Design, Testing and Utilization of Welded-Wire Rack Decking
American National Standard

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Design, Testing and Utilization
of Welded-Wire Rack Decking

Rack Manufacturers Institute
An Affiliated Trade Association of Material Handling Industry of America,
A Division of Material Handling Industry

Approved 15 November 2007
American National Standards Institute, Inc.
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This standard, which was developed under the Canvass method of Material Handling Industry and approved by ANSI on 15 November 2007, represents suggested design practices and performance testing criteria for welded-wire rack decking. It was developed with the sole intent of offering information to parties engaged in the manufacture, marketing, purchase, or use of welded-wire rack decking. This standard is advisory only and acceptance is voluntary and the standard should be regarded as a guide that the user may or may not choose to adopt, modify, or reject. The information does not constitute a comprehensive safety program and should not be relied upon as such. Such a program should be developed and an independent safety adviser consulted to do so.

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Foreword  (This foreword is not part of American National Standard MH26.2-2007)

Development of this Standard was undertaken by a technical working group of the Rack Manufacturers Institute (RMI). This document replaces an earlier edition designated American National Standard MH26.2-2004. This standard was originally developed in 1997 by the Industrial Metal Containers and Wire Decking (IMC&WD) Product Section of Material Handling Industry of America (MHIA). Upon admitting wire deck manufacturers into its membership, the Rack Manufacturers Institute assumed responsibility for maintenance and further development of the document.

The Welded Wire Decking Technical Group is a working group of the Rack Manufacturers Institute (RMI), an affiliated trade association of Material Handling Industry of America (MHIA). The Welded-Wire Decking Technical Group is comprised of a substantial portion of the major companies that design and manufacture welded-wire rack decking in the United States. This standard is the result of the group’s recognition of the need to develop a comprehensive safety standard and establish minimum design and performance criteria to ensure the safe application and utilization of welded-wire rack decking, and was formulated under MHIA procedures approved by the American National Standards Institute (ANSI).

At the date of approval of this standard, the Welded Wire Decking Technical Work Group of RMI consisted of the following member companies:

- American Wire Products
- Atlas Material Handling, Inc.
- Cargotainer
- ITC
- J&L Wire Products
- Nashville Wire Products Manufacturing Co., Inc.
- Wireway Husky Corporation

Suggestions for improvement, and questions regarding interpretation, of this standard will be welcome. They should be sent to: MH26.2 Working Group (RMI), Material Handling Industry of America, 8720 Red Oak Blvd., Suite 201, Charlotte, NC, 28217-3992; standards@mhia.org.
Design, Testing and Utilization of Welded-Wire Rack Decking

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Design, Testing and Utilization of Welded-Wire Rack Decking

1 SCOPE AND OBJECTIVES

This standard is established to provide a guideline for design, testing, fabrication and utilization of welded-wire mesh rack decking utilized as an accessory for industrial steel storage racks.

This standard applies to uniformly loaded rack decking fabricated from welded-wire mesh, with permanently attached reinforcements, for use in storage racks. The purpose for such rack decking is to provide storage capability by creating a surface, in conjunction with a superstructure or framework hereinafter referred to as rack, upon which to place materials that may be on pallets, in containers, or in some other form.

This standard does not apply to:

- Rack decking manufactured prior to publication date of this standard
- Rack decking that has been improperly installed, altered, damaged, or used in any manner other than that for which it was originally intended, designed, purchased, sold, or a combination thereof
- Decking or shelf surface materials other than welded-wire rack decking

2 NORMATIVE REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this American National Standard. At the time of publication of this document, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[7] ASTM A82-ae1-1997, Specifications for Cold-Dawn Steel Wire for Concrete Reinforcements
3 DEFINITIONS

3.1 General

3.1.1 **Beam** – A horizontal load-carrying member of the steel storage rack system (See Figure 1, Items A and B).

3.1.2 **Capacity** – A maximum recommended uniformly distributed static load independent of the support system.

