

Technical Guide On “Poka Yoke”



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Ministry of Industries & Production
Government of Pakistan**

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1. Disclaimer:

This information memorandum is to introduce the subject matter and provide a general idea and information on the said matter. Although, the material included in this document is based on data/information gathered from various reliable sources; however, it is based upon certain assumptions, which may differ from case to case. The information has been provided on AS IS WHERE IS basis without any warranties or assertions as to the correctness or soundness thereof. Although, due care and diligence has been taken to compile this document, the contained information may vary due to any change in any of the concerned factors, and the actual results may differ substantially from the presented information. SMEDA, its employees or agents do not assume any liability for any financial or other loss resulting from this memorandum in consequence of undertaking this activity. The contained information does not preclude any further professional advice. The prospective user of this memorandum is encouraged to carry out additional diligence and gather any information which is necessary for making an informed decision; including taking professional advice from a qualified consultant/technical expert before taking any decision to act upon the information.

1.1 Introduction to SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in Employment Generation and Value Addition to the national income, through development of SME sectors, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify Policy, Access to Finance, Business Development Services, strategic initiatives and institutional collaboration & networking initiatives.

Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA.

Concurrent to the prefeasibility studies, a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

For more information on services offered by SMEDA, please contact our website: www.smeda.org

1.2 Industry Support Program

In order to enhance competitiveness of SMEs and achieve operational excellence, SMEDA established an Industry Support Cell (ISC) for provision of foreign technical support and knowledge transfer in collaboration with International Development Organizations. SMEDA's Industry Support Program (ISP) initially launched with Japan International Cooperation Agency (JICA) and actively engaged in reducing energy inefficiencies and improving production and quality of products with the support of Japanese Experts. Later on, similar activities with other international partner organizations like German Corporation for International Cooperation (GIZ), Training and Development Centers of the Bavarian Employers' Association (bfz), Germany, and United Nations Industrial Development Organization (UNIDO) were also successfully implemented.

2. What is Poka Yoke?

Poka Yoke is a Japanese term and a lean manufacturing tool that helps to avoid mistakes and errors. If we do not care about the mistake and errors the result is a **“WASTE”**. **“WASTE”** is any activity that consumes resources but does not add value to the product/service being produced for the customer. This means cost is incurred to the company but the customer is not willing to pay for the **“WASTE”** produced which means loss or failure to the business.

Mistakes adversely affect the following.

- Customers & Consumers (in the form of defects). Defects are mistakes that pass through a system and reach the customer.
- Employees (in the form of injuries)

Poka Yoke avoids the mistakes by preventing, detecting, correcting & eliminating mistakes at the source. The fundamental concept is to improve the process so that mistakes become impossible or if occurred they may be easily detected and corrected immediately at the source. Poka yoke attempts to prevent the mistakes from becoming the defect. Poka Yoke aims to resolve the problems during the manufacturing process, removing the requirement for quality control after the production has occurred.

In the term “Poka Yoke”, **“Poka”** referred to as an **'accidental mistake'** and **'Yokeru'** is Japanese term for **'preventing'**. It was created in the sixties of the earlier century by Shigeo Shingo from Japan. Initially Shingo called the term as **“Baka Yoke”** referred as **“Idiot Proofing or Fool Proofing”** but later on modified to less offending term to **“Poka Yoke”** as the workers were offended. Poka Yoke also referred to as Mistake Proofing, Error Proofing & Fail Safing etc.

2.1 Examples of Poka Yoke

Some of the examples of the Poka Yoke are as follows.

1. Typing software is often equipped with grammar and spelling errors check.
2. USB ports & electrical plugs prevent users to connect the wrong direction of the cables.
3. Safety sensors installed in the elevators that prevent the door from closing in presence of a person.
4. Car seat belt alarms and doors open alarms while car or engine is running.
5. Bar code for correct product identification.
6. In manufacturing operations where dies are required like for example stamping operation. Wrong placement of stamping die can result in product quality and efficiency issues. To avoid this dies are often provided with guide pins so that they can only fit in one direction.

7. Modifications in checking fixtures making it impossible to place the part in wrong directions or modification in the part itself for the same effect i.e. to avoid the error.

