Specifications and the RMI R-Mark Certification Process

Sponsored by:

RMI

RACK MANUFACTURERS INSTITUTE

Presented by:

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MHI

Rack Manufacturers Institute
&
Certification

About RMI

- Independent, incorporated non-profit Trade Association
- Formed in 1958
- Mission: To advance standards, quality and safety in the use of Industrial Steel Storage Rack Products
- Membership requirements:
  - Must control the structural design and manufacture of storage products made for sale in the USA
  - Pay dues to support RMI Mission
  - Actively participate in meetings
  - Participate in the monthly statistical program
  - Voluntarily agree to design rack in accordance with RMI/ANSI 16.1-2012
- Members are leading manufacturers from the US and other countries
- Current membership consists of 17 storage rack companies and 5 associate members producing rack decking

What is RMI Certification?

- Voluntary process
- Standards based – ANSI-MH16.1- 2012
- Independently validated by Professional Engineers outside of the RMI
- License allowing application by the company's Registered Professional Engineer

What Does Certification do for the Customer?

- Provides independent verification of a company's compliance with the Industry Standard
- Ensures that a company knows how to comply with the current code
- Differentiates companies that may otherwise appear similar

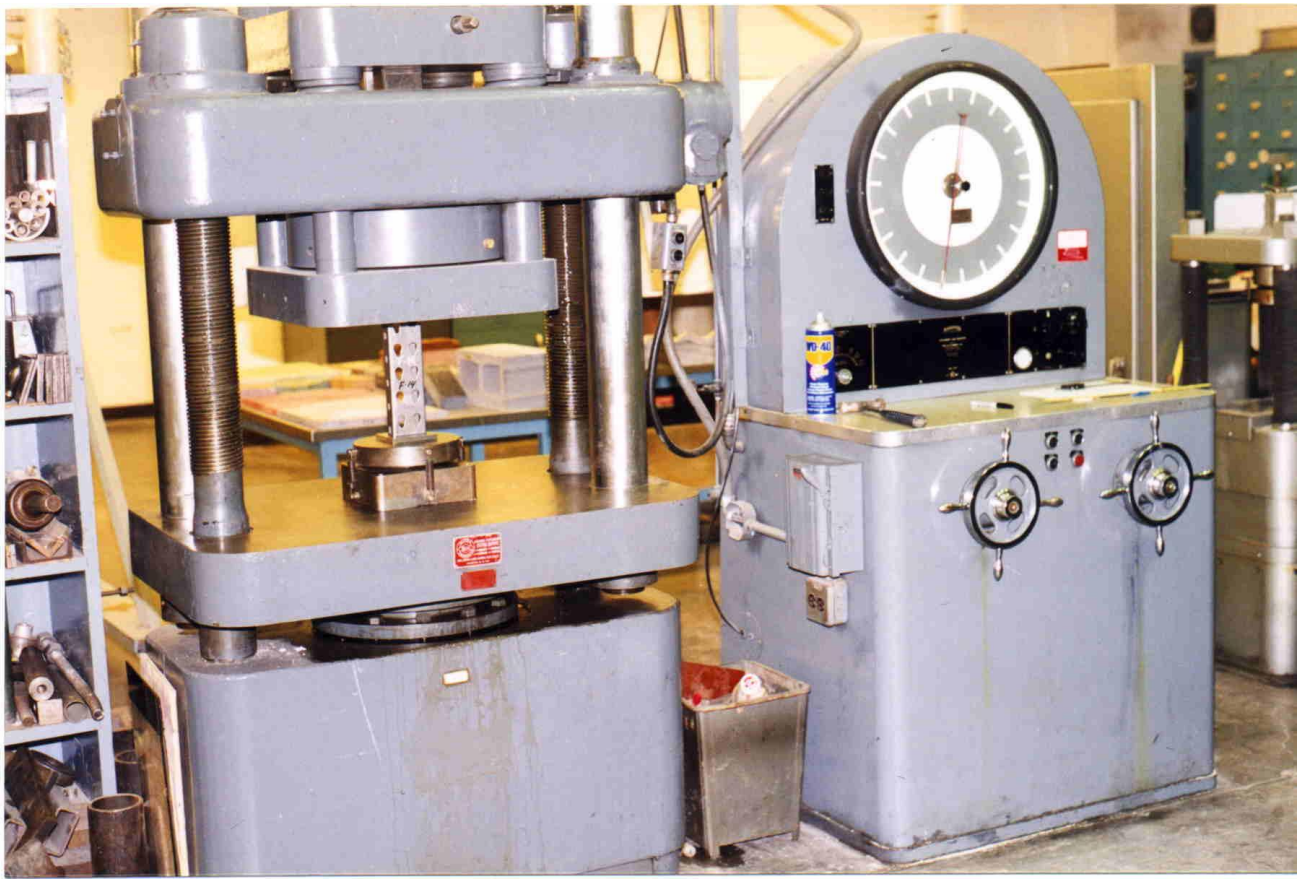
How Does a Manufacturer Obtain Certification?

- Manufacturer conducts component testing
- Submits test data along with design calculations and load tables to the RMI
- Demonstrates compliance with RMI code
- RMI administers the process and submits documents to two independent P.E.’s
- RMI awards an R-Mark license following approval of both P.E.’s

Testing

- Stub Column
- Cantilever Test
- Cyclic Connection Testing
- Details later in our presentation

Testing Machine for Stub Columns



How to Determine If Your Rack is Certified

- R-Mark on Published Load Tables
- R-Mark on Installation Drawings
- Visit www.mhi.org/rmi for the latest list of companies with the R-Mark

Frame Capacity Table

Notes:
1. Based on RMI 1997 Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks.
2. * "Spacing" is distance from floor to top of first beam level. If maximum opening is not floor level, "Spacing" is distance from top of beam to top of beam + 1".
3. Applicable for non-seismic use only. Building codes may require otherwise.
4. Capacities are for frame components only. Overall rack system configuration is the responsibility of others.
5. Contact your sales representative for design assistance for applications not covered by above.
6. Where the bottom portion of frames are exposed to potential minor impacts from forklift trucks or moving equipment, consideration shall be given to purchasing one of the optional protection devices offered by the manufacturer.
7. † F14 Frame capacity: 4,000 lbs. max per beam level.

