

POKA YOKE



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Course content

1. What is poka yoke?
2. Importance of error-proofing
3. Human errors
4. Types of error-proofing
5. References

1. What is poka yoke?
 1. Philosophy behind it
 2. Definition
 3. Goals
 4. Benefits

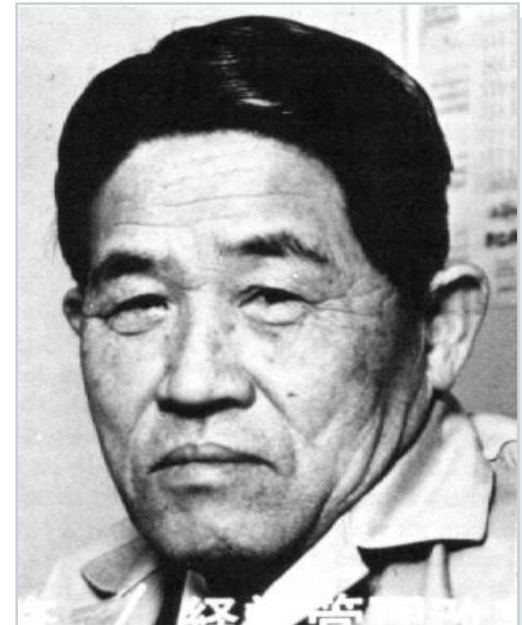
1. What is poka yoke?

1.1. Philosophy behind it:

It is good to do something right the first time.

It is even better to make it impossible to do it wrong the first time.

Use poka yoke!



Shigeo Shingo

1. What is poka yoke?

1.2. Definition:

Poka yoke means: to avoid (yokeru) inadvertent errors (poka)

It is a method which uses devices that detect mistakes and they either prevent them from becoming defects or make mistakes obvious at a glance.



Poka yoke
=
Error-proofing
=
Mistake-proofing
=
~~Fool-proofing~~

1. What is poka yoke?

1.3. Goals:



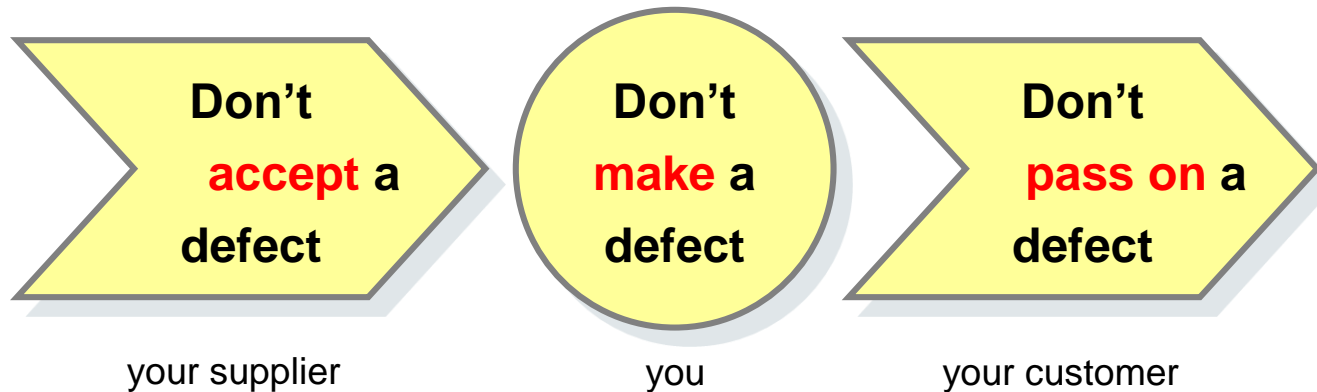
- Rework
- Scrap
- Warranty costs
- Inspection costs