2.2 Categories of Poka Yoke

There are 2 broad categories of Poka Yoke:

1. Prevention Based
2. Detection Based



Prevention Based Poka Yoke: In this type, system is designed in such a way that that mistakes are impossible to occur. It is a proactive approach in which system acts before a defect occurs.

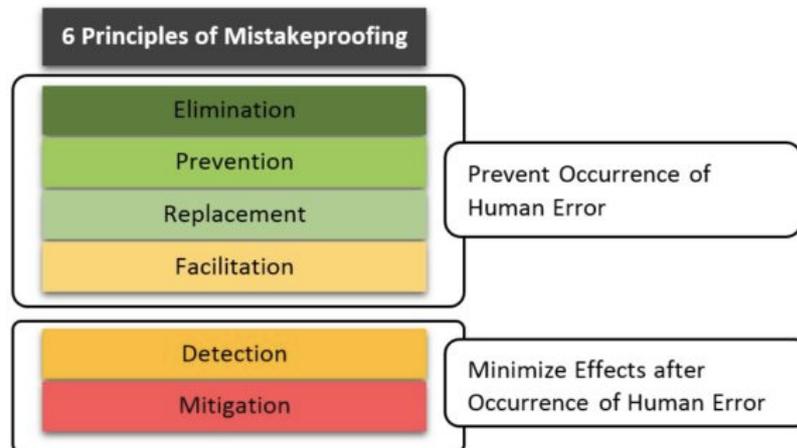
Detection Based Poka Yoke: In this type, system is designed in such a way that it alerts the user when a mistake has been made. It is a reactive approach but it doesn't allow the continuation of the process so that user can quickly correct the problem.

2.3 Principles of Poka Yoke

Poka Yoke is based on following six principles and they are listed in their decreasing order of preference which are:

1. **Elimination:** This principle seeks to eliminate the possibility of error by redesigning the product or process so that the task or particular step is no longer necessary.
2. **Prevention:** This principle engineers the product or process so that it is impossible to make a mistake at all.
3. **Replacement:** This principle substitutes a more reliable process to improve consistency and lessen the chances of error occurring.
4. **Facilitation:** This principle uses techniques and combines steps to make work easier to perform.
5. **Detection:** This principle involves identifying an error before further processing is done. The user can quickly correct the problem without further damage to equipment or personnel.
6. **Mitigation:** This principle seeks to minimize the effects of errors without solving them. This is the least preferable solution.

Based on the explanation of the Poke Yoke categories in section 2.2 the Poka Yoke principles are categorized as follows:



Elimination, Prevention, Replacement and Facilitation are to avoid the occurrence of mistakes i.e. **Prevention Based Poka Yoke**. **Detection and Mitigation** are to minimize the effects of mistakes once they occur i.e. **Detection Based Poka Yoke**.

2.4 Determining the Errors & Minimizing Its Effects

In Poka Yoke system there are three ways to determine the error and reduce its consequences which are as follow.

1. Inspection Method
2. Setting Function
3. Regulatory Function.

1. Inspection Method: For mistake proofing there are three types of inspection methods that give quick analyses:

- a. **Self-inspection:** In this inspection method operators evaluate their own work directly after completing it.
- b. **Successive Inspection:** In this method operator checks the work of their colleagues before starting new operation.
- c. **Source Inspection:** In this method operators or its supervisor checks prior to the process if the conditions are right so as to initiate the process. Most of the time it is a routine and keeps the method from continuing until all conditions are correct.

2. Setting Function: In this method product attributes or process parameter are inspected for detecting and preventing errors in a process. The Toyota Production System defines the following different approaches for defects identification.

- a. **Contact Method:** In this method the testing and inspection of products physical features such as size, shape, colour, temperature and diameter etc. to be done via physical contact or with a source of energy to identify defects.

Examples of Contact Method, Poka Yoke:

1. Common Error Prevention Example includes, Limit Switches, Electrodes and Guide Blocks/Pins Etc.
2. Common Error Detection Examples includes, Weight Sensors, Dimension Sensor and Parts Bins Etc.

b. Fixed Value (or Constant number) Method: As name suggests this type of Poka Yoke is applied to detect errors when number of items, movements, or events is not followed or made. Normally this type of Poka Yoke is applied to the processes where the same action is repeated several times. This method alerts operator if certain movements are not made as defects, an alert or warning sign appears.