FRAME CAPACITIES (LBS.)

MAXIMUM BEAM SPACING*	F14† 3" x 1⅝" COL.	F20 3" x 2½" COL.	F24 3" x 2½" COL.	F30 3" x 3" COL.	F35 3" x 3" COL.
36"	17437	23906	28005	31162	38909
42"	16400	22610	26364	29481	36692
48"	15220	21149	24530	27594	34218
54"	13937	19559	22557	25549	31556
60"	12594	17884	20502	23398	28775
66"	11232	16167	18420	21194	25948
72"	9870	14426	16332	18965	23101
78"	8683	12794	14406	16842	20448
84"	7679	11396	12771	15019	18183
90"	6827	10195	11379	13449	16243
96"	6101	9160	10188	12095	14577

Beam Capacity Table

Notes:

1. Based on RMI 1997 Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks.
2. Capacities are based on uniformly distributed loading in pounds per shelf (pair of beams).
3. Deflection limited to span/180.
4. Spans from 48" to 80" designed for 25% impact from placing 1 load per shelf.
5. Spans from 82" to 120" designed for 25% impact from placing 1 of 2 loads per shelf.
6. Spans from 122" to 144" designed for 25% impact from placing 1 of 3 loads per shelf.
7. Applicable for non-seismic use only. Building codes may require otherwise.
8. Capacities are for beam components only. Overall rack system configuration is the responsibility of others.
9. Contact your sales representative for design assistance or for applications not covered by above.
10. For beam lengths over 144" (green tinted on capacity chart) - 2 safety bars required per beam level, tek screwed to beam.

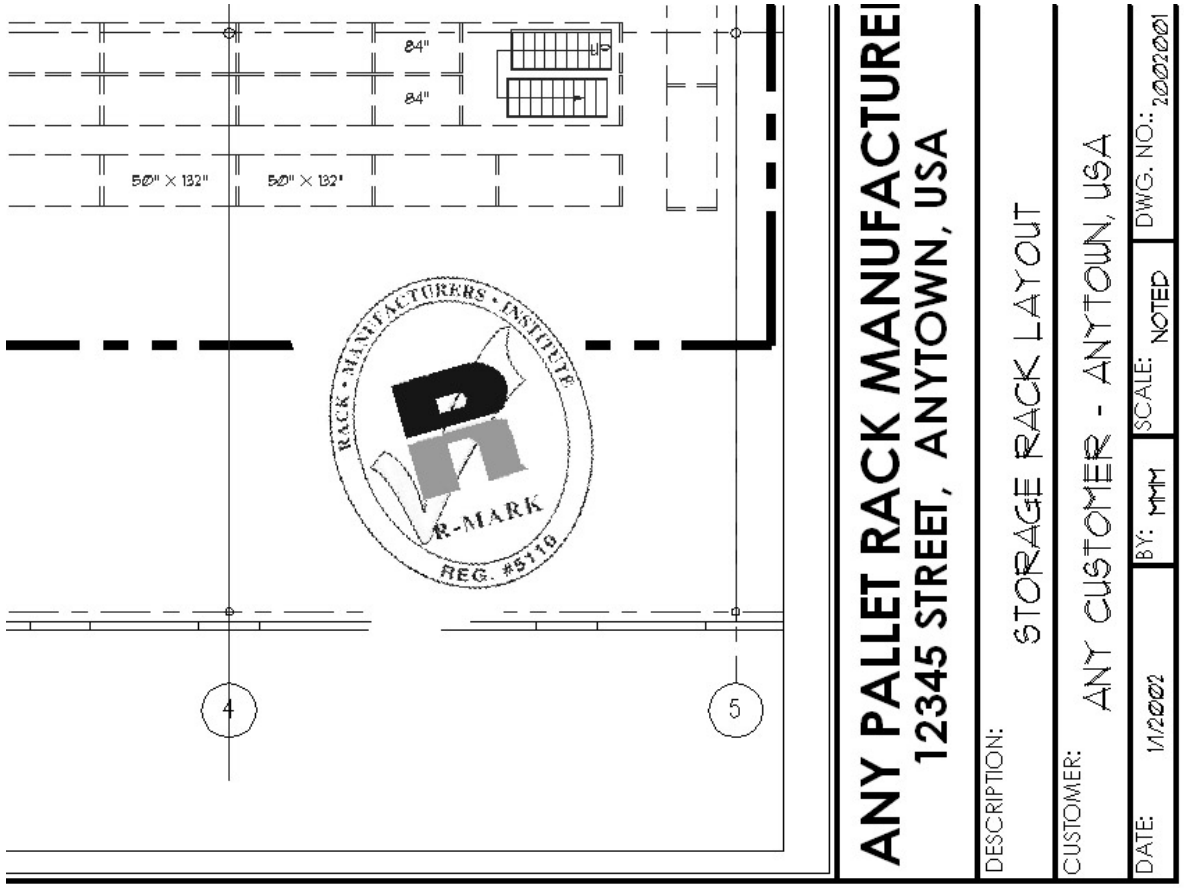
BEAM CAPACITIES (LBS. PER PAIR)

Other sizes available - Please contact your sales representative for information.

BEAM LENGTH (INCHES)	MODEL NO. P2250	P2500	T3600	T4124	T4624	T5124	T5900	T6500
48"	**3144**	**4066**	**6910**	**8775**	**10597**	**12000**	**12000**	**12000**
60"	2556	3285	5612	7097	8552	10767	12000	12000
72"	2002	2762	4743	5975	7186	9029	12000	12000
84"	1492	2252	4485	5734	6883	8632	12000	12000
96"	**1155**	**1735**	**3483**	**5028**	**6067**	**7596**	**10583**	**12000**
102"	1027	1540	3106	4476	5731	7168	9975	11825
108"	**919**	**1376**	**2788**	**4011**	**5309**	**6788**	**9434**	**11206**
120"	**747**	**1115**	**2283**	**3276**	**4330**	**5887**	**8512**	**10152**
132"				2726	3599	4887	7682	9196
144"				**2303**	**3038**	**4120**	**6511**	**8482**
156"					2597	3519	5551	7335
168"							4765	6357
180"							4163	5562

NOTE: SIZES HIGHLIGHTED IN BOLD INDICATE STANDARD SIZES.

