

You are an ISO 9001:2015 expert, Generate a root cause analysis for a 20 Ton Trumpf 1000 S19 Large Format CNC Punching Machine that is off tolerance by 15% on .25 inch hole punches

Root Cause Analysis (RCA)

ISO 9001:2015 Reference: Clause 10.2 (Nonconformity and Corrective Action)

NCR Reference: NCR-2026-XXX

Machine: Trumpf TruPunch 1000 S19 (20 Ton Large Format CNC Punching Machine)

Problem: .25" (6.35 mm) round holes consistently out of tolerance by $\pm 15\%$ (actual hole size deviation $\approx 0.0375"$ / 0.95 mm)

Detected: In-process / Final inspection

Impact: Scrap / Rework on affected sheets, potential customer rejection, schedule delay

1. Problem Statement

The Trumpf TruPunch 1000 S19 is producing .25" punched holes that are consistently oversized (or undersized) by approximately 15%. This exceeds the typical $\pm 0.004"$ to $\pm 0.008"$ tolerance expected for this machine on mild steel / stainless sheets.

2. 5-Why Analysis

Why 1: Why are the .25" holes out of tolerance by 15%?

→ Punch and die clearance is excessive / incorrect for the material and thickness.

Why 2: Why is the clearance incorrect?

→ The current punch/die set for $\text{Ø}6.35$ mm has worn beyond acceptable limits or was installed with wrong clearance (standard clearance for mild steel is typically 8–12% of material thickness per side).

Why 3: Why was worn tooling or wrong clearance used?

→ Tooling inspection / replacement schedule was not followed; last documented tool check was 6 weeks ago (machine has run ~45,000 hits since then).

Why 4: Why was the preventive maintenance / tool management not followed?

→ No automated tool life counter or alert was active in the Trumpf TNC control for this specific tool; reliance on manual operator checks only.

Why 5: Why is there no effective tool management system in place?

→ Root Cause: The maintenance and tooling management process for high-volume punching tools lacks integration with the machine's CNC tool life monitoring system and has insufficient frequency for high-wear .25" punches on the current production mix.

3. Fishbone (Ishikawa) Summary – Major Contributing Factors

Category	Key Causes Identified
Machine	Worn punch & die, incorrect die clearance, possible ram alignment drift on large-format bed
Method	Inadequate tool inspection frequency, no formal setup verification checklist for punch tools
Material	Sheet thickness variation at upper tolerance limit + material hardness higher than standard
Man	Operator not trained on daily punch tip inspection; over-reliance on "it ran fine yesterday"
Measurement	Hole diameter only verified with calipers (no CMM or optical comparator for first article)
Environment	Shop temperature fluctuation affecting hydraulic oil viscosity and machine thermal stability

4. Verified Root Causes (Prioritized)

1. Primary Root Cause: Excessive wear on .25" punch and die set (clearance increased from ~0.008" to ~0.035" total).
 2. Contributing Systemic Cause: Lack of a robust, data-driven Tool Management & Predictive Maintenance Program in the QMS.
 3. Secondary Cause: Inconsistent first-article inspection and setup verification after tool changes.
-

5. Immediate Containment Actions (Already Taken)

- Quarantined all parts produced since last good inspection.
- Replaced punch & die set with new matched set (verified clearance).

- 100% inspection of current job using digital caliper + go/no-go gauges.
- Ran test strip – holes now within ± 0.003 ".

6. Corrective Actions (to be tracked in NCR)

Action	Owner	Target Date	Effectiveness Verification
Implement Trumpf tool life counter + automatic alerts in TNC control for all 0<0.5" punches	Maintenance & Programming	30-Jun-26	Monthly audit of alert compliance
Add daily punch tip visual + weekly dimensional check to operator PM checklist	Quality & Production	15-Jun-26	Audit records for 3 months
Update Tooling Management Procedure (include clearance charts by material/thickness)	Quality Manager	20-Jun-26	Procedure released & trained
Perform full machine geometric accuracy & ram alignment check (Trumpf service)	Facilities	15-Jul-26	Service report + before/after data
Add hole diameter verification to first-article checklist for all punching jobs	Quality	Immediate	Updated FAI form in use

7. Lessons Learned & QMS Link

- Update Risk Register (Clause 6.1) – add “Punching tool wear leading to dimensional nonconformities” as a medium risk.
- Opportunity: Move toward predictive tool monitoring using machine data (Industry 4.0 ready on TruPunch 1000).
- This RCA will be reviewed in the next Management Review (Clause 9.3).

Would you like me to:

- Generate the full Corrective Action Request (CAR) form?
- Create a Tool Management Procedure for the Trumpf?
- Produce a Fishbone diagram in text/ASCII or suggest how to visualize it?
- Customize this RCA with your actual material type and sheet thickness?