1. What is poka yoke?

1.3. Goals:

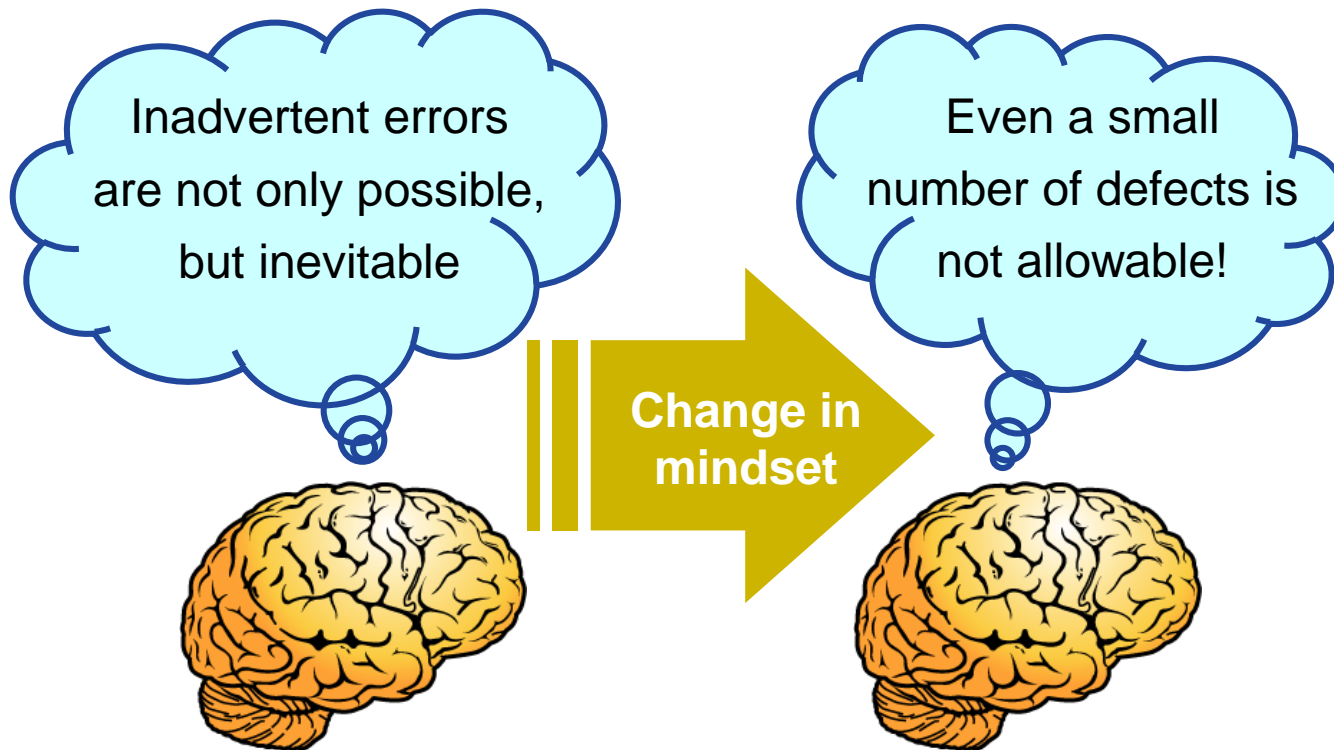
Take the following rules into account:



**Design the product so that
it can't be assembled incorrectly**

1. What is poka yoke?

1.3. Goals:



1. What is poka yoke?

1.4. Benefits:

The use of poka yoke leads to

- Higher productivity
- Safer work environment
- Higher customer loyalty
- Shorter customer lead times
- Lower costs
- Higher output quality

Higher customer satisfaction

2. Importance of error-proofing

1. Not all error-proofing solutions are equally effective
2. Things done right 99,9% of the time means ...
3. Defects are a problem
4. Disadvantages of traditional quality control
5. 1-10-100 rule
6. To err is human

2. Importance of error-proofing

2.1. Not all error-proofing solutions are equally effective



Causes of defects	Counter-measures	Control method	How?	Inspection type
Complexity	Complexity reduction	Simplify design		Eliminate complexity problem
Mistakes	Mistake-proofing	Control/autocorrection Shutdown Warn		Prevent mistake Detect mistake Detect defect
Variation	Variation control	Setting Adjustment		Eliminate adjustment SPC

