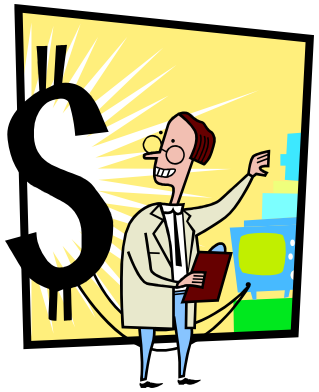


Cost of Quality

Does it cost more to make processes better ?

Making processes better leads to reduced

- Rework
- Scrap
- Warranty costs
- Inspection costs



Inspection

- Judgement/Standard Inspection
  - *Traditional methodology*
  - *Sampling, less than 100%*
  - *Low impact on process or quality*
- Informative Inspection
  - *QA Department or Successive*
  - *SPC*
  - *Reactive*
- Source ('Point of Origin') Inspection
  - *Monitors the process (not its output)*
  - *Flags a problem before a defect is produced*

Source Inspection

- Check for optimum process conditions before processing is done and errors can be made
- Instant feedback
- Corrections are made before defects occur

What Tools are Used to Achieve Zero Defects?

- Cultural factors
  - *teams, driving out fear, management commitment*
- Variance
  - *SPC, Taguchi*
- Complexity
  - *process mapping, TQ*
- Mistakes
  - *Mistake-proofing, Poka-Yoke*

What Causes Defects?
Process Variation from:

1. **Poor procedures or standards.**
2. **Machines.**
3. **Non-conforming material.**
4. **Worn tooling.**
5. ***Human Mistakes.***

Except for human mistakes, these conditions can be predicted and corrective action can be implemented to eliminate the cause of defects.

Ten Types of Human Mistakes

- Forgetfulness
- Misunderstanding
- Wrong identification
- Lack of experience
- Willful (ignoring rules or procedure)
- Inadvertent or sloppiness
- Slowliness
- Lack of standardization
- Surprise (unexpected machine operation, etc.)
- Intentional (sabotage)

Definition


Shigeo Shingo

Mistake:

The execution of a prohibited action,
the failure to correctly perform a required action
or the misinterpretation of information essential to
the correct execution of an action

Mistake proofing:

The use of process or design features to prevent
manufacture of non-conforming product.

Everyday Examples

3.5 inch diskettes cannot be inserted unless diskette is oriented correctly. This is as far as a disk can be inserted upside-down. The beveled corner of the diskette along with the fact that the diskette is not square, prohibit incorrect orientation.

Fueling area of car has three error-proofing devices:

1. *insert keeps leaded-fuel nozzle from being inserted*
2. *tether does not allow loss of gas cap*
3. *gas cap has ratchet to signal proper tightness and prevent over-tightening*

New lawn mowers are required to have a safety bar on the handle that must be pulled back in order to start the engine. If you let go of the safety bar, the mower blade stops in 3 seconds or less.

To Err is Human!!

Have you ever done the following:

- Driven to work and not remembered it?
- Driven from work to home when you meant to stop at a store?

It happens to workers too:

- Workers finish the shift and don't remember what they have done.
- After building green widgets all morning, the workers put green parts on the red widgets in the afternoon.

"Be More Careful" is Not Effective

- "The old way of dealing with human error was to scold people, retrain them, and tell them to be more careful … My view is that you can't do much to change human nature, and people are going to make mistakes. If you can't tolerate them ... you should remove the opportunities for error."

- "Training and motivation work best when the physical part of the system is well-designed. If you train people to use poorly designed systems, they'll be OK for awhile. Eventually, they'll go back to what they're used to or what's easy, instead of what's safe."

- "You're not going to become world class through just training, you have to improve the system so that the easy way to do a job is also the safe, right way. The potential for human error can be dramatically reduced."

Chappell, L. 1996. The Pokayoke Solution. *Automotive News Insights,* (August 5): 24i.

LaBar, G. 1996. Can Ergonomics Cure 'Human Error'? *Occupational Hazards* 58(4): 48-51.

A New Attitude Toward Preventing Errors

- Make wrong actions more difficult
- Make it possible to reverse actions (to ‘undo’ them), or make it harder to do what cannot be reversed.
- Make it easier to discover the errors that occur.