Drawing Sealed with the R-Mark



Specifications, Codes and Design Practices

Why Should I Ask for the RMI/ANSI Specification?

- Best Design Practice
- Required by 2012 International Building Code
- Uniform Testing Methods

Best Design Practices

- Proper accounting for possible column strength reduction due to holes
- Inclusion of latest LRFD load combinations
- Loading combinations including pallets (product loads) and proper load factors
- Specification of performance of shelf connection locking device

Best Design Practices

- Shelf beam deflection limits
- Design requirements for cross-aisle tying and anchoring
- Definition of column design parameters and frame bracing location tolerances
- Storage rack seismic design

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Best Design Practices

- Detailing of owner's responsibilities
- Implementation of the recommendations from FEMA 460
- Seismic design factors from ASCE 7-10 and used in IBC 2012
- Connection rotational capacity requirements and testing procedures
- Inclusion of pick-module design
- Details of base plate & shimming

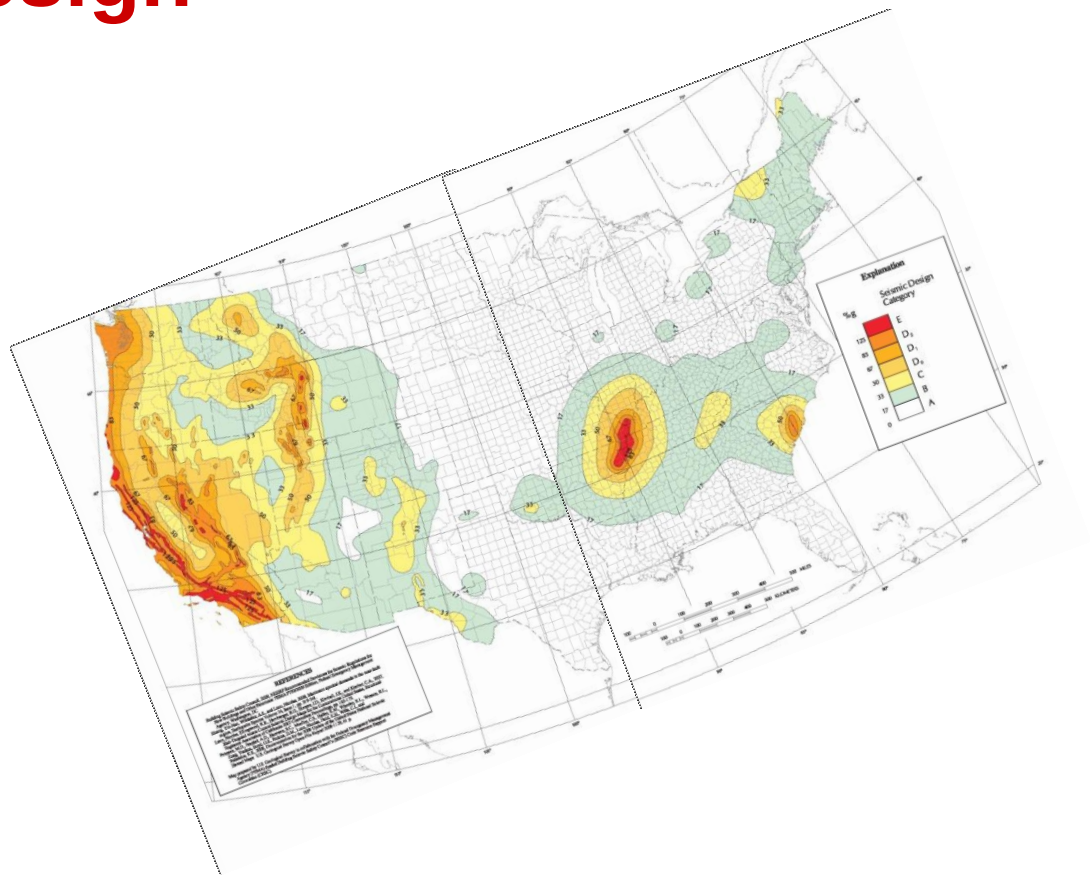
Acceptance by Building Code

- Storage rack referenced standard in the
  International Building Code (IBC) 2012

http://geohazards.usgs.gov/designmaps/us/application.php

Acceptance by Building Code

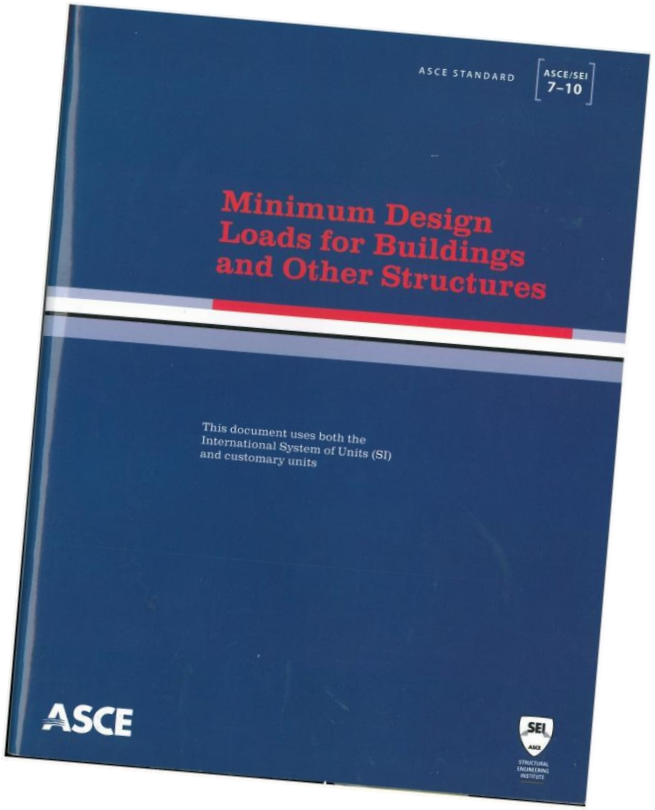
- Uses **Seismic Design Categories**
  - Includes
    - Seismic Use Group
    - Ground Motion
    - Site Factor
  - Replaces old
    - "Seismic Zones"



