Poka-yoke: prevention versus detection

Distinguish preventing a defined error from detecting it before escape, and build a challenge-test record that checks both the control and its failure response.

A keyed part and a warning light solve different problems

Fictional connector assembly: the original connector can be inserted backward. Proposal A introduces a keyed geometry that should prevent that orientation. Proposal B uses a sensor to detect a backward insertion and block release. Engineer Sana must compare mechanisms rather than label both "mistake-proof" without testing.

Your role and the reference condition

Process engineer with operator, quality and design representatives.
Normal: The defined wrong orientation cannot reach accepted downstream output under the approved method.
Gap: The team has only tested correctly oriented parts and claims the wrong-orientation failure is eliminated.

Work within these conditions

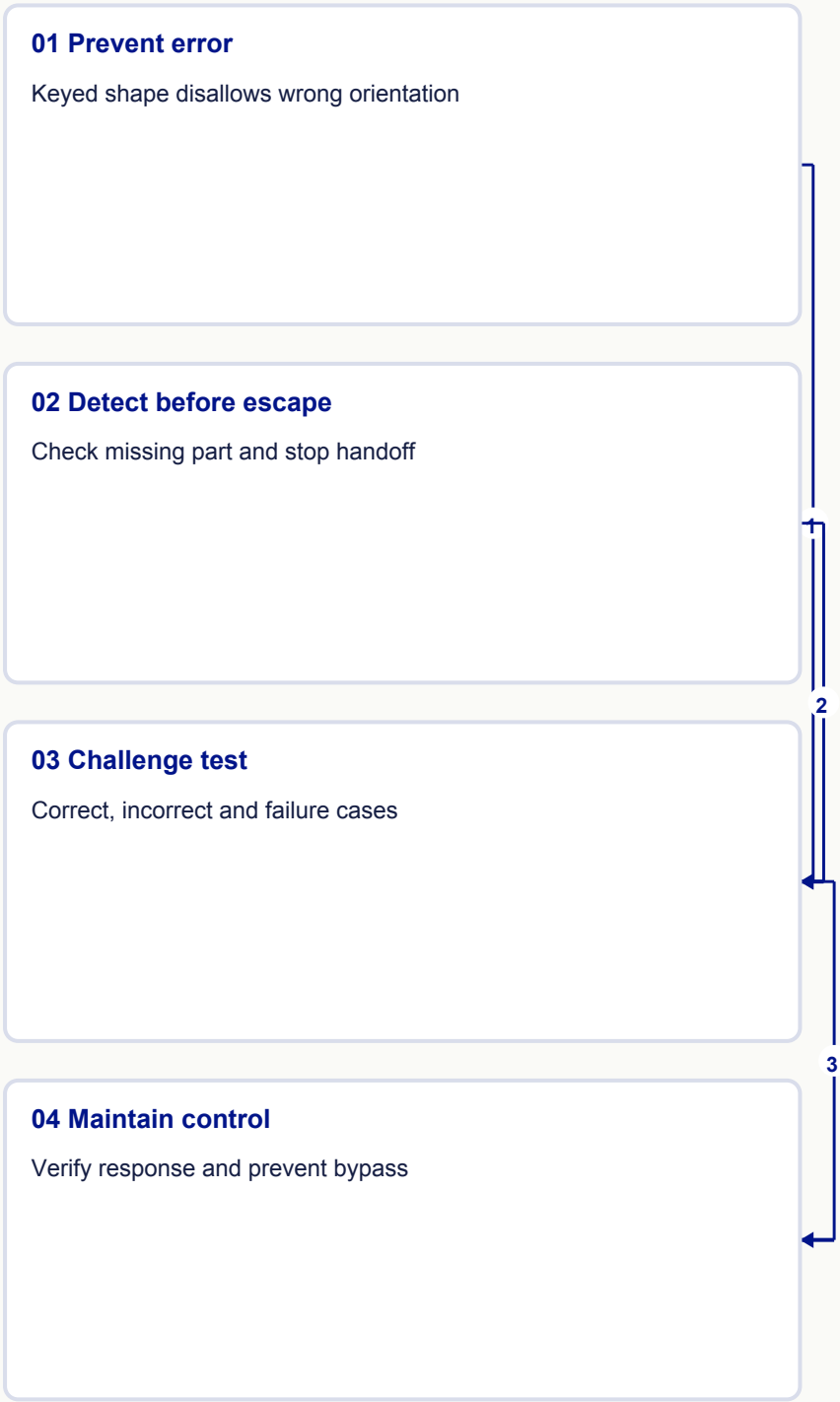
1. This is a desk comparison, not an instruction to bypass or modify production equipment.