3.1.3 **Decking section** – A completely fabricated decking assembly with reinforcing members ready for installation upon supporting storage rack framing (See Figures 4 and 5). One or more decking sections are used to form a shelf surface.

3.1.4 **Nonstep beam** - A beam that offers only one horizontal surface on which the rack decking can be placed. Examples of nonstep beams are "Box" sections, tubing, channels and I-beams (See Figure 1, Item B and Figure 3).

3.1.5 **Nonstep beam application** – An application in which the area of wire decking support is confined to the surface area on the top of the front and rear beams.

3.1.6 **Rack** – The support system for rack decking, specifically the upright-frames and beams in their assembled configuration (See Figure 1).

3.1.7 **Rack Decking (rack deck)** – Same as decking section in 3.1.3 (See Figures 4 and 5).

3.1.8 **Rack opening** – The distance between a pair of upright frames which is measured parallel with the horizontal rack beam (See Figures 1, 2 and 3).

3.1.9 **Reinforcement member** – The component of rack decking which increases the capacity rating and rigidity of the assembly. Examples are channels, tubes, rods, etc. (See Figure 5, Item E).

3.1.10 **Shelf depth (O.D.)** – The horizontal distance measured between the outside faces of beams in their assembled configuration (See Figure 1, Item C).

3.1.11 **Step beam** – A beam that provides two horizontal surfaces on which the rack decking can be placed. Usually the top surface of the beam supports the wire mesh and the notched lower surface of the beam supports the reinforcing members (See Figure 1, Item A and Figure 2).

3.1.12 **Uniformly distributed load (UDL)** – Any static load which is evenly distributed over the entire surface on the rack deck independent of the support system.

[9] ASTM A 1008/A 1008M – 01a, *Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Allow with Improved Formability*
3.1.13 Waterfall – Descriptive term for the portion of the wire mesh utilized on some wire decks that runs perpendicular to the load bearing surface. Most commonly the waterfall extends downward over the outside face of the beam (See Figure 4, Item A). In this case, the waterfall should extend past the radius of the beam a sufficient distance to minimize the potential for accidental displacement of the decking.

3.2 Dimensions

3.2.1 Depth
The overall depth of the wire deck (See Figure 4, Item D)

3.2.2 Width
The overall width of the wire deck (See Figure 4, Item W)

3.2.3 Wire mesh spacing
The nominal center-to-center spacing of the wire mesh configuration. Typically described as front-to-back wire spacing followed by left-to-right wire spacing. Please note this is not the distance between the wires or the dimension of the opening itself but rather the distance from the center of one wire to the center of the next parallel wire. (See Figure 4, Items X and Y)

3.2.4 Inside Dimension (ID)
See Figures 1, 2 and 3.

3.2.5 Bottom (ID)
See Figures 2 and 3.

3.2.6 Step Height
The vertical distance between the two upper horizontal surfaces of a step beam (See Figures 1 and 2, Item C).

3.2.7 Step Depth
The distance between the two inside vertical surfaces of a step beam (See Figures 2, Item E).

3.2.8 Height of Waterfall
Distance measured from the load bearing surface of the deck to the end of the bent perpendicular wire. Typically this dimension is approximately 1.5 inches (38.1mm). (See Figure 4, Item A)

3.2.9 Top Width of Beam
See Figures 1 & 2, Item A

3.3 Safety Factor

The ratio of the failure load to the rated load carrying capacity of the component. Normally the rated load carrying capacity is referred to as the capacity rating. Refer to Section 7.1.3 for allowable load capacity ratings.
4 MATERIALS

This Specification assumes the use of steel of structural quality as defined in general by the specifications of the American Society for Testing and Materials (ASTM) that are listed in the American Iron and Steel Institute (AISI) North American Specification for the Design of Cold-Formed Steel Structural Members [4], and the American Institute of Steel Construction (AISC) Specification for Structural Steel Buildings [3].