Acceptance by Building Code

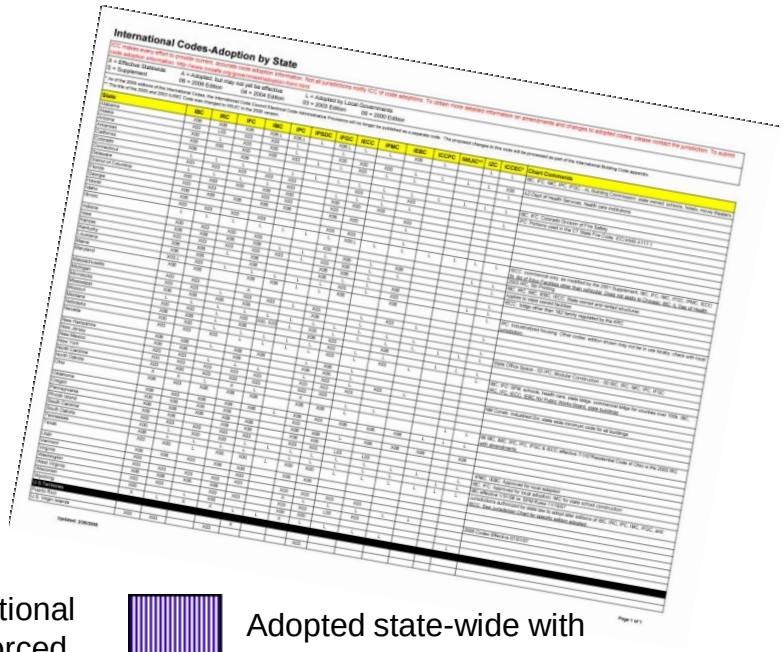
- American Society of Civil Engineers

ASCE-7 10



Acceptance by Building Code

- International Building Code (IBC) 2012



One or more International Codes currently enforced state-wide

One or more International Codes currently enforced within state at local level

Adopted state-wide with Future enforcement date

http://www.iccsafe.org/government/adoption.html

Acceptance by Building Code

- IBC is the building code adopted in all 50 states
- Different states use different IBC editions
- The 2012 RMI Specification is expected to be included by reference, without exceptions, by the ICC for the 2015 International Building Code
- 2012 IBC is the latest edition being adopted by the states

Acceptance by Building Code

- The ICC has issued an updated IBC every three years since 2000
- Each jurisdiction adopts an edition of the IBC and updates their adoption periodically
- The 2012 IBC references the RMI 2008 edition
- 2012 IBC is the latest edition being adopted by the states

Acceptance by Building Code

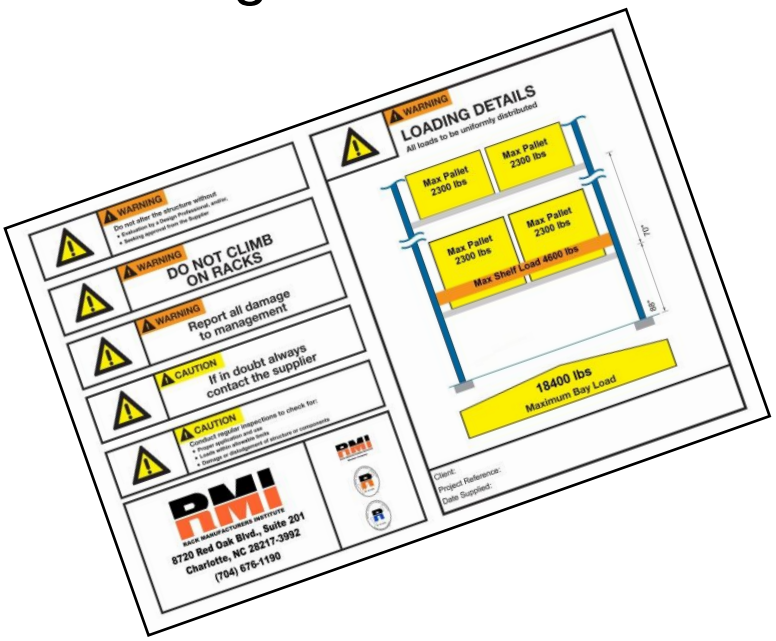
- Seismic Design:
  1. Proper use of storage rack period approximations
  2. Seismic load distribution when first shelf is 12” or less above floor
  3. Suggested period determination based on connection stiffness testing