2. The control addresses a specific error mode; other wrong, missing or damaged parts require their own analysis.

Fictional teaching case. Supplied observations support the exercise; proposed actions are not verified customer results.

See how the method works

Start with a specific error mechanism rather than a general request to be more careful. A keyed shape can prevent an incorrect orientation; a detection device can identify a missing part before it passes downstream. These are different levels of protection. Challenge the proposed control with known correct and incorrect cases, including plausible failure or bypass conditions. Define what happens when the check fails and who maintains the mechanism. A warning that people can overlook is not equivalent to physical prevention. Preserve required technical approval and verify the effect on quality before making the control part of the standard method.



Read every connection

1. Step 1 > 3
Validate

2. Step 2 > 3
Validate

3. Step 3 > 4
Accepted control

Connected method map: Prevent error, Detect before escape, Challenge test, Maintain control. Every authored connection is shown with a numbered arrow and named legend.

Follow the evidence and decisions

Inspect the supplied case inputs

Proposal / evidence	Declared mechanism
Original connector	Backward insertion physically possible
A: keyed geometry	Intended to prevent backward insertion
B: sensor and release block	Intended to detect wrong orientation before release
Tests completed	Correctly oriented parts only
Missing tests	Wrong orientation, absent part, fault/bypass response as applicable

01 / Name the error precisely

Sana defines the target as backward orientation of the specified connector at the insertion step. She separates it from missing connector, wrong model and damaged housing.

Why: "Assembly errors" is too broad to support a testable prevention claim. A control may handle one mechanism while leaving others unchanged.

Evidence / check: Target failure mode and point of occurrence are explicit.

02 / Describe what each control does

Proposal A is a prevention candidate if the approved geometry truly makes backward insertion impossible without damage or bypass. Proposal B is a detection/control candidate if sensing reliably blocks unsuitable release.

Why: The distinction concerns the mechanism, not which proposal sounds more advanced. Detection can be useful, but it must have a dependable response.

Evidence / check: A prevents the insertion mechanism; B detects and blocks escape under its validated conditions.

03 / Challenge the failure modes safely

Using approved challenge parts and test conditions, test correct orientation and the defined incorrect orientation. Include credible sensor fault, missing part or bypass scenarios where relevant to the control.

Why: Passing normal parts tests availability, not necessarily protection. Deliberate challenge testing needs controlled conditions and traceable test objects.

Evidence / check: Test matrix records expected and actual outcome for each defined case.

04 / Verify the response to control failure

Check that a failed or uncertain result leads to the required controlled state and named response, rather than a silent pass. Confirm reset/restart behavior through the approved method.

Why: A detector that can fail unnoticed may provide false confidence. An audible warning alone may not prevent escape.

Evidence / check: Fault/uncertain-state row includes containment, response owner and acceptance decision.

05 / Maintain the control and its scope

Document the validated failure modes, challenge frequency and change triggers. Recheck after relevant product, fixture, software or maintenance changes.

Why: A successful initial test does not make the control permanent or universal. The operational standard must retain the challenge method and response.

Evidence / check: Control owner, approved test record and scope limitations accompany release.