2. Importance of error-proofing

2.2. Things done right 99,9% of the time means....:

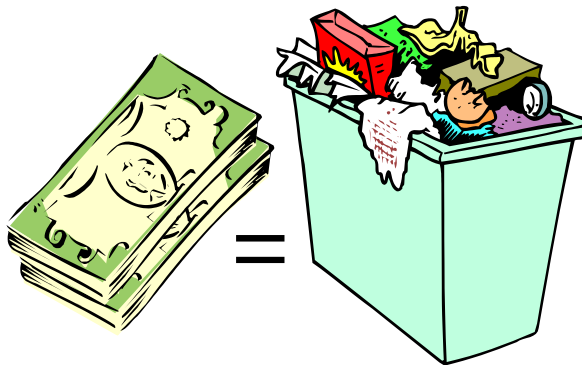
- 1 hour of unsafe drinking water per person per month,
- 2 unsafe landings at O'Hare airport a day,
- 16 000 lost pieces of mail per hour,
- 20 000 incorrect drug prescriptions per year,
- 500 incorrect surgical operations per week,
- 50 newborn babies dropped each day by doctors,
- 22 000 checks per hour deducted from wrong accounts,
- 32 000 missed heartbeats per person each year.

Source: http://elsmar.com/Error_Proofing/

2. Importance of error-proofing

2.3. Defects are a problem: because they

cost us **money**



cost us **time**

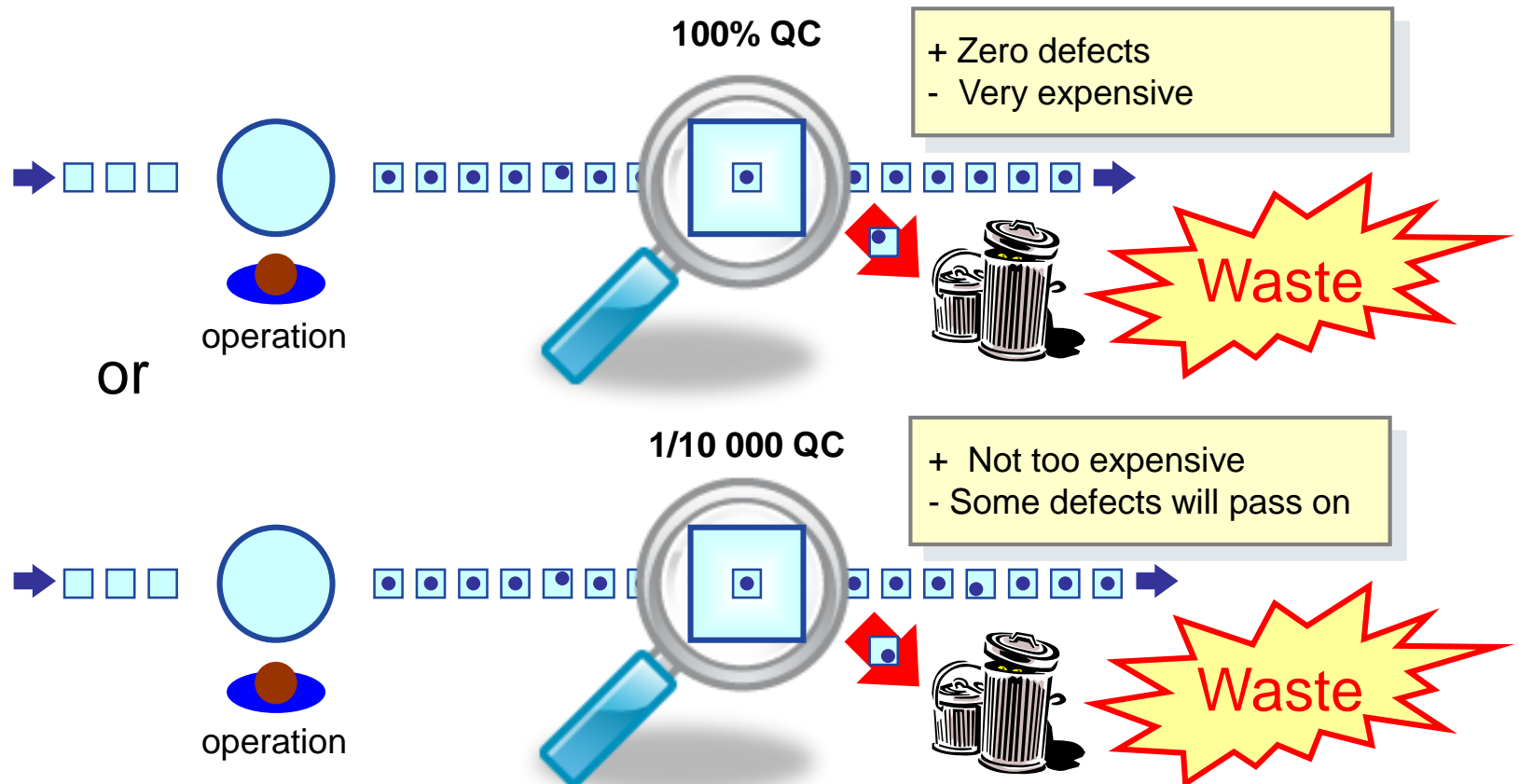


cause us **danger/**
possible **injury**



2. Importance of error-proofing

2.4. Disadvantages of traditional quality control ...:



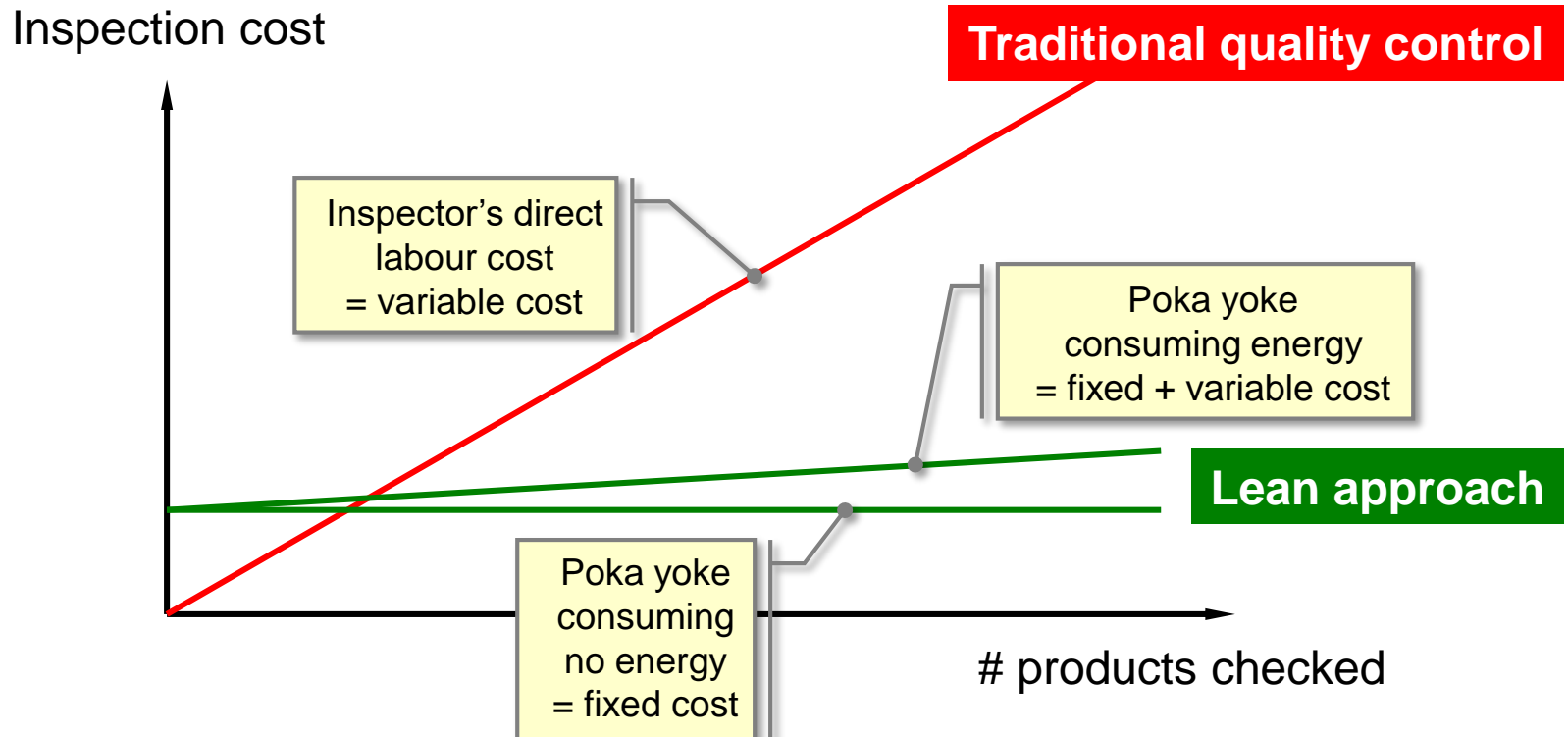
2. Importance of error-proofing

2.4. ... compared to the lean approach:



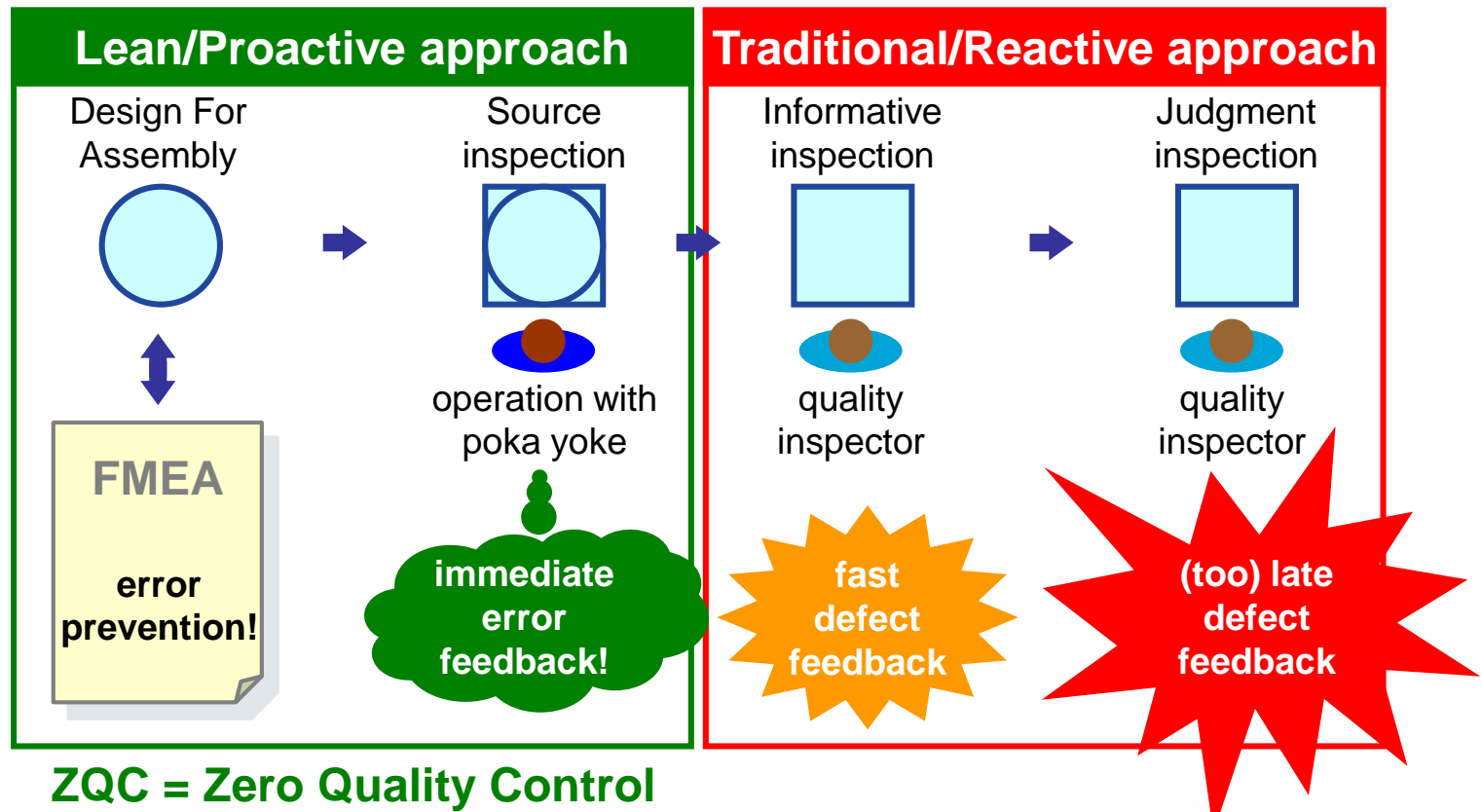
2. Importance of error-proofing

2.4. Disadvantages of traditional 100% quality control ...:



2. Importance of error-proofing

2.4. Disadvantages of traditional quality control ...:



2. Importance of error-proofing

2.5. 1-10-100 Rule:

As a product or service moves through the production system, the cost of correcting an error multiplies by 10.

Activity	Cost
Order entered correctly	€ 1
Error detected in billing	€ 10
Error detected by customer	€ 100
Dissatisfied customer shares the experience with others	€ 1 000

2. Importance of error-proofing

2.6. To err is human:

Donald Norman in The design of every day things:

“The human brain's default mode of operation is pattern recognition and autopilot execution. If the pattern is familiar, a behavior that has been successful in the past is "launched." It's only when feedback suggests that things are not going as planned that more in-depth thought is called up.”

2 options:



Demand vigilance

Mistake-proof

3. Human errors

1. Examples of errors at home
2. Examples of errors at work
3. Types of human errors
4. Causes of human errors
5. Human mistakes and their causes





3. Human errors

3.1. Examples of errors at home:

- Forgetting to unplug the iron,
- Forgetting to switch off the coffee set,