Acceptance by Building Code

- System Identification

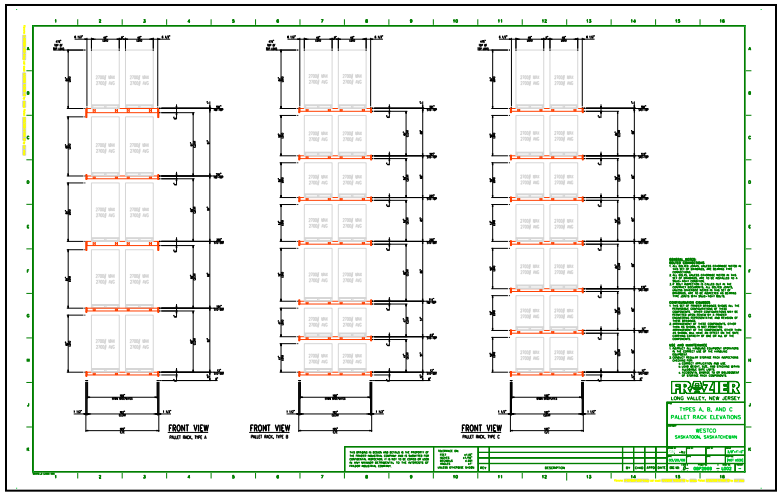
Plaque

Load generalities



Load Application and Rack Configuration Drawings

Configuration Specifics

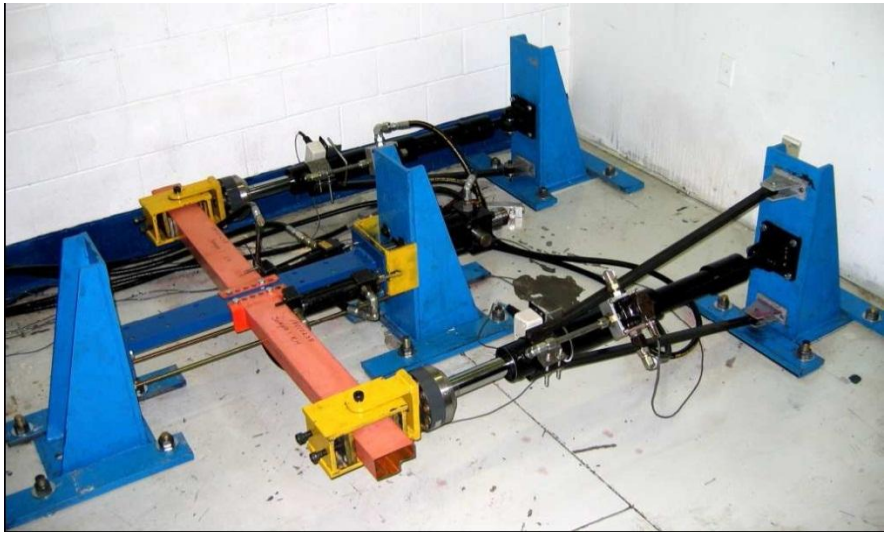


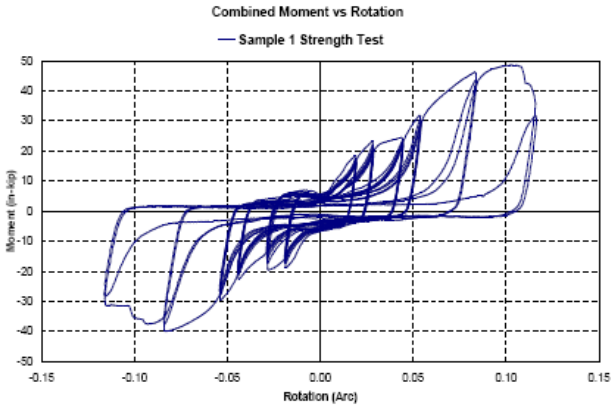
Uniform Testing Methods

- Beam-to-column connection test including seismic cyclical test procedure
- Stub column test
- Optional tests
  - Shelf capacity
  - Upright frame tests

Uniform Testing Methods

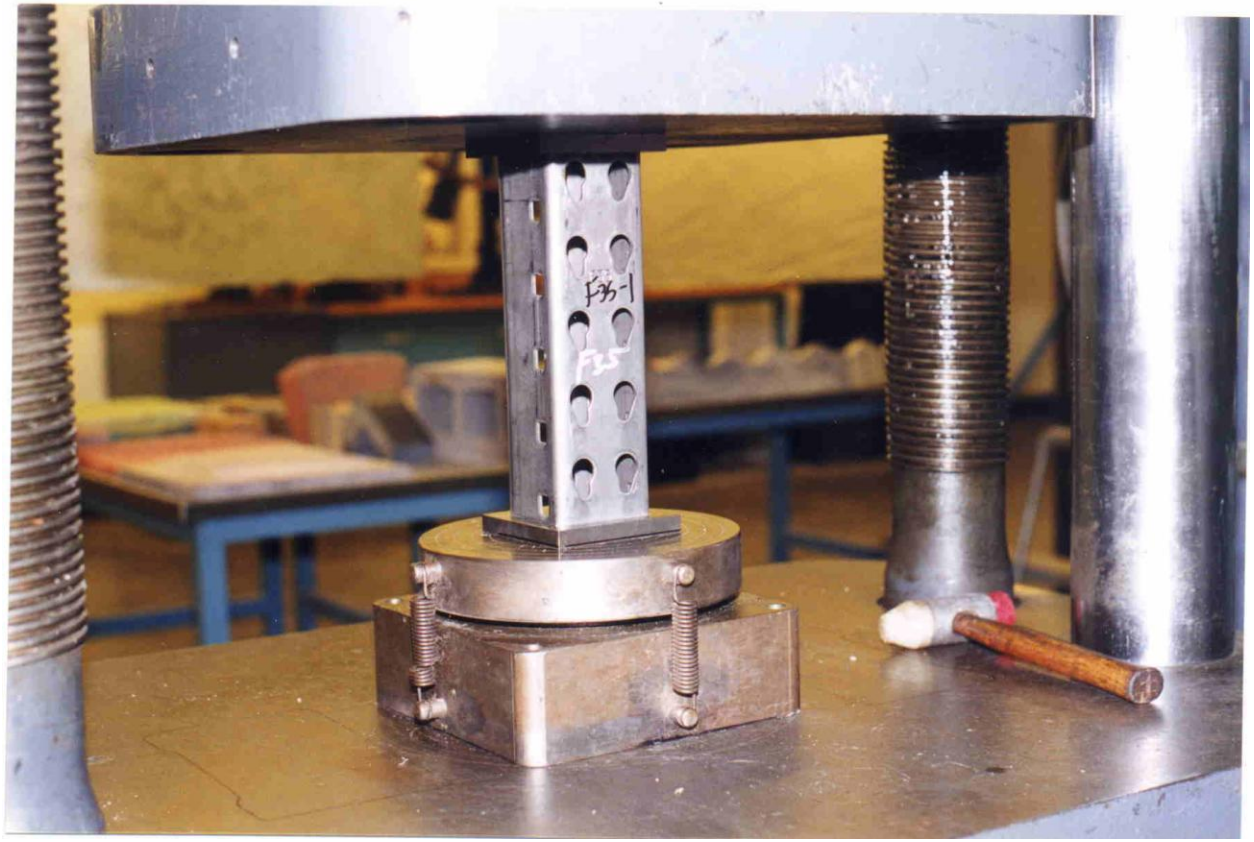
- Beam-to-column connection test including seismic cyclical test procedure





Uniform Testing Methods

- Stub column test



How To Be Sure You Receive An RMI Certified Product

Specify that all racking components conform to the **RMI/ANSI MH16.1-2012 Standard** and further require the **R-Mark** on the Capacity Plaque and the Load Application and Rack Configuration Drawings

Introducing R-Mark

for

Welded Wire Deck

The Wire Deck Industry Group has joined the

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Why?

