



**AMERICAN NATIONAL STANDARDS INSTITUTE/ STEEL DECK INSTITUTE**

RD1.0 - 2006 Standard for

# **Steel Roof Deck**



## 1. General

### 1.1 Scope:

- A. This Specification for Steel Roof Deck shall govern the materials, design, and erection of cold formed steel deck used for the support of roofing materials, design live loads and SDI construction loads.
- B. Commentary shall not be considered part of the mandatory document.

### 1.2 Reference Codes, Standards and Documents:

- A. Codes and Standards: For purposes of this Standard, comply with applicable provisions of the following Codes and Standards:
  1. American Iron and Steel Institute (AISI) Standard - *North American Specification for the Design of Cold-Formed Steel Structural Members*, 2001 Edition with Supplement 2004
  2. American Welding Society - ANSI/AWS D1.3 Structural Welding Code/Sheet Steel - 98 Structural Welding Code - Sheet Steel
  3. American Society for Testing and Materials (ASTM) A653 (A653M)-06, A924 (A924M)-06, A1008 (A1008M)-06
  4. American Society of Civil Engineering (ASCE) – SEI/ASCE7-05
  5. Underwriters Laboratories (UL) Fire Resistance Directory - <http://www.ul.com/database> 2006

- B. Reference Documents: Refer to the following documents:
  1. SDI Manual of Construction with Steel Deck - MOC2-2006
  2. SDI Standard Practice Details - SPD2-2001
  3. SDI Position Statement - Field Painting of Steel Deck-2004
  4. SDI Diaphragm Design Manual - DDM03-2004

- D. The deck type (profile) and thickness (gage) shall be as shown on the plans.

### 2.2 Tolerance:

- A. Uncoated thickness shall not be less than 95% of the design thickness as listed in Table 2.2.1:

**Table 2.2.1**

Gage No.	Design Thickness		Minimum Thickness	
	in.	mm.	in.	mm.
22	0.0295	0.75	0.028	0.71
21	0.0329	0.84	0.031	0.79
20	0.0358	0.91	0.034	0.86
19	0.0418	1.06	0.040	1.01
18	0.0474	1.20	0.045	1.14
17	0.0538	1.37	0.051	1.30
16	0.0598	1.52	0.057	1.44

## 2. Products

### 2.1 Material:

- A. Sheet steel for galvanized deck shall conform to ASTM A653 (A653M) Structural Quality, with a minimum yield strength of 33 ksi (230 MPa).
- B. Sheet steel for cold rolled plus painted deck shall conform to ASTM A1008 (A1008M) with a minimum yield strength of 33 ksi (230 MPa). Other structural sheet steels or high strength low alloy steels are acceptable, and shall be selected from the *North American Specification for the Design of Cold-Formed Steel Structural Members*.
- C. Sheet steel for accessories shall conform to ASTM A653 (A653M) Structural Quality for structural accessories, ASTM A653 (A653M) Commercial Quality for non-structural accessories, or ASTM A1008 (A1008M) for either structural or non-structural accessories. Other structural sheet steels or high strength low alloy steels are acceptable, and shall be selected from the *North American Specification for the Design of Cold-Formed Steel Structural Members*.

- B. Panel length shall be within plus or minus 1/2 inch (12 mm) of specified length.
- C. Panel cover width shall be no greater than minus 3/8 inch (10 mm), plus 3/4 inch (20 mm).
- D. Panel camber and/or sweep shall be no greater than 1/4 inch in 10 foot length (6 mm in 3 m).
- E. Panel end out of square shall not be greater than 1/8 inch per foot of panel width (10 mm per m).

### 2.3 Finish:

- A. Galvanizing shall conform to ASTM A653 (A653M).
- B. Painted with a shop coat of primer shall be applied to steel sheet conforming to ASTM A1008 (A1008M).
- C. The finish of the steel roof deck shall be suitable for the environment of the structure.

**2.3 Finish:**

**Commentary:** The primer coat is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating. Field painting of prime painted deck is recommended especially where the deck is exposed. (See *SDI Field Painting of Steel Deck*).

In corrosive or high moisture atmospheres, a galvanized finish is desirable in a G60 (Z180) or G90 (Z275) coating. In highly corrosive or chemical atmospheres or where reactive materials could be in contact with the steel deck, special care in specifying the finish should be used.

**2.4 Design:**

A. The deck shall be selected by the designer to provide the load capabilities shown on the drawings (design live and dead loads and the SDI construction loads).