Completed mechanism and validation review

Item	Assessment	Required evidence
Keyed geometry	Prevention candidate	Wrong orientation cannot be assembled under approved conditions
Sensor + block	Detection/control candidate	Wrong orientation reliably stops release
Correct parts only	Insufficient challenge	Test defined incorrect conditions
Missing/wrong model	Separate failure modes	Assess control scope
Fault response	Not yet demonstrated	Verify controlled state and response

The sensor loses power

A fault test shows the sensor has no valid result after power loss, yet the proposed release signal remains permissive.

Decision

Do not approve the claimed detection control; the owner must correct and revalidate the fault response.

Reasoning

A normal-operation success cannot compensate for a known escape path in the tested fault condition.

What would change the decision?

Fault case recorded as failed, with affected claim and required retest.

Practise with a changed case

Prevent a missing washer

Separate fictional assembly uses a fixture pocket intended to prevent the next step unless a washer is present. A camera alternative flags a missing washer but only shows a message; downstream release is unaffected.

Option	Declared behavior
Fixture interlock	Intended to prevent next step without washer
Camera	Detects absence; warning only
Current validation	Present-washer case passed

Your task

1. Classify the intended mechanisms and state what is still unproven.
2. Write challenge cases for an absent washer and a control fault.
3. Explain whether the warning-only camera establishes prevention of escape.

Use the next page to record your reasoning before reading the answer.

Your practice worksheet

Prevent a missing washer

Defined error and escape point

Mechanism classification

Expected / actual challenge result

Fault-state response

Scope and retest trigger

Complete your reasoning before turning to the answer. Use the separate learner workbook for group practice.

Check your reasoning and transfer it

1. The fixture is a prevention/control candidate for proceeding without a washer, but the missing-washer and fault cases remain untested.

2. The camera detects absence as described; a warning alone does not establish blocked downstream escape.

3. A valid test record specifies expected behavior for present, absent and applicable fault conditions, using approved controlled test methods.

Suggested completed record

Control / evidence	Mechanism	Remaining requirement
Fixture	Prevent proceeding without washer	Challenge absence and fault
Camera	Detect and warn	Escape not proven blocked
Normal test	Present washer passed	Does not prove missing-part control

Plausible wrong turns

1. A warning is not automatically an interlock.

2. Testing only acceptable parts cannot prove protection against a specific error.

Evidence of a sound answer

1. Define the error and its escape boundary.

2. Separate intended design from validated behavior.

3. Include the fault response and maintenance/retest ownership.

Take the learning back to work

Commitment	Agreed follow-through
Owner	Process/design control owner with quality and operators
Record	Validated challenge matrix, response standard and change-trigger review
Review	At initial approval, defined challenge intervals and relevant changes
Verification evidence	Correct response to target error and credible faults without unsafe test practices
If unresolved	Retain containment and escalate failed controls; revise and revalidate the claim before relying on it.

Help someone else apply the method

Prepare

1. Two design proposal cards and a blank challenge matrix
2. Approved test-object placeholder; no live-machine challenge in class

Minutes	Activity and coaching prompt
4	Define the error Which orientation and which connector are in scope?
8	Compare mechanisms Where does each proposal interrupt the error path?
8	Test the washer reasoning What does a warning allow to happen next?
5	Plan maintenance What change would require revalidation?

Debrief

1. Ask learners to identify a different failure mode outside each claim.
2. Do not reward a stronger prevention label without challenge evidence.

Individual or remote practice

Draw the error path, mark where the control acts and complete expected outcomes before reading the answer.

Connect the method and check its boundaries

Before application

1. Known error mode
2. Approved test method

Outside this lesson

1. A reminder is weaker than prevention
2. A sensor can fail or be bypassed

LEI: Error-Proofing

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Prevent wrong/missing/reversed parts or prevent their passing downstream

Method reference; original OPEX scenario and diagram are synthetic teaching content, not source case results.

Open this lesson and its visual aids