Sample · 5 Whys · Loose bolted joint

Problem statement

Fictional sample case: customer incoming inspection finds loose bolted joints on 8 of 200 brackets. Required tightening torque: 12 ± 1 Nm. All details and evidence are invented for illustration only.

Working analysis: hypotheses are not proven causes. Status and evidence are supplied by the user.

Occurrence cause

1. Why: The joint is loose because tightening torque was too low.

Status: Evidence-supported
Evidence: Sample evidence: station delivered 8 Nm in the comparison test; at 12 Nm no loose joint occurred.
Verification / next steps: Verify the causal chain experimentally; validate corrective actions in D6 afterwards.

2. Why: Torque was too low because the driver used another variant's program.

Status: Evidence-supported
Evidence: Sample evidence: station log shows program B at 8 Nm instead of program A at 12 Nm.
Verification / next steps: Verify the causal chain experimentally; validate corrective actions in D6 afterwards.

3. Why: The wrong program remained active because manual program selection was not changed during the variant changeover.

Status: Evidence-supported
Evidence: Sample evidence: repeating the changeover from B to A without switching reproduces the defect.
Verification / next steps: Verify the causal chain experimentally; validate corrective actions in D6 afterwards.

4. Why: The changeover was not safeguarded because part identification was not linked to the driver program.

Status: Evidence-supported
Evidence: Sample evidence: station accepts variant A with program B; no interlock signal.
Verification / next steps: Verify the causal chain experimentally; validate corrective actions in D6 afterwards.

5. Why: The safeguard was missing because variant mix-up was not considered in the process FMEA and station approval.

Status: Evidence-supported
Evidence: Sample evidence: approval documents contain no test of the wrong-program / correct-part combination.
Verification / next steps: Verify the causal chain experimentally; validate corrective actions in D6 afterwards.

Detection cause

1. Why: The defect escaped because final inspection checked the bolted joint visually only.

Status: Evidence-supported
Evidence: Sample evidence: eight loose joints pass the repeated visual inspection.
Verification / next steps: Test inspection logic with deliberate defects and good parts; confirm effectiveness in D6.

2. Why: Visual inspection found nothing because insufficient torque has no visible indication.

Status: Evidence-supported
Evidence: Sample evidence: good and defective parts look alike; torque records differ.
Verification / next steps: Test inspection logic with deliberate defects and good parts; confirm effectiveness in D6.

3. Why: There was no alarm because inspection logic checked cycle completion, not variant-specific torque.

Status: Evidence-supported
Evidence: Sample evidence: an 8 Nm cycle receives an OK signal for variant A.
Verification / next steps: Test inspection logic with deliberate defects and good parts; confirm effectiveness in D6.

4. Why: Inspection logic was insufficient because the control plan did not require checking the program-to-part assignment.

Status: Evidence-supported
Evidence: Sample evidence: inspection plan specifies cycle OK and visual inspection only.
Verification / next steps: Test inspection logic with deliberate defects and good parts; confirm effectiveness in D6.

5. Why: The gap persisted because inspection effectiveness was not validated using deliberately defective parts.

Status: Evidence-supported
Evidence: Sample evidence: inspection approval contains no challenge test with incorrect torque.
Verification / next steps: Test inspection logic with deliberate defects and good parts; confirm effectiveness in D6.