Linear axis positioning and repeatability (ISO 230-2)

linear-axis-positioning

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

Scope

Positioning, repeatability and reversal error of NC axes, precision stages and linear modules for acceptance, compensation and diagnosis.

Equipment and configuration guidance

• Laser interferometer with air sensors

• Optics matched to travel

• Acquisition software and part program

Principle and calculation

Deviation is command minus mean measured position; repeatability follows the standard interval; reversal is the difference between approach directions.

On-site checklist

• Beam alignment and cosine error checked

• Compensation on and logged

• Count and sequence per standard

• Before/after data retained

Limitations

Positioning accuracy is not machining accuracy; screw growth and servo gain vary with speed and load.

Detailed teaching example

Worked bidirectional positioning example over 500 mm

Scenario and task

Teaching example: five targets approached from both directions; unidirectional mean deviation, repeatability and reversal are derived. One run per direction is shown; the standard requires more.

Preparation and measurement steps

01. Define target count, distribution, repeat count and feed rate.

02. Set up the beam, align to the axis and check return over full travel.

03. Approach each target from both directions in the standard sequence.

04. Compute positioning deviation, repeatability and reversal error; look for periodic terms.

Teaching example readings

• Targets in mm: 0, 125, 250, 375, 500.

• Forward deviations in µm: +0, -2, +4, -3, +2.

• Reverse deviations in µm: +3, +3, +9, +2, +6.

Calculation procedure

Forward mean 0.2 µm, reverse mean 4.6 µm; forward range 7 µm; reversal B = 4.4 µm. A formal report needs the number of runs the standard requires.

Example result and interpretation

Reversal of 4.4 µm exceeds the unidirectional range, pointing at backlash or preload rather than random noise.

Example verification checklist

• Check cosine error; a misaligned beam scales all readings.

• Log compensation and material temperature; never mix compensated and raw data.

• Accuracy, repeatability and reversal are three separate figures.

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