Examples of Fixed Value (or Constant number) Method, Poka Yoke:

1. Common Error Prevention Example includes Counters, logic controllers and part dispensers
2. Common Error Detection Examples includes, Parts Bins and lights/alarms

c. Motion Step (or sequence) Method: This type of Poka Yoke device determines the defined process steps to assure that steps are done in defined/standard sequence.

Examples of Motion Step (or sequence) Method, Poka Yoke:

1. Common Error Prevention Example includes, Timed Gate/switch, numbering scheme, ordered instructions and successive checks.

d. Information Enhancement Method: This method makes sure that information is available and perceivable when and where required.

3. Regulatory functions: These are signals that alert the workers that an error has occurred. Poka Yoke devices take following two approaches to prevent and detect errors.

a. Warning Functions: As the name suggest signal is generated in case of errors and defects using warning functions like lights, buzzers, bells, and other sensory alert devices. You can also consider the use of symbols, shapes, color-coding, and other distinctive sounds. This method does not shutdown or stops the machine or process on each time but generates a warning signals to alert the operator in case of errors and defects.

b. Control Functions: In this approach the problem is sensed and it stops the line or process from proceeding until the error is corrected (if it has already occurred) in this way it prevents avoiding serial defect generation or to check initial parameters if

they are as per standard (in case of source inspection and the error has not yet occurred).

3. Why Implement Poka Yoke?

Human make mistakes and these can result in making defective products in the manufacturing industry. Defective products can be very costly to the business & it can directly affect the bottom line of the business. For Safety applications in different industries a failure due to defective may even cause a loss of life.

Poka yoke provides many benefits to the manufacturing processes. Some of the benefits are as follows.

1. **Improved Safety:** Poka Yoke aims to make it difficult to get injured accidentally. Safety is built into the processes for example a machine will not run until the operator is in a safe zone, it prevents employees from making dangerous movements or being in the wrong place at wrong time in this way it brings improvement in workers' safety.
2. **Improved Productivity:** As a result of errors prevention, defects detection and solving the problems immediately results in lower defect rates and hence improved the productivity of the production processes.
3. **Zero Defects Leading to Reduced Cost via Waste Reduction:** By reducing the defective products produced and faster error prevention results in less raw material wastage and also lesser time spent by workers and machines on reworking defective products. This will eventually lead to lowering the cost of production and Waste reduction also occurred.
4. **Lower Skill Requirement:** By using Poka yoke the processes will have guidelines built into them that helps prevents and avoid errors. This means that you have to spend less time and money on skill development of workers.
5. **Culture of continuous improvement:** Poka yoke help workers by making their tasks simpler, safer and efficient by reducing the reworks and defects this leads to an improved buy in for the tool. Further it promotes a positive attitude among the workers and instead of blame game in case of a defect it explains them it is the process that is deficient and not the employees. It then encourages employees to solve problem by addressing the root cause and using the Poka yoke techniques to prevent them. As a result, a culture of continuous improvement is developed.
6. **Improved Customer Satisfaction:** Quality products lead to increased customer satisfaction and loyalty. It also increases stakeholder confidence.

4. How to Implement Poka Yoke?

The **American Society for Quality** describes the following Poka Yoke or Mistake Proofing procedure.

Step # 1: Obtain or create a flowchart of the process. Review each step, thinking about where and when human errors are likely to occur.

Step # 2: For each potential error, work back through the process to find its source.

Step # 3: For each error, think of potential ways to make it impossible for the error to occur. **Consider Prevention based Poka Yoke (section 2.2 & 2.3 describes them in detail and already discussed above)** a brief is also referred as below.

- **Elimination:** eliminating the step that causes the error.
- **Replacement:** replacing the step with an error-proof one.
- **Facilitation:** making the correct action far easier than the error.

Step # 4: If you cannot make it impossible for the error to occur, think of ways to detect the error and minimize its effects. **Consider Detection based Poka Yoke (section 2.2 & 2.3) and the following strategies (section 2.4 describes them in detail above).**

- **Inspection Methods**
- **Setting Functions**
- **Regulatory Functions**

Step # 5: Choose the best mistake-proofing method or device for each error. Test it and then implement it.