Wire Deck & The RMI

- **Generally**
  - Wire Deck was previously part of the IMCWD (Industrial Metal Container & Wire Deck) Group of MHI but chose to join the RMI because Wire Deck is almost exclusively an accessory of Pallet Rack
- **Specifically**
  - To promote consumer education on the safe application of Wire Deck
  - To promote application of the existing Wire Deck Standards

Existing Standard

ANSI MH26.2 Standard

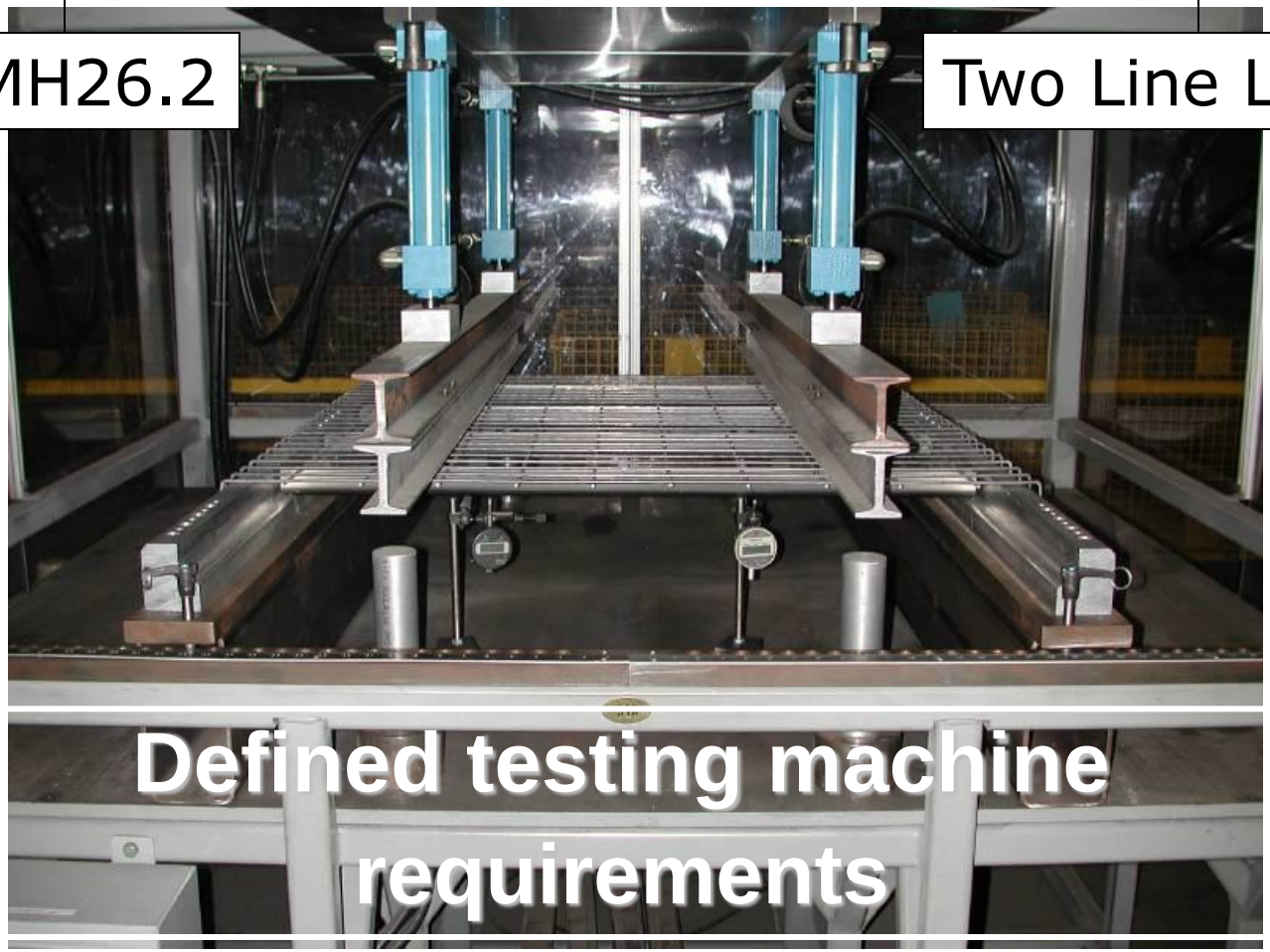
ANSI MH26.2 Standard Testing Principles

- Wire Deck capacities are based on loading from a ‘Uniformly Distributed Load’
- Wire Deck testing includes:
  - A safety factor of 1.67
  - Does not account for impact loading or for ‘point loads’
  - Safety factor mirrors rack beams

ANSI MH26.2 Standard Testing Procedure

ANSI: MH26.2

Two Line Load Test



Defined testing machine requirements

ANSI MH26.2 Standard Testing Procedure

The ‘two-line’ load test method, with the load lines placed as shown at the 1st and 3rd quarter points, mathematically equates to a ‘Uniformly Distributed Load’ of the same magnitude

ANSI MH26.2 Standard Testing Procedure

- Protocol:
  - Load the Deck to allowable deflection (depth/165) and record applied load… W1 = Applied Allowable Load
  - Load the Deck until structural failure occurs and record the applied load… W2 = Applied Failure Load/2
  - Deck is rated as the lesser of the two values; W1 or W2
  - This is equivalent to a safety factor of 1.67 (mirroring rack beams)