Poka-yoke Systems Govern the Process

Two Poka-Yoke System approaches are utilized in manufacturing which lead to successful ZDQ:

1. Control Approach

   Shuts down the process when an error occurs.

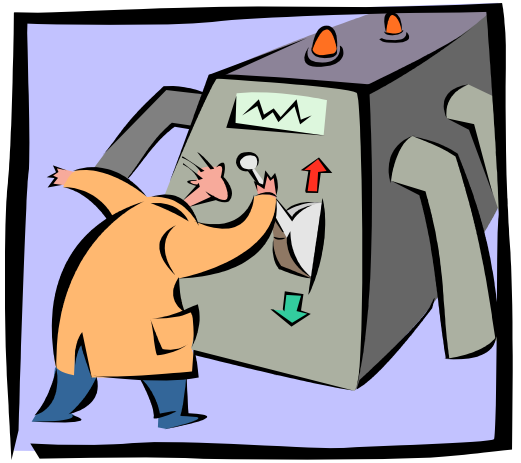
   Keeps the "suspect" part in place when an operation is incomplete.

2. Warning Approach

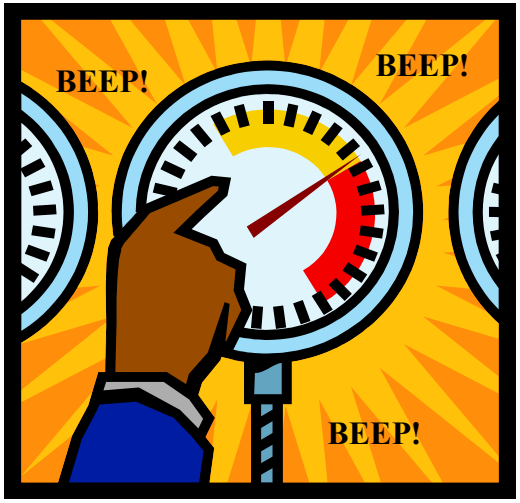
   Signals the operator to stop the process and correct the problem.

Control System

- Takes human element out of the equation; does not depend on an operator or assembler.
- Has a high capability of achieving zero defects.
- Machine stops when an irregularity is detected.



Warning System

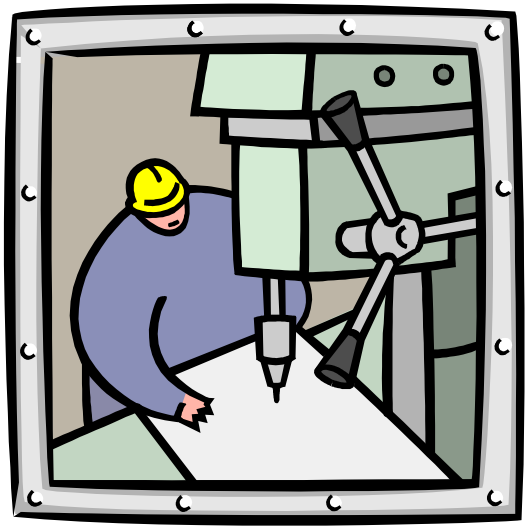


- Sometimes an automatic shut off system is not an option.
- A warning or alarm system can be used to get an operators attention.
- Above is an example of an alarm system using dials, lights and sounds to bring attention to the problem.
- Color coding is also an effective non automatic option.

Methods for Using Poka-Yoke

Poka-yoke systems consist of three primary methods:

1. Contact
2. Counting
3. Motion-Sequence



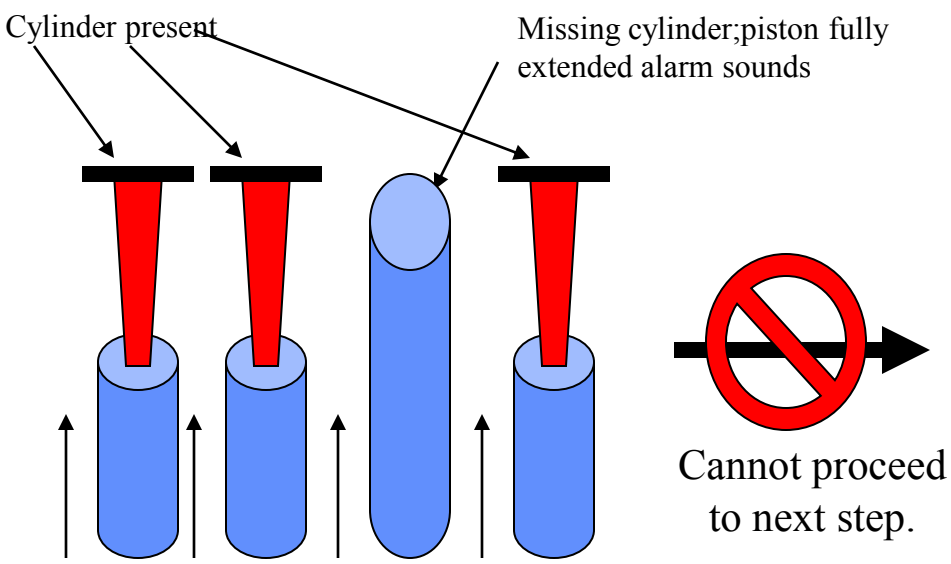
Each method can be used in a control system or a warning system.

Each method uses a different process prevention approach for dealing with irregularities.

Contact Method

A contact method functions by detecting whether a sensing device makes <u>contact</u> with a part or object within the process.

An example of a physical contact method is limit switches that are pressed when cylinders are driven into a piston. The switches are connected to pistons that hold the part in place. In this example, a cylinder is missing and the part is not released to the next process.



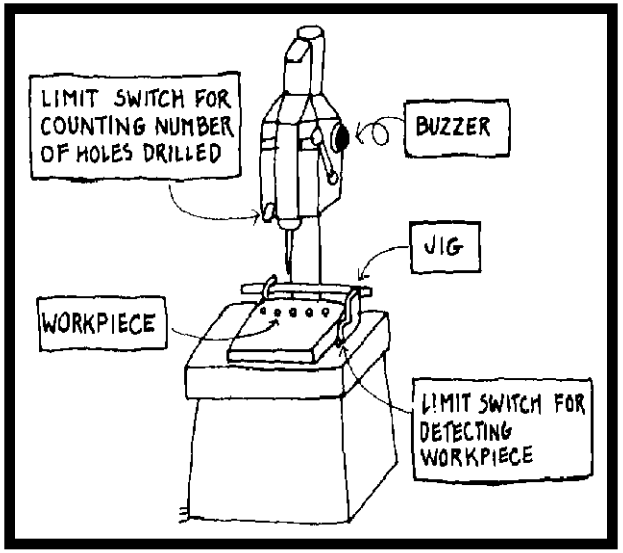
Contact Method using limit switches identifies missing cylinder.

Counting Method

Used when a *fixed* number of operations are required within a process, or when a product has a fixed number of parts that are attached to it.

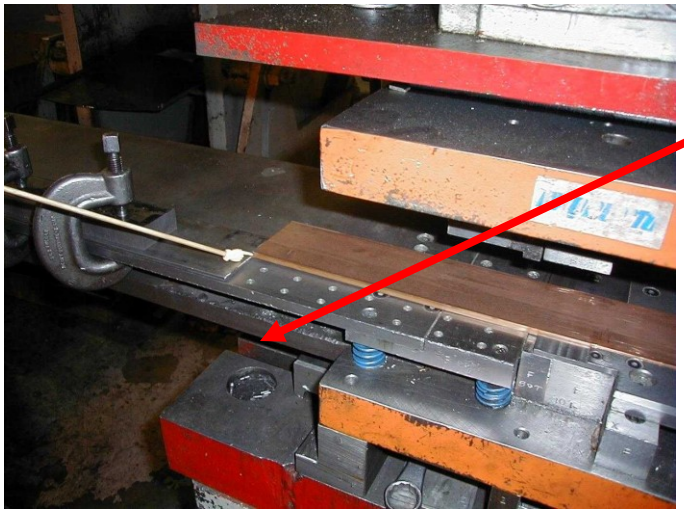
A sensor counts the number of times a part is used or a process is completed and releases the part only when the right count is reached.

In the example to the right a limit switch is used to detect and count when the required amount of holes are drilled. The buzzer sounds alerting the operator that the appropriate amount of steps have been taken in the process.



Motion-Sequence Method

The third poka-yoke method uses sensors to determine if a motion or a step in a process has occurred. If the step has not occurred or has occurred out of sequence, the the sensor signals a timer or other device to stop the machine and signal the operator.

