Wafer stage guideway and flatness

wafer-stage-guide

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

Scope

Straightness, flatness and thermal stability of wafer, exposure and precision XY stages.

Equipment and configuration guidance

• High-resolution autocollimator or interferometer

• Granite datum and vibration isolation

• Temperature and airflow monitoring

Principle and calculation

Straightness by angle integration or direct displacement; flatness on one datum; drift as reference-point motion over time.

On-site checklist

• Isolation and airflow stable

• Time and temperature logged

• Two planes separate

• Drift reported separately

Limitations

Sub-micron results depend on support, airflow and operator position; measure in the service state.

Detailed teaching example

Worked 300 mm stage straightness and thermal drift example

Scenario and task

Teaching example: a 300 mm travel split into five bays, angles integrated into straightness, with a reference point tracking thermal drift. Synthetic data.

Preparation and measurement steps

01. Confirm cleanliness, isolation and vibration limit.

02. Stabilise thermally and establish the datum, avoiding hand heat.

03. Measure straightness in both planes and table flatness.

04. Run multi-point repeatability and reversal, logging thermal drift.

Teaching example readings

• Bay angles in arc-seconds: +0.3, +0.2, -0.1, -0.2, -0.2 over 60 mm bays.

• Accumulated height: 0.087, 0.145, 0.116, 0.058, 0 µm.

• Reference point drifted 0.05 µm over 2 h, used to separate thermal effects.

Calculation procedure

Δh = 0.087 µm; the accumulated range 0.145 µm is the straightness over this travel. Drift is reported separately and never subtracted from the profile.

Example result and interpretation

Straightness is about 0.145 µm concentrated in the first bays, suggesting mounting or preload at the entry; drift is far smaller and not the cause.

Example verification checklist

• Airflow and acoustic vibration disturb sub-micrometre readings; switch off non-essential equipment.

• Let the sensor reach stage temperature; measuring on a cold start adds thermal error.

• Keep straightness, flatness and angular error separate.

Document generated: 2026-11-16