ANSI MH26.2 Standard

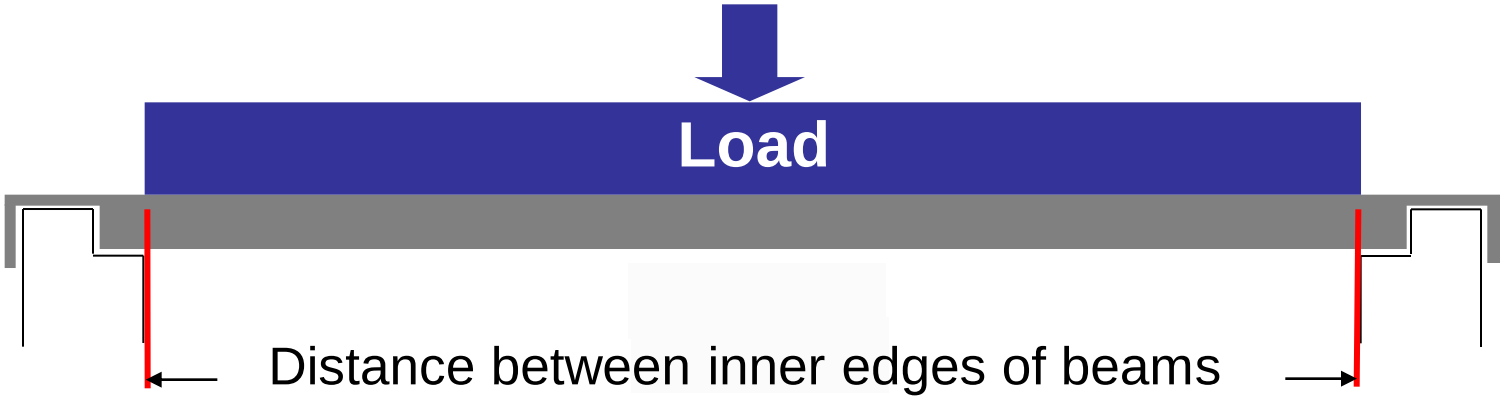
The Standard Applied in Practice

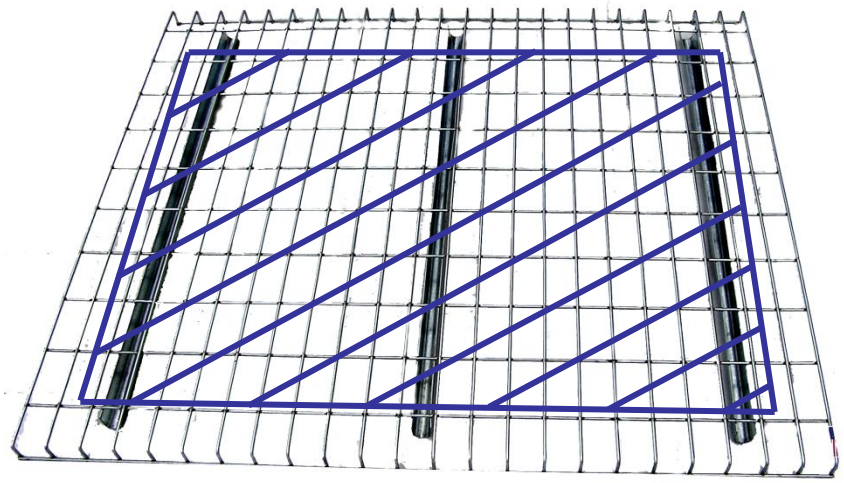
In Practice

- Wire Deck capacities are based on Uniformly Distributed Loading. Approximately 90% of the load bearing capacity of the Deck is provided by the supporting channels.

- Therefore, the ANSI Wire Deck capacity is applicable to a load base that distributes the load evenly over *all* of the supporting channels for, at minimum, that part of the Deck which is suspended unsupported between the inner edges of the supporting rack structure.

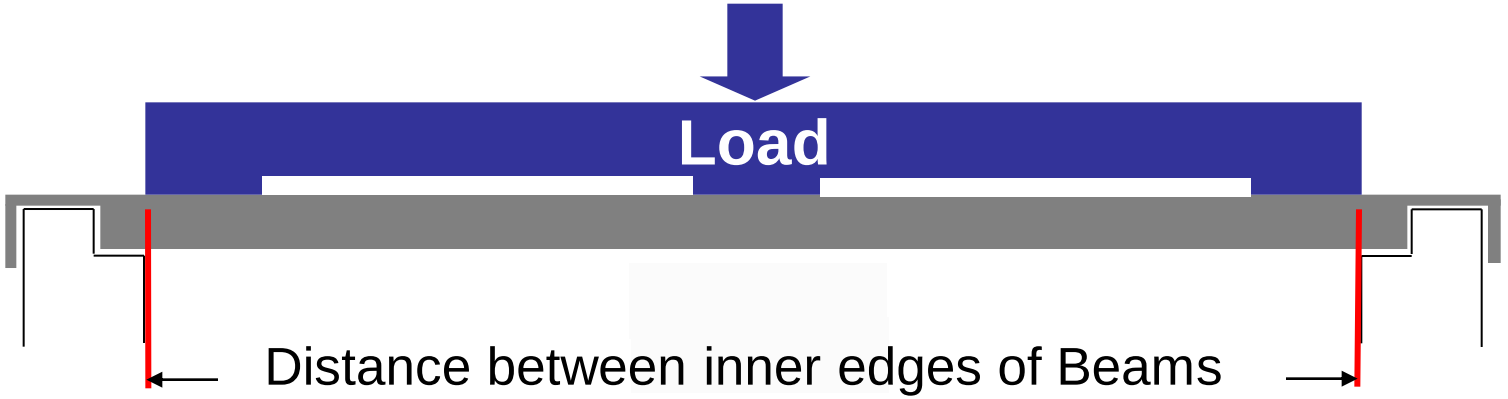
In Practice

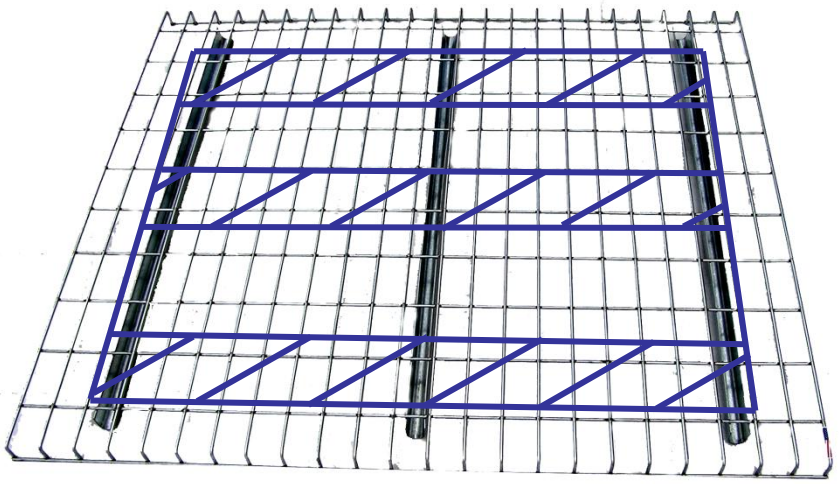




Shelf Load

In Practice





Pallet Load

In Practice

Non ANSI application of Wire Deck!

The R-Mark

So what's changing from ANSI MH26.2?

