



KNIGHT ALUMINUM RAIL GENERAL STANDARDS FOR MATERIALS AND DESIGN PROCESS

Material Standards:

All aluminum used in the manufacturing of various Knight extruded rail sections, with or without integral backer sections meets the international **ASTM B221** for **6005-T5** alloy and temper material specification. The mechanical properties we use are as determined by others with standard test methods **ASTM B557**.

(The minimum yield strength and ultimate tensile strengths as well as minimum elongation values, are comparable to the structural grade material specification ASTM B308 for 6061-T6 AL alloy and temper).

Also referenced is the technical report titled: Aluminum and its alloys (the **Aluminum Association**, Inc.)

Applicable Design Standards Employed:

RE: Floor Mounted Steel Structures and Cantilevered Support Systems for Knight Work Station Layouts:

Systems are designed in accordance with principals and guidelines of **AISC Steel Construction Manual**, as applicable, for the structural steel framing supports for monorail and “multiple runway rail” systems.

For aluminum rail assemblies, Knight uses **MMA** (Monorail Manufacturers Association) **ANSI Standard MH27.2-2003** specification for enclosed track systems as a reference and conservative guide in the design and detailing of long lasting, trouble-free bridges and runways.

ANSI Specification **ASME B30.11** and **OSHA** Specification **1910.179** cover safety standards for Monorails.

When Canadian standards are applied to overhead rails, we reference **CSA Standard B167-96** and **CSA Standard C22.2 No.33-M2004** guidelines as required.

Knight Bridge and Runway **Rail system design capacities** include **allowance for hoist weight plus a 25% factor** applied to actual loads to **account for Impact or potential Overload conditions**.

Deflection Criteria and Guidelines:

During the design process, both target deflection ratios and allowable material stresses are compared to arrive at the final live load deflection that does not exceed the permissible aluminum extreme fiber stress. (Most rail sections selected will not exceed an **L / 450** ratio; where L is the design span in inches.)

Allowable or **permissible stresses** in rail sections under maximum design loading are limited per **MMA guidelines** to Aluminum material yield stress divided by 3.0 or the ultimate tensile stress divided by 3.6. Note that a customer’s requirements such as **Ford G.V.O.S.S.** or **GM Global Specification SP-M_ Bridge and Rail system requirements, 2.0 for Materials**, may have more stringent allowable stress values that will then supersede those of MMA.



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Professional Engineering Design Certification Process Summary

Review workstation layout for structural adequacy and stability to safely resist gravity loads and moving loads plus associated lateral loads as applicable. (Check for adequacy of lateral bracing.)

Verify the adequacy of the designer selected rail capacity limits. These will be displayed on rails.

Review and analyze the rail components selected relative to cross sectional properties and stiffness required to limit extreme fiber stresses to those outlined in the referenced guidelines and to minimize excessive deflections for optimal operational performance when in service.

Highlight select critical structural load carrying members, calculate actual maximum material stresses and compute relative safety factors that are to be greater than a minimum value of 3.

Quality control, Testing and Safety Standards:

Knight-Global is an **ISO 9001:2015** registered company that manufactures, machines, assembles and ships “customer specific” ergonomic products and support system structures that include aluminum rails and steel weldment assembly lifting fixtures while following safety and reliability guidelines and procedures for the benefit of both the customer and company alike.

As product development or other circumstances require, Knight can in-house **test rail sections**, hangers, trolleys and related system components to verify capacity and improve performance and longevity. (This was done in the past to verify working capacities for new “strong backer” rail sections in our updated testing lab and repetitive motion lab facility to better assess fatigue strength or identify potential long-term performance, serviceability and functionality problems).

Knight is now also an **ISO 14001** certified management organization; seeking to incorporate environmental awareness and responsibility into the daily company operations at all levels.