

## Poka-Yoke for Quality

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*BNP Media Staff*

Shigeo Shingo introduced the concept of poka-yoke (pronounced POH-kah YOH-kay) in 1961, when he was an industrial engineer at Toyota Motor Corp. The initial term was baka-yoke, which means fool proofing. In 1963, a worker at Arakawa Body Co. refused to use

baka-yoke mechanisms in her work area, because of the term's dishonorable and offensive connotation. Hence, the term was changed to poka-yoke, which means error proofing or mistake proofing.

**Mistake Proofing:** Apply to the process to prevent mistakes from occurring, stop the error from further processing, and warn that the error has occurred.

**Error Proofing:** Apply to design to prevent assembly errors.

However, most people use the terms interchangeably.

## What is Poka-Yoke?

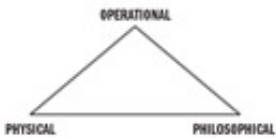
Poka-Yoke is a process improvement designed to prevent a specific defect from occurring. It is a process improvement system that prevents personal injury, promotes job safety and prevents faulty products and machine damage. Poka-yokes are mechanisms used to mistake proof an entire process. Ideally, poka-yokes ensure that proper conditions exist before actually executing a process step, preventing defects from occurring in the first place. Where this is not possible, poka-yokes perform a detective function, eliminating defects in the process as early as possible.

Many people think of poka-yokes as limit switches, optical inspection systems, guide pins or automatic shutoffs that should be implemented by the engineering department. This is a very narrow view. These mechanisms can be electrical, mechanical, procedural, visual, human or any other form that prevents incorrect execution of a process step. Poka-yokes also can be

implemented in areas other than production such as sales, order entry, purchasing or product development where the cost of mistakes is much higher than on the shop floor. The reality is that defect prevention, or defect detection and removal, has widespread applications in most organizations.

**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.

**Poka-Yoke (Mistake/Error Proofing):** The use of process or design features to prevent the manufacture of nonconforming product.



## Error Proofing Triangle

**Physical Error proofing:** involves installing components such as fixtures or sensors to eliminate conditions that may lead to an error.

**Operational Error proofing:** involves making modifications or installing devices that reinforce the correct procedure sequence.

**Philosophical Error proofing:** involves identifying situations that cause defects and doing something about it-empowerment of workforce.

## Approaches to Error Proofing

**Prevention:** Prevents errors from creating defects.

**Detection:** Detects defects and immediately initiates corrective action to prevent multiple defects from forming.

**Definition of a Defect:** A defect is the result of any deviation from product specifications that may lead to customer dissatisfaction.

To classify as a defect:

1. The product has deviated from manufacturing or design specifications.
2. The product does not meet internal and/or external customer expectations.

**Definition of an Error:** An error is any deviation from a specified manufacturing process. There can be an error without a defect, but there cannot be a defect without an error.

Error proofing as it is understood and practiced today is an outgrowth of the quality movement, specifically the Zero Defects initiative. It is a team-based, plant-floor improvement strategy that focuses on production processes and operations. Error proofing aims to prevent errors and deviations from standards of all types that can impact quality, safety, manufacturing costs and customer satisfaction.



# Zero Defects System

## Failure Mode Effects Analysis (FMEA) application into Error Proofing-Design/Process FMEA

A design FMEA is an analytical technique used by product or process designers as a means to ensure that, to the extent possible, potential failure modes and their associated causes have been considered and addressed. The design must be improved based on the results of the FMEA study. All the design and possible error proofing should be identified during the development of Design Failure Mode Effects Analysis (DFMEA) and integrated into design.

All the manufacturing and process issues are prioritized to help identify opportunities for greatest impact for customer and return for investment. The most common tool used to identify and prioritize the issues is Process Failure Mode and Effects Analysis (PFMEA). The process FMEA method is used by the cross-functional team approach to answer all process-related questions and to quantify the results in the form of Risk Priority Number (RPN). The PFMEA tool helps the team to ask the key question to identify and implement the proper error proofing to improve the process.

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## Error Proofing Techniques

**Design For Manufacturability (DFM):** Techniques in designs that cannot be incorrectly manufactured or assembled. This technique also can be used to simplify the design and, therefore, reduce its cost for product.

**Poka-Yoke System:** Set-up devices or inspection techniques that ensure setup is done correctly; for example, produce 100% good parts from the first piece on.

**Design Stage:** Best opportunity to impact quality and cost.

## Why Use Error Proofing?

**Competitive Advantage:** In a global market the cost of quality is part of the competitive advantage. It costs far less to prevent defects from occurring in the first place than to catch them later through inspection and have to rework or repair them.

**Knowledgeable Workers:** When every employee understands the principles of error proofing, work teams can see more easily how defects are generated and can then effectively eliminate them. They can participate in the design and improvement of parts processing and assembly operations in order to prevent defects from occurring. These methods can be employed in the office as well to eliminate errors in paper processes.

**Predictability:** If machines (manual or robotic) include error-proofing devices, then there is assurance that the end product will be defect free. This eliminates inspection and rework operations, as well as scrap.

**Reduced Variation:** Error Proofing devices also ensure that subassembly and assemblies are exactly the same. There will be little chance of part-to-part variation if the machines are designed or modified to prevent errors and their resulting defects. Human error is natural. But sometimes when errors can be traced back to the operator's interaction with the process, there is a tendency to blame the operator. But the root cause of the error is usually failure to account for the possibility of human errors or omissions-by people who design machinery, layouts or operating procedures. Error proofing can correct this.

## Errors are Inevitable

Important facts to realize about human error are:

Errors are inevitable, a part of human nature. Few workers make errors intentionally; most strive to prevent errors. Error proofing alters the work environment to reduce the opportunity for human errors.

When incorporating error proofing into the work environment, understanding human limits is essential. These limits include:

**Vision:** People vary in ability to distinguish details, colors or adjust vision to lighting.

**Hearing:** Individual upper and lower thresholds of hearing change when background noise is added.

**Repetition Ability:** Muscular efficiency and mental tracking decrease as rates of repetition increase.

**Six Sigma and Error Proofing:** In a DMAIC (Define-Measure-Analyze-Improve-Control) project, this step is usually performed in the Control phase to prevent a specific defect from occurring. It is next to impossible to reach Six Sigma and lean implementation without applying error-proofing concepts.

## Tech Tips

- Poka-yoke is a process improvement designed to prevent a specific defect from occurring.
- Poka-yoke works by making a process mistake and error proof.
- In a lean Six Sigma deployment using DMAIC, poka-yoke will be implemented in the control phase of the project.

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