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- In terms of theoretical and practical application of Wire Decks… nothing!
- However, the whole Engineering Standard will now follow - and be subject to - the RMI independent verification protocol
  - Wire deck members of former IMCWD group are now Associate members of the RMI
  - The ANSI MH26.2 standard is now the Wire Deck R-Mark standard

The R-Mark

- Most importantly ‘voluntary’ adherence to the Industry Standard will not be adequate for an R-Mark . . .
  - Engineering must be approved by independent Professional Engineers
  - Capacity load tables must be approved by independent Professional Engineers
  - Material specifications & certifications must be approved by independent Professional Engineers

Benefits

The RMI has a market tested mechanism to level the playing field using approved Engineering Standards

Benefits

- The R-Mark allows for consumer confidence when purchasing welded wire rack decking
- The independent PE protocol of the R-Mark engenders confidence in the validity of each manufacturer's certification
- Comparing R-Mark products allows for an objective evaluation of compliant products from certified suppliers

Consumer Validation

As a consumer, how can I be sure
I receive R-Mark product?

Validation

Same as Rack, look for the R-Mark!…

…the ‘Blue’ one in this case

Validation On Load Tables

Family: **Step Beam Applications**

Mesh Pattern: **2.5"x4"**

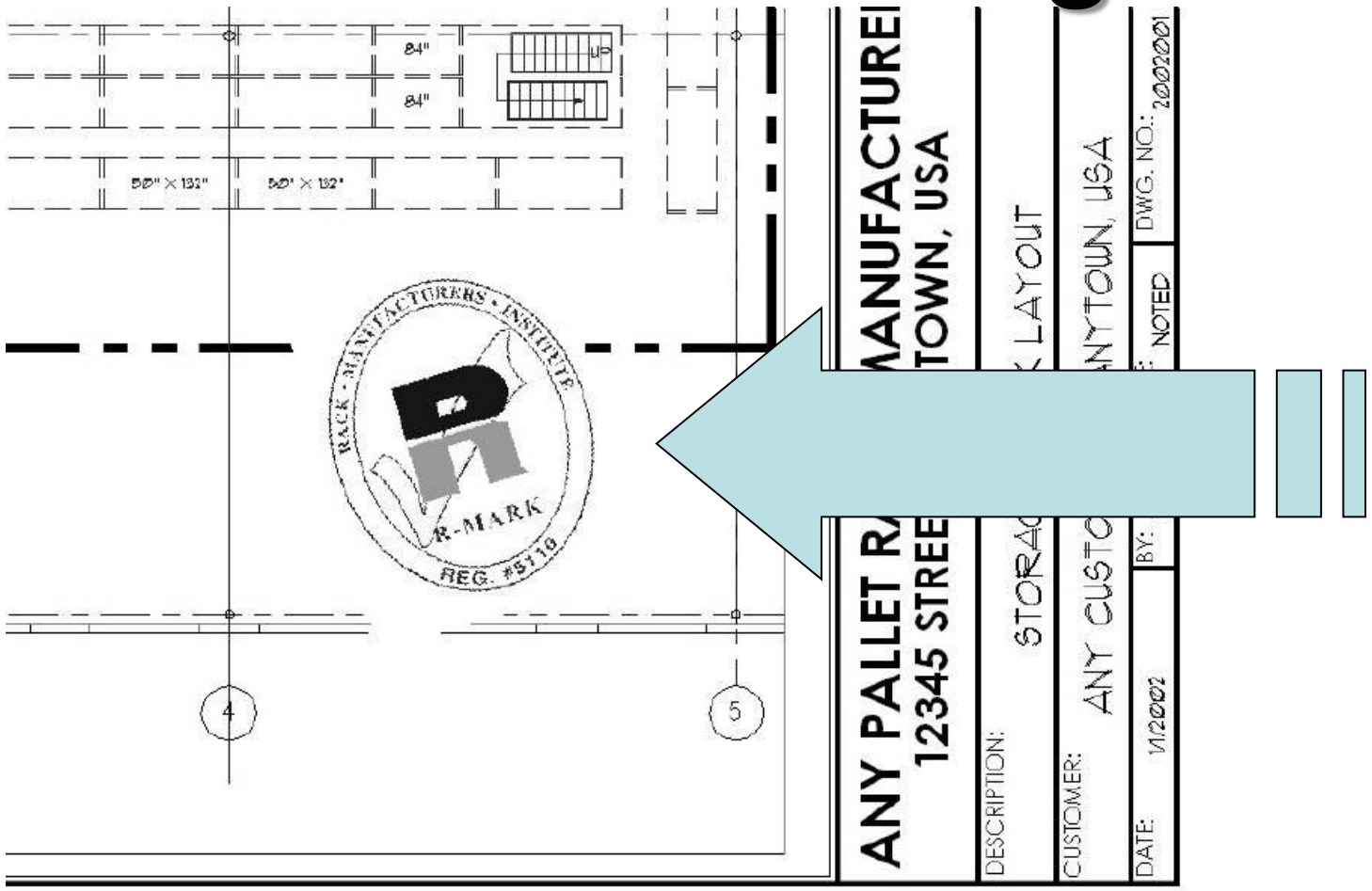
Channel Gauge: **13 (0.083"- 0.089")**

Mesh Gauge: **6.0 (0.191" - 0.193")**

Deck Depth (Inches)	3-chnls 3	4-chnls 4	5-chnls 5	6-chnls 6	7-chnls 7	8-chnls 8
24	3,000	4,000	5,000	6,000	7,000	8,000
30	3,000	4,000	5,000	6,000	7,000	8,000
36	3,000	4,000	5,000	6,000	7,000	8,000
42	2,500	3,233	3,966	4,699	5,432	6,165
44	2,400	3,100	3,800	4,500	5,200	5,900
48	2,250	2,900	3,550	4,200	4,850	5,500
54	2,000	2,566	3,132	3,698	4,264	4,830
60	1,750	2,233	2,716	3,199	3,682	4,165
72	1,203	1,604	2,004	2,405	2,806	3,207
88	984	1,311	1,639	1,967	2,295	2,623

ASTM A510 / Yield Min = 30ksi

Validation
Sealed on Drawings



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Specifications

- RMI/ANSI MH 16.1-2012
- RMI/ANSI MH 26.2-2007

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