- Locking keys in your car,
- Running out of gas,
- Driving home from work when you meant to stop at a store?
- Switching on the wrong burner on your kitchen stove,
-



3. Human errors

3.2. Examples of errors at work:

- Missed operations
- Processing errors
- Errors in part set-up
- Missing parts
- Wrong parts
- Processing wrong workpiece
- Misoperation
- Adjustment error
- Improper equipment set-up
- Improper tools and jigs

3. Human errors

3.3. Categories of human errors:

- Defective material
- Information
- Maladjustment
- Omission
- Selection errors

3. Human errors

3.3. Categories of human errors:

Rasmussen and Jensen: classification of human performance/errors:

- Skill-based
- Rule-based
- Knowledge-based

3. Human errors

3.3. Categories of human errors:

Different types of human errors need different actions!

Human error type	Preventive actions
Mistakes	Training & instructions, change work situation
Violations	Persuasion, change work situation
Mismatches	Change work situation
Slips & lapses	Change work situation

Source: Prof. Trevor Kletz, Loughborough University

3. Human errors

3.4. Causes of human errors

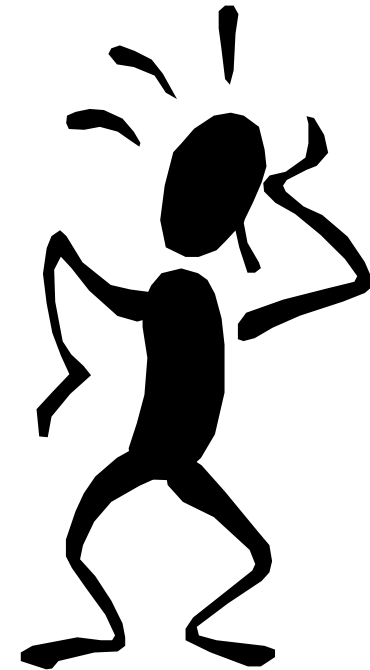
- Poor procedures or standards
 - Machines
 - Non-conforming material
 - Worn tools
 - Human Mistakes
- } predictable
- not predictable