Steels not listed in the above specifications are not excluded provided they conform to the chemical and mechanical requirements of either reference [4] or [3], or other published specifications which establish their properties and structural suitability, and provided they are subjected either by the producer or the purchaser to analyses, tests, and other controls in the manner prescribed by either reference [4] or [3] as applicable.

5 DIMENSIONAL CHARACTERISTICS

5.1 Nominal Dimensions

The nominal dimensions of welded wire rack decking shall be described by . . .

5.1.1 Specifying the front-to-back dimension followed by the left-to-right dimension.

5.1.2 Describing the mesh by specifying the center-to-center dimension of the front-to-back wires (See Figure 4, Item X), followed by the center-to-center dimension of the left-to-right wires (Figure 4, Item Y), followed by the gauge of the wire or the diameter of the wire expressed in decimal inches to the nearest .001 inch.

5.1.3 Specifying the quality and description of supports attached to the decking section.

5.1.4 Specifying the uniformly distributed load capacity of the decking section.

5.2 Actual Dimensions

The actual dimensions of the welded-wire rack decking sections represent the manufacturing dimensions which shall take into account necessary clearances required to fit the specific rack being used.

5.3 Manufacturing Tolerances

The allowable tolerances from actual manufacturing dimensions shall be specified in the following paragraphs.

5.3.1 The front-to-back dimensions of the finished welded-wire rack decking sections shall be the actual dimension plus or minus 1/8 inch (3.2 mm).

5.3.2 The left-to-right dimension of the finished welded-wire rack decking sections shall be the actual dimension as measured from out to out or centerline of end wires plus or minus 1/4 inch (6.3 mm).

1 Numbers in brackets refer to corresponding numbers in Section 2, Normative References.
5.3.3 The diagonal measurements (squareness) shall be within 1/2 inch (12.7 mm) or 1%, whichever is greater.

5.3.4 The length of reinforcing members shall be within plus or minus 1/16 inch (1.5 mm). The camber and sweep of reinforcing members shall be no greater than 1/2 of 1% of their lengths with a maximum of 1/4 inch (6.3 mm).

5.3.5 Center-to-center distances between wires on mesh panels shall be within plus or minus 1/8 inch (3.2 mm), non-cumulative, or the specified wire mesh spacing.

Figure 1. Steel Storage Rack System


**Figure 2. Step Beam**

- **A**: TOP WIDTH OF BEAM
- **B**: INSIDE DIMENSION (BEAM TO BEAM)
- **C**: STEP HEIGHT
- **D**: OUTSIDE DIMENSION (BEAM TO BEAM)
- **E**: STEP WIDTH

**Figure 3. Box Beam**

- **A**: TOP WIDTH OF BEAM
- **D**: OUTSIDE DIMENSION (BEAM TO BEAM)
- **B**: INSIDE DIMENSION (BEAM TO BEAM)
Figure 4. Deck Section

Note: Wire mesh shown without reinforcements for clarity only.
Refer to Section 3.2 Dimensions

Figure 5. Decking Section with Reinforcement
6 DESIGN & FABRICATION PROCEDURES

6.1 Design Procedures

6.1.1 Design shall be based upon determination of capacity and allowable deflections. Designs shall be based upon uniformly distributed static loading. The determination of safe load-carrying capacity and allowable deflections shall be carried out in accordance with generally accepted engineering practices, and as specified in AISI SG 671, ASIS SG 672, or AISC M016. However, where the composition or configuration of elements, assemblies, or details of cold-formed or hot-rolled structural members is such that calculation of their safe load-carrying or deflection cannot be made in accordance with the above listed specifications, their safe structural performance shall be established through a testing program as specified in Section 7. Note that test results must be based upon tested yield as compared or in proportion to the material specification’s allowable minimum yield.

6.1.2 While welded-wire rack decking is generally designed for static uniformly distributed loads, manufacturers may be able to provide designs suitable for static non-UDL loads upon special request. Welded-wire rack decking may not be suitable for dynamic loading.

