Installation inspection plan for a cleanroom precision motion stage

cleanroom-stage-install

SHANGHAI MICROCRE OPTICS-MECH TECH CO.,LTD

Telephone: 400-812-7833 | 021-58391850

Address: 1478 Nanfeng Road, Fengcheng Town, Fengxian District, Shanghai, China | Postal code: 201411

Contact email: shanghai@yr17.net

Service email: rockwei@yr17.net

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

Scope

For post-installation inspection of an air-bearing/linear-motor precision stage in a cleanroom (600×600 mm base, example/teaching data): base flatness, overall level and in-travel attitude angles (pitch/yaw/roll). Clean, ESD-safe operation throughout, with micro-vibration and thermal disturbance controlled. Agree the datum, grid-measure the base, step through travel for attitude angles, then re-measure after settling.

Equipment and configuration guidance

• Photoelectric autocollimator (0.1″ class) with 150 mm reflector base (example)

• Polygon or orthogonal mirror set for attitude measurement

• Calibrated electronic level

• Cleanroom consumables, ESD strap and micro-vibration monitor

Principle and calculation

Δh=L·tanθ; pitch and yaw are read directly at each station; roll φ≈(h1−h2)/B, where h1, h2 are paired-station heights of two parallel lines and B the line spacing. With L=150 mm, 1″≈0.727 μm (example/teaching data).

On-site checklist

• Cleanroom and ESD measures in place

• Readings taken after air pressure/motor state stabilised

• Settling re-measurement difference recorded

Suggested records

• Base flatness report and levelling correction

• In-travel attitude curves (pitch/yaw/roll)

• Temperature and micro-vibration log

Limitations

Does not cover positioning accuracy, repeatability or dynamic response of the stage; vibration-isolation performance must be verified separately with a vibrometer. This plan does not replace the vendor's acceptance test.

Detailed teaching example

Cleanroom Precision Stage Installation Inspection · Tutorial Case

Scenario and task

Teaching demonstration, not a real customer project: segmented straightness inspection of a precision linear stage base installed in a cleanroom; data are instructional settings.

Workflow overview

Cleanroom prep → Isolation check → Segment survey → Log environment → Straightness result

Preparation and measurement steps

01. Gown up with ESD protection and clean the base

02. Confirm the vibration-isolated foundation is stable and the stage is free-floating

03. Place the autocollimator on an independent stand; survey with a 150 mm bridge step by step

04. Read each segment while logging temperature and humidity

05. Cumulate the results for base straightness

Teaching example readings

• Bridge span L=150 mm; segment 1 autocollimator reading θ□=+0.5″

• Segment 2 autocollimator reading θ□=-0.5″

• Segment 3 autocollimator reading θ□=+1″

Calculation procedure

Height conversion: Δh = L·tan(θ·π/648000)×1000 (μm). Segment 1: 150×tan(+0.5″)=+0.36 μm; Segment 2: 150×tan(-0.5″)=-0.36 μm; Segment 3: 150×tan(+1″)=+0.73 μm. Cumulative heights: 0→+0.36→+0.00→+0.73 μm; peak-to-valley PV=+0.73−(+0.00)=+0.73 μm.

Example result and interpretation

Tutorial result PV≈0.73 μm, demonstrating micrometre-level installation straightness inspection in a cleanroom.

Example verification checklist

• Personnel and instruments follow cleanroom protocol

• Readings only after isolation state is confirmed

• Temperature drift during readings within 0.2 °C

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