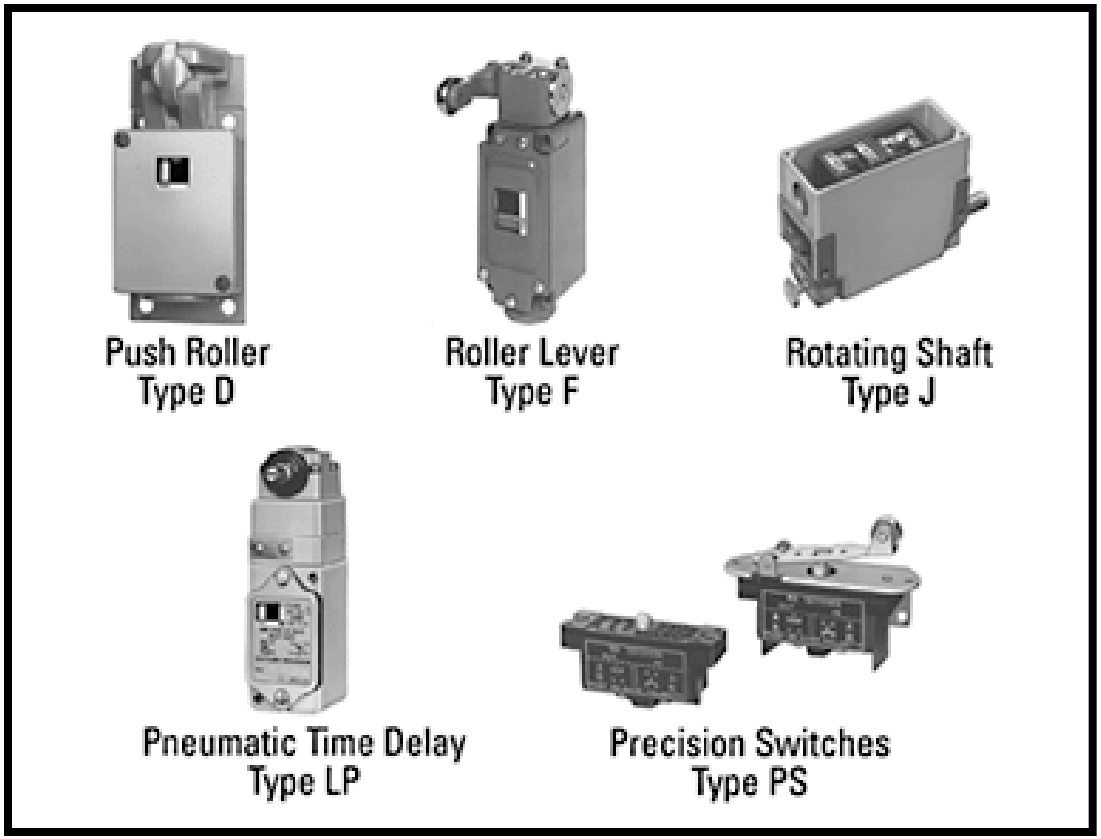


This method uses sensors and photo-electric devices connected to a timer. If movement does not occur when required, the switch signals to stop the process or warn the operator.

Physical Contact Sensors

These devices work by physically touching something. This can be a machine part or an actual piece being manufactured.

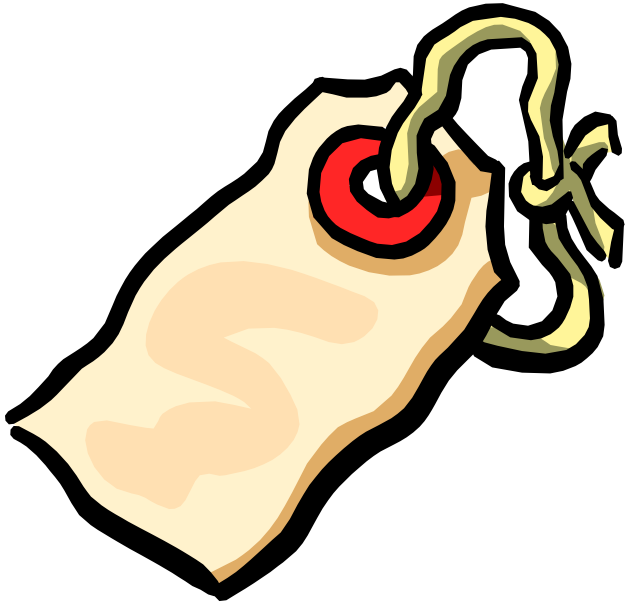
In most cases these devices send an electronic signal when they are touched. Depending on the process, this signal can shut down the operation or give an operator a warning signal.