1. The section properties of the steel roof unit deck shall be computed in accordance with the *North American Specification for the Design of Cold-Formed Steel Structural Members*.
2. Allowable Stress Design (ASD): Bending stress shall not exceed 0.60 times the yield strength with a maximum of 36 ksi (250 MPa) under the combined dead and design live loads.
3. Load and Resistance Factor Design (LRFD): The load

factors are defined in the governing code. ASCE 7 (See section 1.2.A.5) shall be used in the absence of a governing code. The resistance factors and nominal resistances shall be determined in accordance with the *North American Specification for the Design of Cold-Formed Steel Structural Members*.

4. Deck Deflection: Deflection of the deck shall not exceed 1/240 of the span (centerline to centerline) or 1 inch (25 mm), whichever is less, under the uniformly distributed design live load. All spans are to be considered center-to-center of supports.

**Commentary:** The adequacy of deck edge support details should be reviewed by the designer. At the building perimeter or any other deck termination or direction change, occasional concentrated loading of the roof deck could result in temporary differences in deflection between the roof deck and the adjacent stationary building component. Supplemental support such as a perimeter angle may be warranted.

5. Suspended Loads: All suspended loads shall be included in the analysis and calculations for stress and deflection.

**Commentary:** The designer must take into account the sequence of loading. Suspended loads may include ceilings, light fixtures, ducts or other utilities. The designer must be informed of any loads applied after the roofing has been installed.

6. Construction and Maintenance Loads: Deck shall be selected by the designer to provide a minimum 30 lbs/sq.ft. (1.44 kPa) construction load. Span lengths shall be governed by a maximum stress of 0.7 Fy and a maximum deflection of 1/240 of the span with a 200-pound (0.89 kN) concentrated load at midspan on a 1 foot (300 mm) wide section of deck. If the designer contemplates loads of greater magnitude, spans shall be decreased or the thickness of the steel deck increased as required. All loads shall be distributed by appropriate means to prevent damage to the completed assembly during construction.

7. Cantilever loads: The cantilever span shall be determined by the lowest value considering,
  - (a) construction phase load of 10 psf (0.48 kPa) on adjacent span and cantilever, plus 200 pound load (0.89 kN) at end of cantilever with a stress limit of 0.7 Fy (ASD),
  - (b) a service load of 45 psf (2.15 kPa) on adjacent span and cantilever, plus 100 pound load (0.44 kN) at end of cantilever with a stress limit of 0.6 Fy (ASD), or
  - (c) with service loads, a deflection limitation of 1/240 of adjacent span for interior span and deflection limitation at end of cantilever of 1/120 of overhang.

**Commentary:** Under Construction and Maintenance Loads, and Cantilever Loads, 0.7 Fy maximum stress was selected to unify the ASD and LRFD values. Apply a load factor of 1.4 to 200 pound load when LRFD is used.

8. Diaphragm Shear Capacity: Roof deck shear capacity shall be determined in accordance with the SDI *Diaphragm Design Manual* or from tests conducted by an independent professional engineer.

**Commentary:** Calculations of diaphragm strength and stiffness should be made using the SDI *Diaphragm Design Manual*. If testing is used as the means for determining the diaphragm strength and stiffness, then it should follow the AISI TS 7-02 test protocol.

- B. Load Tables: Uniform loads determined for published tables shall be based on equal adjacent two and three span conditions and on single spans. Appropriate combinations of shear and bending shall be made to determine the published loads. Lengths of 1-1/2 inches (38 mm) for end bearing and 4 inches (100 mm) for interior bearing shall be used to check web crippling. Deflection coefficients shall be 0.013 for single spans, 0.0054 for double spans and 0.0069 for triple spans.

**Commentary:** For deck layouts that provide more than three equal spans, the user can apply the loads published for three spans. Published uniform load tables do not apply for adjacent spans that differ in length by more than 10%.

### 2.5 Accessories:

- A. Ridge and valley plates, and flat plates at change of deck direction shall be furnished as shown on plans to provide a flat (finished)

surface for the application of roof insulation and roof cover.

- B. Sump pans shall be furnished to receive roof drains as shown on plans. Holes for drains are to be field cut (by others) in the field.
- C. Mechanical fasteners or welds shall be permitted for deck and accessory attachment.

