Assembly flatness inspection plan for a satellite panel

satellite-panel-assembly

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

Scope

For assembly-state flatness of a satellite honeycomb panel (2000×1500 mm, example/teaching data). Emphasis on low-stress fixturing, temperature stability criteria and drift monitoring throughout. The full surface is measured on a grid with a closed-loop drift monitor; data exceeding the drift criterion are discarded and re-measured.

Equipment and configuration guidance

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

• Low-stress fixturing and torque wrench

• Fixed drift-monitor mirror and multi-point thermometers

• Low-temperature-cure reflective markers and grid marking tools

Principle and calculation

Flatness is the peak-to-valley of the height matrix after datum unification; drift correction $\Delta h_i(t)=h_i-\delta(t)$, with $\delta(t)$ linearly interpolated from monitor re-readings. With L=150 mm, 1″≈0.727 μm (example/teaching data).

On-site checklist

• Temperature stability criterion met and logged

• Closed-loop drift monitoring effective

• Torque records matched to line data versions

Suggested records

• Height matrix and flatness result

• Drift monitoring curve and correction log

• Torque record and re-measurement comparison

Limitations

Does not predict deformation under launch mechanical loads or thermal-vacuum conditions; skin local bulges below grid resolution are outside the evaluation. Structural strength and assembly process qualification are not covered.

Detailed teaching example

Satellite Panel Assembly Flatness Inspection · Tutorial Case

Scenario and task

Teaching demonstration, not a real customer project: segmented angular measurement of satellite panel assembly flatness; data are instructional settings.

Workflow overview

Soak & support → Aim at datum → Light bridge steps → Environment control → Flatness evaluation

Preparation and measurement steps

01. Support the panel teaching article steadily on the thermally controlled bench

02. Aim the autocollimator along the panel datum face

03. Survey step by step with a lightweight 150 mm bridge

04. Log angular readings while controlling ambient temperature

05. Cumulate and convert for flatness results

Teaching example readings

• Bridge span L=150 mm; segment 1 autocollimator reading θ□=+0.4″

• Segment 2 autocollimator reading θ□=-0.8″

• Segment 3 autocollimator reading θ□=+0.6″

Calculation procedure

Height conversion: Δh = L·tan(θ·π/648000)×1000 (μm). Segment 1: 150×tan(+0.4″)=+0.29 μm; Segment 2: 150×tan(-0.8″)=-0.58 μm; Segment 3: 150×tan(+0.6″)=+0.44 μm. Cumulative heights: 0→+0.29→-0.29→+0.15 μm; peak-to-valley PV=+0.29−(-0.29)=+0.58 μm.

Example result and interpretation

Tutorial result PV≈0.58 μm, demonstrating the flatness inspection workflow for aerospace structures.

Example verification checklist

• Lightweight bridge avoids denting the panel face

• Gloves worn to prevent contaminating the datum face

• Temperature logged at 20 °C±0.2 °C

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