5S Programs

1. Seiri = sort, necessary items
2. Seiton = stabilize, efficient placement
3. Seison = shine, cleanliness
4. Seiketsu = standardize, cont. improvement
5. Shitsuke = sustain, discipline

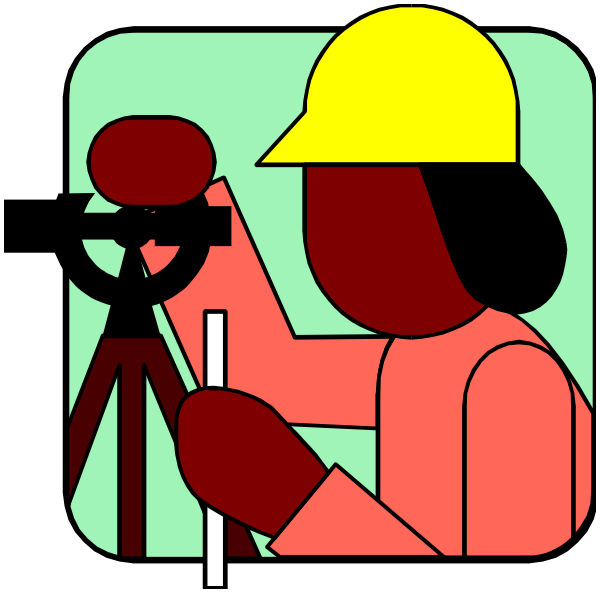
Sort



- Red tag process
- Key idea: "When in doubt, move it out"
- Prepare tags
- Attach red tags to unneeded items
- Remove red tagged items to "Dinosaur Burial Ground"
- Evaluate (disposition) red-tagged items

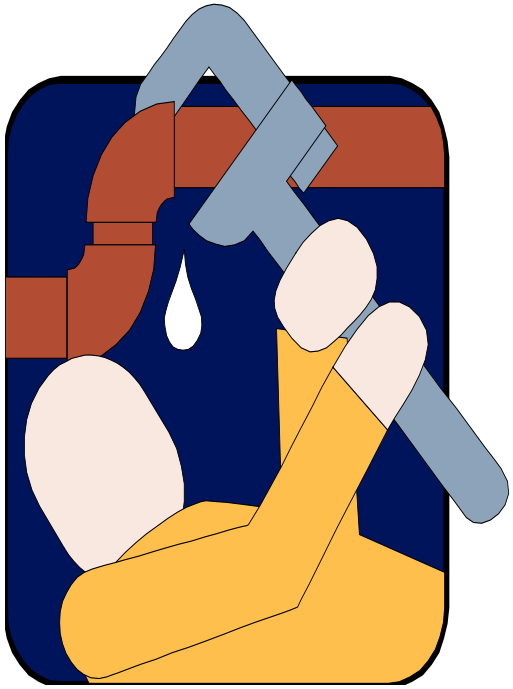
Straighten

Make it obvious where things belong



- *Lines*
  - Divider lines
  - Outlines
  - Limit lines (height, min-max)
  - Arrows show direction
- *Labels*
  - Color coding
  - Item location
- *Signs*
  - Equipment related information
  - Show location, type, quantity, etc.

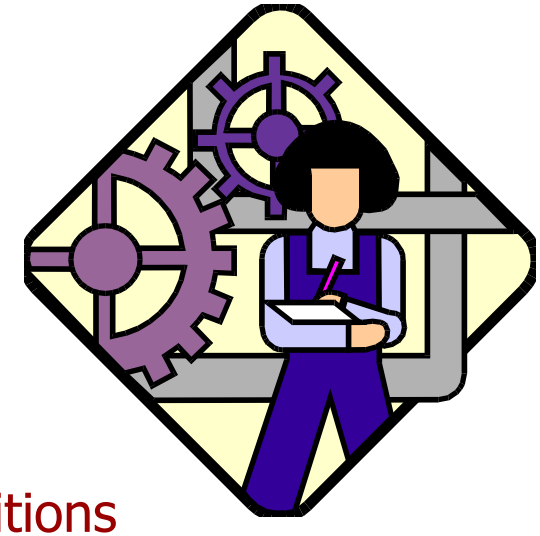
Shine



- Clean everything, inside and out
- Inspect through cleaning
- Prevent dirt and contamination from reoccurring

