Geometry inspection plan for a railway bogie frame

bogie-frame-geometry

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

Scope

For straightness of the two side beams, their mutual parallelism and the rectangularity of a railway bogie frame (2500 mm wheelbase, example/teaching data). The autocollimator establishes a reference axis on one side beam; a datum-transfer target carries it to the opposite beam, and diagonal lengths are checked with length gauges.

Equipment and configuration guidance

• Photoelectric autocollimator (0.1″ class) with 200 mm reflector base (example)

• Datum-transfer target with repeatable clamping fixture

• Four-point equal-height levelling supports

• Diagonal length gauges and temperature logger

Principle and calculation

Parallelism is the peak-to-valley of paired-station transverse angle differences converted by the baseline length; rectangularity is the diagonal difference |d1−d2|; datum-transfer error is assessed from target re-clamping differences and included in the budget. With L=200 mm, 1″≈0.970 μm (example/teaching data).

On-site checklist

• Four-point support equal height verified

• Datum-transfer repeatability assessed

• Diagonal measurement temperature recorded

Suggested records

• Side-beam straightness profiles

• Parallelism evaluation and diagonal difference

• Support state and datum-transfer records

Limitations

Does not cover frame strength, welding residual stress or full wheelbase dimensional-chain qualification; wheelbase is length metrology — this plan checks angles and geometric relations only.

Detailed teaching example

Railway Bogie Frame Geometry Inspection · Tutorial Case

Scenario and task

Teaching demonstration, not a real customer project: segmented flatness measurement of a rolling stock bogie frame mounting face; data are instructional settings.

Workflow overview

Rig support → Aim at side face → Step survey → Convert heights → Flatness evaluation

Preparation and measurement steps

01. Place the frame on the inspection rig with four-point support

02. Aim the autocollimator at the side-beam mounting face

03. Survey with a 200 mm bridge along the face step by step

04. Record the angular reading per segment

05. Cumulate and convert for face flatness results

Teaching example readings

• Bridge span L=200 mm; segment 1 autocollimator reading θ□=+1″

• Segment 2 autocollimator reading θ□=-0.5″

• Segment 3 autocollimator reading θ□=+1.2″

Calculation procedure

Height conversion: Δh = L·tan(θ·π/648000)×1000 (μm). Segment 1: 200×tan(+1″)=+0.97 μm; Segment 2: 200×tan(-0.5″)=-0.48 μm; Segment 3: 200×tan(+1.2″)=+1.16 μm. Cumulative heights: 0→+0.97→+0.49→+1.65 μm; peak-to-valley PV=+1.65−(+0.00)=+1.65 μm.

Example result and interpretation

Tutorial result PV≈1.65 μm, demonstrating segmented geometric inspection of the bogie frame.

Example verification checklist

• Frame rock-free on four-point support

• Bridge avoids threaded bushing holes

• Survey symmetric positions on both side beams

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