NC machine geometric acceptance (ISO 230-1)

cnc-geometric-acceptance

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Application template; not a claim of a completed customer project.

Scope

For new-machine acceptance, post-relocation verification or overhaul. Measure each item with agreed lines, travel and evaluation.

Equipment and configuration guidance

• Select autocollimator or interferometer by travel and tolerance

• Bridge, span gauge, pentaprism and reference square

• Temperature, pressure and vibration logging

Principle and calculation

Convert angles by $\Delta h = L \cdot \tan\theta$. Combine axes on a common datum; do not subtract independently zeroed profiles.

On-site checklist

• Stations and spans recorded

• Bidirectional repeatability consistent

• Environment within limits

• Out-of-tolerance item localised

Limitations

Geometric acceptance does not replace positioning, circular or cutting tests. Contract tolerances govern.

Detailed teaching example

Worked single-axis straightness example for an 800 mm travel

Scenario and task

Teaching example, not an acceptance record: five 200 mm bays over 800 mm, angles read by autocollimator and integrated into a profile before evaluating straightness. Synthetic data.

Preparation and measurement steps

01. Agree the standard, item list, tolerances and evaluation method in a signed measurement plan.

02. Warm up the machine and record temperature, foundation and air supply.

03. Measure straightness, squareness, parallelism and spindle items per ISO 230-1 with one datum and sign convention.

04. For out-of-tolerance items, separate installation, thermal and geometric causes before adjusting.

Teaching example readings

• Bay angles: +1″, +0″, -1″, -1″, +0″ at 0, 200, 400, 600, 800 mm.

• Height increments: 0.97, 0, −0.97, −0.97, 0 μm.

• Accumulated profile in μm: 0.97, 0.97, 0, −0.97, −0.97 μm.

Calculation procedure

Δh = 200×1000×tan(1π/648000) = 0.97 μm; the profile range is 1.939 μm. Using the end-point line as datum gives a different number and must be stated.

Example result and interpretation

Straightness is about 1.939 μm with a convex middle. If the drawing states a per-metre tolerance, scale it to 800 mm before comparing.

Example verification checklist

• Keep one sign convention; re-zeroing mid-travel breaks the integration.

• A reverse run exposes contact and drift; never average two inconsistent directions.

• Straightness applies to one line, never to a whole surface.

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