  - *Results in*
    - Fewer breakdowns
    - Greater safety
    - Product quality
    - More satisfying work environment

Standardize



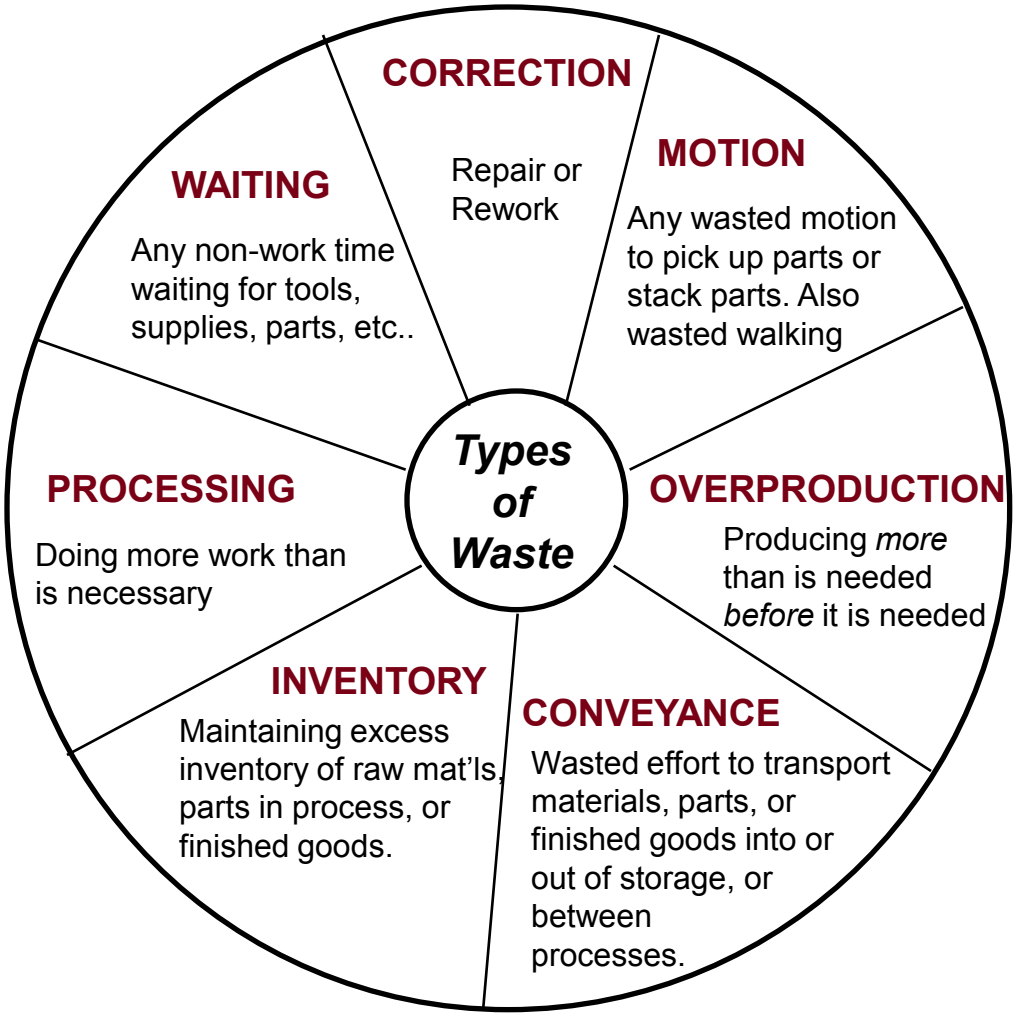
- Establish guidelines for the team–5-S conditions
- Make the standards and 5-S guidelines visual
- Maintain and monitor those conditions