3. Human errors

3.4. Causes of human errors

Human mistakes:

- Errors made by amateurs,
- Surprise errors
- Willful errors
- Inadvertent or sloppiness errors
- Errors due to lack of standardization
- Errors due to misunderstanding
- Errors due to forgetfulness
- Identification errors
- Errors due to slowness
- Intentional errors



3. Human errors

3.5. Human mistakes and their causes

● highly correlated
○ correlated

Causes of defects	Human errors	Intentional	Misunderstanding	Forgetful	Misidentification	Amateurs	Willful	Inadvertant	Slowness	Non-supervision	Surprise
Missed operations	●	○	○	●	○	○	○	●	○	○	
Processing errors	●	●	●	○	○	●	●	●	●	●	
Errors in part set-up	○	○	○	●	○	○		●	○	○	
Missing parts	●	○	○	○		○	○	●		○	
Wrong parts	●	●	●	●	●	●	●	●		●	
Processing wrong workpiece	○	●	●	●	○	○	●	●		○	
Misoperation				○				○		○	●
Adjustment error	○	○	○	○	●	○	●	○	○	○	○
Improper equipment set-up				○				●			●
Improper tools and jigs				○				●			○

3. Human errors

3.5. Human mistakes and their causes

Don't try to change people



Change the environment!

Source: Prof. Trevor Kletz, Loughborough University

4. Types of error-proofing

1. Basic functions of a poka yoke system

1. Warning
2. Control (shutdown or autocorrection)

2. Types of poka yoke methods

1. Contact
2. Fixed value
3. Motion-Step

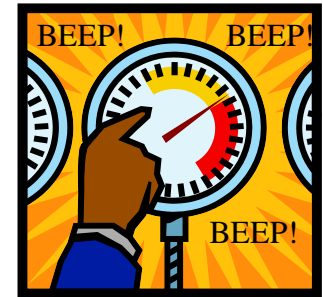
3. Not all mistake-proofing solutions are equally effective

4. Types of error-proofing

4.1. Basic functions of a poka yoke system

1. Warning poka yoke:

- Signals the operator to stop the process and correct the problem.
- Recommended when an automatic shut down system is not an option.
- Implemented using e.g. dials, lights, alarms, warnings and colour coding



4. Types of error-proofing

4.1. Basic functions of a poka yoke system

2. Control poka yoke:

- Shuts down the process when an error or irregularity is detected.
- Keeps the “suspect” part in place when an operation is incomplete.
- Takes human element out of the equation; does not depend on operator vigilance or memory.
- Has a high capability of achieving zero defects.





4. Types of error-proofing

4.2. Types of poka yoke methods

1. Contact:

- Makes contact or has a geometry that inhibits mistakes.
- Identifies mistakes by testing the product's shape, size, colour, or other physical attributes.

4. Types of error-proofing

4.2. Types of poka yoke methods

1. Contact: examples

Control



Connectors

Warning



Parking height bar



4. Types of error-proofing

4.2. Types of poka yoke methods

2. Fixed value:

- Alerts or reminds the operator if a certain number of movements is not made or a certain number of parts is not used.

4. Types of error-proofing

4.2. Types of poka yoke methods

2. Fixed value: examples

Control



Kitting cart

Warning



Trays with indentations



4. Types of error-proofing

4.2. Types of poka yoke methods

3. Motion-Step:

- Checks whether the prescribed procedure has been followed.

4. Types of error-proofing

4.2. Types of poka yoke methods

3. Motion-Step: examples

Control



Push-down & turn medicine bottle cap

Warning



Beepers on banc terminals

5. References

1. Papers
2. Books
3. Websites

5. References

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