



Testing Methodology Report for Racking Systems

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1. Introduction

This document outlines the testing methodology for verifying the structural adequacy of racking systems in compliance with **AS 4084-2023**. The approach combines **physical testing of individual components** and **analytical validation** by Barrason's Group to evaluate system-wide behaviour. This ensures compliance while minimizing the need for full-scale physical system testing.

2. Objectives

- To verify the strength, stability, and deflection limits of racking system components.
 - To perform system-wide analysis using finite element methods (FEM) and validate global performance.
 - To ensure compliance with **AS 4084-2023** requirements for structural safety and serviceability.
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3. Load Combinations

3.1. Ultimate Limit States (ULS)

1. $1.3 \times \text{Dead Load} + 1.4 \times \text{Pallet Load}$
2. $1.3 \times \text{Dead Load} + 1.4 \times \text{Pallet Load} + 1.4 \times \text{Earthquake Load in X-direction}$
3. $1.3 \times \text{Dead Load} + 1.4 \times \text{Pallet Load} + 1.4 \times \text{Earthquake Load in Y-direction}$

3.2. Serviceability Limit States (SLS)

1. Dead Load + Pallet Load
 2. Dead Load + Pallet Load + Earthquake Load in X-direction
 3. Dead Load + Pallet Load + Earthquake Load in Y-direction
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4. Member-Specific Loads

4.1. Pallet Load Values

Cross Beams

- **ULS:** 0.270 kN/m (uniform distributed load)
- **SLS:** 0.193 kN/m (uniform distributed load)

Main Beams

- **ULS:** 0.784kN/m (uniform distributed load)
 - **SLS:** 0.560kN/m (uniform distributed load)
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4.2. Columns

- **Maximum Axial Load:**
 - 24.403 kN
 - **Test Load:**
 - Apply axial load incrementally up to 24.403 kN
 - **Combined Loading:**
 - Simulate axial force combined with moments from lateral loads to verify stability.
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4.3. Braces

- **Maximum Axial Load:**
 - 2.028 kN
 - **Test Load:**
 - Apply axial tensile and compressive loads incrementally up to 2.028 kN
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4.4. Beams

- **Maximum Deflection Limit:**
 - 6.35 mm (for serviceability limit states).
 - **Test Loads:**
 - Cross Beams:
 - **ULS:** 0.270kN/m
 - **SLS:** 0.193kN/m
 - Main Beams:
 - **ULS:** 0.784kN/m
 - **SLS:** 0.560kN/m
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4.5. Connections

- **Applied Loads:**
 - Moment: 0.346 kN.m
 - Shear: 0.813 kN
- **Test Method:**
 - Simulate shear and moment loads simultaneously at the beam-to-column connection.

- Incrementally increase loads to validate joint strength and deformation behaviour.

4.6. Base Plate and Anchor Loads

Vertical Load

- **Maximum Vertical Load:** 30.593 kN

Horizontal Load

- **Maximum Horizontal Load:** 1.086 kN

Test Method

1. Apply a vertical load of 30.593 kN to the base plate.
2. Simultaneously apply a horizontal load of 1.086 kN to the anchors.
3. Monitor:
 - Base plate deformation.
 - Anchor pullout resistance.
 - Combined stress in the base plate and anchor bolts.

5. Analytical Validation by Barrason's Group

5.1. Overview

Barrason's Group will perform detailed analytical validation using component test results as input. This validation will assess global system behavior and interactions between components.

5.2. Methodology

1. **Finite Element Model Setup:**
 - Develop an FEM of the racking system, including beams, columns, braces, and connections.
 - Define material properties and boundary conditions based on component test results.
2. **Load Simulation:**
 - Apply design loads, including:
 - Dead loads.
 - Live loads (e.g., pallet loads).
 - Lateral loads (e.g., seismic or operational forces).
 - Incorporate load combinations as per **AS 4084-2023**
3. **Validation Parameters:**
 - **Deflection:** Simulate deflections under service loads and ensure compliance with deflection limits.
 - **Stability:** Analyse resistance to overturning and lateral forces.
 - **Load Transfer:** Validate stress distribution and interaction between components.

5.3. Reporting

Barrason's Group will provide a detailed analytical report including:

1. **Model Description:**
 - Assumptions, boundary conditions, and loading scenarios.
2. **Results:**
 - Deflection values, stress distributions, and stability analyses.
3. **Compliance:**
 - Comparison of analytical results with **AS 4084-2023** criteria.
4. **Recommendations:**
 - Suggestions for design adjustments or improvements if required.

6. Conclusion

This testing and validation methodology ensures a rigorous evaluation of racking systems in compliance with **AS 4084-2023**. By combining physical testing of components with advanced analytical validation performed by Barrason's Group, we provide a comprehensive assessment of structural adequacy while optimizing resources.