Sustain

Determine the methods your team will use to maintain adherence to the standards

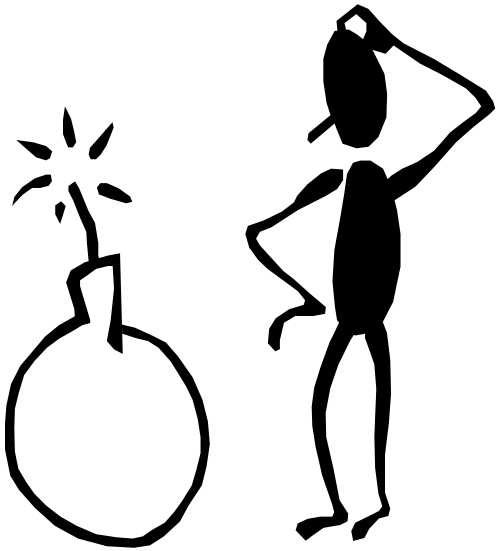
- 5-S concept training
- 5-S communication board
- Before and after photos
- One point lesson
- Visual standards and procedures
- Daily 5-minute 5-S activities
- Weekly 5-S application

7 Forms of Waste



Ref: Richard Wysk

Waste Causes



- Facility layout
- Excessive setup times
- Incapable process
- Poor preventive maintenance
- Uncontrolled work method
- Lack of training
- Boredom
- Production planning/scheduling
- Lack of workplace organization
- Lack of supplier quality and reliability
- Lack of concern (accountability)

Waste Causes *(continued)*

- Passing on defective parts
- Not communicating improvements
- Overproduction
- Inventories
- Motion
- Non-value-added processes
- Transportation
- Waiting
- Counting

Long-Term Strategic Partnerships

Lean companies

- Develop supplier partners, especially in the commodities key to their company's growth and future success
- Ensure that there is a close match in technology, growth plans, and corporate culture to have an open and successful relationship
- Plan and execute for a long-term relationship
- Exchange much more data than traditional relationships

Long-Term Strategic Partnerships

Traditional companies

Do not develop long-term relationships, but change to another supplier at the first disagreement on price or delivery

- Do not discuss strategic issues like technology roadmaps, capacity planning, plant locations, major quality initiatives, redesigning for cost reduction
- Release only that confidential information required for the immediate purchase
- Do not try to understand the motivations and aspirations of the supplier nor its needs to make a profit to grow and continue as a viable supplier

Long-Term Strategic Partnerships

Benefits:

- Permits frank discussions at all levels so that you understand the technical, cost, and quality issues of the supplier's product, which after all, becomes a part of your product
- Allows frank discussion of growth and capacity planning
- Allows frank discussion of quality and reliability improvement plans and exchange of very detailed product failure data (Ford / Firestone?)
- Allows technology discussions detailed enough to produce a better solution for both companies than could result from an arms length relationship
- Allows for exchange of detailed cost data which can reduce duplication of effort and produce savings to be shared

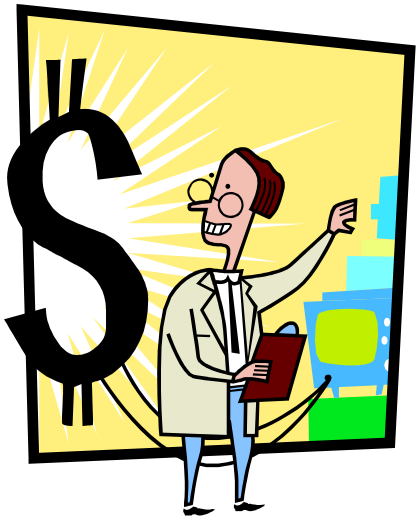
Expectations from Suppliers

- Frequent deliveries.
- Hours (not days) lead time.
- Rapid response capability
  (not from stocks).
- Delivery to assembly line at the right time
  in the right sequence without inspection.
- Reliability (quality and timing).

Supplier Relationships

- Long-term, steady relationships with a few suppliers.
- Negotiation based on a long term commitment to productivity and quality improvement.
- Interested in supplier capabilities.
  - *Continuous improvement.*
  - *Product/process technology.*
  - *Design for manufacturability.*

What's in it for a Supplier?



- A Stable Manufacturing Environment.
  - *Steady production volume.*
- Leaner Processes.
  - *Cost/Flexibility/Quality*
- Profits.