



## **Mistake-Proofing (AKA: Poka-Yoke) an Effective Quality Tool**

The originator of this idea was Shigeo Shingo from Japan. The term Poka-Yoke comes from anglicizing the Japanese words "poka" (inadvertent mistake) and "yoke" (prevent).

### **The underlying philosophy of Mistake-Proofing explicitly recognizes that:**

- People forget and make errors
- Machines and processes fail and make errors
- The use of simple mistake-proofing ideas and methods in product design and process design can eliminate both human and mechanical errors

Mistake-proofing is very easy to understand, it is grounded in common sense. It's essence is to design both the product and the processes so that mistakes are either impossible to make or, at the least, they are easy to detect and correct. At the heart of mistake-proofing is simply paying careful attention to every activity in the process and then placing appropriate checks and problem prevention facilitators at each step in the process. It's simply a matter of constant data feedback, similar to that required to maintaining your balance while riding a bicycle. Mistake-proofing is achieved, in its simplest form, by taking the three sequential steps shown in Table 1.

Table 1. Mistake-Proofing in Three Simple Steps

1. **Identify possible errors that might still occur in spite of preventive actions.** At each step in the process simply ask the question "What possible human error or equipment malfunction could take place at this step?" E.g., an apparently symmetrically shaped part could inadvertently be installed backward. *This could be an area where a truly negative or paranoid person within the organization becomes an asset.*
2. **Determine a way to detect that an error or malfunction either is taking place, or is about to take place.** A guide pin might be added to prevent the incorrect part installation sited in #1 above. *Don't just rely on people to simply catch their own errors all the time.*
3. **Identify and select the specific action to be taken when an error is detected.** There are three basic actions. Listed in their order of preference, they are:
  - **Control.** An action that self-corrects the process error, e.g., a spell-checker/corrector.
  - **Shutdown.** A procedure that blocks or shuts down the process when an error occurs, e.g., a lockout switch.
  - **Warning.** Alert the person involved that something is going wrong. E.g., a aircraft pilot's altitude voice warning PULL UP, PULL UP. *The primary weakness with warnings is the fact that they are frequently ignored, especially if they occur too frequently. Therefore, controls and shutdowns are generally preferred over simple warnings.*

Mistake-proofing might also be thought of as an extension of "Design/Process FMEA". While an FMEA helps in the prediction and prevention of problems, mistake-proofing emphasizes the **detection and correction of mistakes before they become defects.** Defects that may subsequently be delivered to either the end customer or the next-in-line customer.

Mistake-proofing is achieved by 100% inspection **while the work is in process**, not by the use of quality inspectors between work areas. The key to this inspection is the fact that it is accomplished as an integral part of the work process either by the worker or, better yet, automatically, not by an "inspector". Some examples of mistake-proofing are given in Table 2.

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Table 2. Some Examples of Mistake-Proofing

Polka-Yoke Tool	Manual Implementation	Automated Implementation
Guide pins	Asymmetric pins prevent the worker from inserting parts upside down, and different sized pins prevent the use of incorrect parts.	Photodetectors sense the alignment of parts and stop the line if one is not in proper position.
Error detection and alarms	The worker uses a kit with the exact number of parts needed. A part left over after assembly alerts him to an error.	General Motors used a process in which the automated detection of a hidden nut was required for an assembly to continue down the production line.
Limit switches	A torque wrench prevents over-tightening of a nut.	Movement of a machine is sensed and stopped at preset limits.
Counters	A digital counter indicates the number of holes drilled in a plate. An incorrect reading at the end indicates an error.	A computer counts the number of welds on an auto body. The line does not move until the correct number is reached.
Checklists	Worker checks off tasks as they are performed.	Use of a software program to control a machine.

American industry has long used an apparently related term "fool-proofing". The contrast between "fool-proofing" and "mistake-proofing" however, is critical. The essential difference is one of attitude. Rather than putting down the worker, Mr. Shingo respected and utilized the intelligence of his workers. He considered them partners and he relied upon their help in improving quality by challenging their imagination in problem solving. Most of the improvements that he initiated actually resulted from the worker's suggestions.

Mistake-proofing facilitates our understanding how defects originate and then helps us to focus our attention on simple devices/methods to eliminate defects. The real challenge is coming up with specific methods to detect, self-correct, block/shut down, or warn of a problem. This can sometimes require real imagination and creativity, but the emphasis is usually on inexpensive solutions. Some common examples of mistake-proofing methods are shown in Table 3.

Table 3. Examples of Common Mistake-Proofing Methods

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| <ul style="list-style-type: none"> <li>• Color- and/or shape-coding of materials and documents. <i>(Remember, however, that approximately one in ten people have some form of color blindness.)</i></li> <li>• Use distinctive shapes for key items e.g., legal documents typically are typed on a different size paper than routine documents.</li> <li>• Use symbols and/or icons to identify easily confused items.</li> <li>• Use computerized checklists and/or standardized pre-prepared forms.</li> <li>• Carefully think-through each procedure and utilize simplified workflows.</li> <li>• Identify and document "Red Flags" i.e., those conditions in the process that commonly provoke errors. <i>Red Flags point to Errors, and Errors point to Defects.</i></li> <li>• Find out how your people are self-correcting problems that can't be prevented upstream, and then share these "best practices" with others.</li> </ul> |
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From an organizational viewpoint, one of the most positive results of implementing mistake-proofing is the fact that people, at all levels and across all functions, begin to think in a "preventive mode" rather than an "after the fact" detection mode relative to design and process errors.



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## **Mistake-Proofing (AKA: Poka-Yoke) an Effective Quality Tool (Cont'd)**

Mistake-proofing or Poka-Yoke is just one of a number of available quality improving tools/philosophies aimed at the production of World-Class products. Others quality tools include, but are not limited to Benchmarking, Quality Function Deployment, Statistical Methods, Statistical Process Control, Design of Experiments, Failure Mode and Effects Analysis, Supplier Certification, etc. Many of these tools are described in more detail in the **RAC Quality Toolkit**.

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### **Source:**

- RAC Publication, QKIT, *Quality Toolkit*.

### **For More Information:**

- Zero Quality Control: Source Inspection and the Poka-Yoke System, Shigeo Shingo, Cambridge Productivity Press, 1986.