6.2 Fabrication Procedures

6.2.1 All welding shall be performed in a manner consistent with AWS C1.1 [2], for resistance welding and ANSI/AWS D1.1 [1], for arc welding.

6.2.2 The wires shall be assembled by means that will ensure accurate spacing and alignment of all members of the finished wire mesh. The crosswire members shall be welded at each intersection.

6.2.3 The reinforcing members of rack decking shall be assembled by means that will ensure accurate spacing and alignment of all members of the finished rack deck. The reinforcing members shall be welded at each intersection with the crosswire members.

7 TEST PROCEDURES

7.1 Line Load Test

7.1.1 Equipment Required

- An apparatus capable of applying two-line loads to a decking surface at the 1st and 3rd quarter points (Figure 6). The line loads shall be 2 inches (50.8 mm) wide steel bars or tubes and no less than 2 inches (50.8 mm) greater in length than the width of the rack decking assembly to be tested. The bars or tubes shall be affixed to a steel platen in such a manner as to prevent flexing or deforming greater than 1/100 inch (0.25 mm) under the heaviest load applied. The apparatus must be designed in such a way that at no time during the test does anything
other than the 2 inch (50.8 mm) surface of the bar or tube come into contact with the rack decking assembly. The apparatus must be 400 lbs. (181.8 kg) or less in weight.

- A support system within which to place the rack decking assembly shall be designed to duplicate the support provided by a steel storage rack system. This support system may duplicate any beam configuration (roll-formed step beams, roll-formed box beams, structural beams, etc.) but may not flex or deform more than 1/100 inch (0.25 mm) under the heaviest load applied.

- Any convenient means of applying a variable and controllable static load to the apparatus described above.

- Any convenient means of measuring deflection in 1/100-inch (0.25 mm) readings.

7.1.2 Procedure

The following test procedure is designed to apply a line load at each of two quadrants, (specifically, the 1st and 3rd) of the wire decking assembly by running parallel to the rack beams. The load applied at the quadrants is equal to the uniformly distributed load (UDL).

Example: 2000 lbs. (907.2 kg) applied using two-line loads at the first and third quadrants of the deck is equal to 2000 lbs. (907.2 kg) uniformly distributed load.

1) Place the rack decking assembly on a rigid, level support system that supports the rack decking at its extended locations. The support system should support the rack decking assembly in a manner identical to that of the beams of a steel storage rack system.

2) Position deflection-measuring devices on both:

- The reinforcing member nearest the geometric center, at the point midway between the rack beams.
- The reinforcing member nearest either side at the point midway between the rack beams. If the rack decking assembly has only two reinforcing members, then position the deflection measuring devices on either side of the two reinforcing members, at a point midway between the rack beams.

3) Position the apparatus onto the decking so that the 2 inch wide (50.8 mm) bars or tubes contact the surface of the rack decking assembly to be tested and run parallel to the rack beams so as to create 2-line loads at the first and third quadrants (Figure 6) of the rack decking.

4) Apply an initial line load of 10% of the desired test capacity or the actual weight of the testing apparatus, whichever is greater, to ensure the rack decking assembly has been properly seated into the support system to begin recording deflections.
5) Increase the Load applied up to the point at which deflection of D/165 is achieved in a minimum of four increments. Record the capacity exerted as “W1”. (Refer to Figure 4 whereas “D” is defined as the overall depth of the deck).

6) Increase the Load applied to Structural Collapse in a minimum of no less than four increments. Record the capacity exerted when structural collapse occurs. Define “W2” by dividing the recorded load by two (2). Structural collapse is defined as the point at which the support channels continue to deflect without any additional load being applied.

7.1.3 Allowable Load Capacity Ratings

Capacity shall be defined as the lesser of the two values W1 and W2.

Figure 6: Two Line Load Testing Diagram