## 3. Execution

### 3.1 Installation/General:

- A. Support framing and field conditions shall be examined for compliance with requirements for installation tolerances and other conditions affecting performance of work of this section. All OSHA rules for erection shall be followed.
- B. Deck panels and accessories shall be installed according to the SDI *Manual of Construction with Steel Deck*, placement plans, and requirements of this Section.
- C. Deck panels shall be placed on structural supports and adjusted to final position with ends aligned, and attached securely to the supports immediately after placement in order to form a safe working platform. All deck sheets shall have adequate bearing and fastening to all supports to prevent slip off during construction. Deck ends over supports shall be installed with a minimum end bearing of 1-1/2 inches (38 mm). Deck areas subject to heavy or repeated traffic, concentrated loads, impact loads, wheel loads, etc. shall be adequately protected by planking or other approved means to avoid overloading and/or damage.

- D. Lapped or Butted Ends: Deck ends shall be either lapped or butted over supports. Gaps up to 1 inch (25 mm) shall be permitted at butted ends.
- E. Deck units and accessories shall be cut and neatly fit around scheduled openings and other work projecting through or adjacent to the decking.

**Commentary:** It is the responsibility of the designer to designate holes/openings to be decked over in compliance with applicable federal and state OSHA directives. Care should be taken to analyze spans between supports at openings, when determining those holes/openings to be decked over. When a framed opening span exceeds the maximum deck span limits for construction loads, the opening must be detailed around instead of decked over. (Minimum roof construction load 30 lbs/sq ft (1.44kPa), unless job specific requirements dictate otherwise).

- F. Trades that subsequently cut unscheduled openings through the deck shall be responsible for reinforcing these openings based upon an approved engineered design.

### 3.2 Installation/Anchorage:

A. Roof deck units shall be anchored to steel supporting members including perimeter support steel and/or bearing walls by arc spot welds of the following diameter and spacing, fillet welds of equal strength, or mechanical fasteners. Anchorage shall provide lateral stability to the top flange of the supporting structural members and resist the following minimum gross uplifts; 45 pounds per square foot (2.15 kPa) for eave overhang; 30 pounds per square foot (1.44 kPa) for all other roof areas. The dead load of the roof deck construction shall be deducted from the above forces.

1. All welding of deck shall be in accordance with ANSI/AWS D1.3, *Structural Welding Code - Sheet Steel*. Each welder shall demonstrate an ability to produce satisfactory welds using a procedure such as shown in the *SDI Manual of Construction with Steel Deck*, and/or as described in ANSI/AWS D1.3.
2. Welding washers shall be used on all deck units with metal thickness less than 0.028 inches (0.7 mm). Welding washers shall be a minimum thickness of 0.0598 inches (16 gage, 1.50 mm) and have a nominal 3/8 inch (10 mm) diameter hole.
3. Where welding washers are not used, a minimum visible 5/8 inch (15 mm) diameter arc puddle weld shall be used. Weld metal shall penetrate all layers of deck material at end laps and shall have good fusion to the supporting members.

4. Weld spacing: Ribs of panels shall be welded at each support. Space additional welds an average of 12 inches (300 mm) apart but not more than 18 inches (460 mm).
5. When used, fillet welds shall be at least 1-1/2 inches (38 mm) long.
6. Mechanical fasteners, either powder actuated, pneumatically driven, or screws, shall be permitted in lieu of welding to fasten deck to supporting framing if fasteners meet all project service requirements. When the fasteners are powder actuated or pneumatically driven, the load value per fastener used to determine the maximum fastener spacing is based on a minimum structural support thickness of not less than 1/8 inch (3 mm) and on the fastener providing a minimum 5/16 inch (8 mm) diameter bearing surface (fastener head size). When the structural support thickness is less than 1/8 inch (3 mm), powder actuated or pneumatically driven fasteners shall not be used, but screws are acceptable.

**Commentary:** Mechanical fasteners (screws, powder or pneumatically driven fasteners, etc.) are recognized as viable anchoring methods, provided the type and spacing of the fastener satisfies the design criteria. Documentation in the form of test data, design calculations, or design charts should be submitted by the fastener manufacturer as the basis for obtaining approval.

7. For deck units with spans greater than 5 feet (1.5 m), side laps and perimeter edges of units between span supports shall be fastened at intervals not exceeding 36 inches (1 m) on center, using one of the following methods:
  - a. #10 self drilling screws.
  - b. Crimp or button punch.
  - c. Arc puddle welds 5/8 inch (15 mm) minimum visible diameter, or minimum 1 inch (25 mm) long fillet weld.

**Commentary:** The above side lap spacing is a minimum. Service loads or diaphragm design may require closer spacing. Good metal to metal contact is necessary for a good side lap weld. Burn holes are to be expected.

- B. Accessory Attachment:
1. Accessories shall be anchored to supporting members by arc spot welds or self drilling screws at 12 inches (300 mm) maximum intervals or as shown on design drawings.