CHAPTER 22

STEEL

SECTION 2201
GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel used structurally in buildings or structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provision of Sections 2204 through 2208 and 2214 through 2224.

SECTION 2202
DEFINITIONS

2202.1 Definitions. The following terms are defined in Chapter 2:

STEEL CONSTRUCTION, COLD-FORMED.

STEEL JOIST.

STEEL MEMBER, STRUCTURAL.

SECTION 2203
IDENTIFICATION AND PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203.1 Identification. Identification of structural steel members shall comply with the requirements contained in AISC 360. Identification of cold-formed steel members shall comply with the requirements contained in AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Steel that is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standards.

2203.2 Protection. Painting of structural steel members shall comply with the requirements contained in AISC 360. Painting of open-web steel joists and joist girders shall comply with the requirements of SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 and SJI LH/DLH-1.1. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200.

SECTION 2204
CONNECTIONS

2204.1 Welding. The details of design, workmanship and technique for welding, inspection of welding and qualification of welding operators shall conform to the requirements of the specifications listed in Sections 2205, 2206, 2207, 2208, 2210 and 2211 (see Section 2222 for HVHZ).

2204.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of the specifications listed in Sections 2205, 2206, 2207, 2210 and 2211.

2204.2.1 Anchor rods. Anchor rods shall be set in accordance with the *construction documents*. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

SECTION 2205
STRUCTURAL STEEL

2205.1 General. The design, fabrication and erection of structural steel for buildings and structures shall be in accordance with AISC 360. Where required, the seismic design of structural steel structures shall be in accordance with the additional provisions of Section 2205.2.

2205.2 Seismic requirements for structural steel structures. The design of structural steel structures to resist seismic forces shall be in accordance with the provisions of Section 2205.2.1 or 2205.2.2, as applicable.

2205.2.1 Seismic Design Category B or C. Structural steel structures assigned to *Seismic Design Category* B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1 is used for the design of structural steel structures assigned to *Seismic Design Category* B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

Exception: The response modification coefficient, R, designated for "Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems" in ASCE 7, Table 12.2-1 shall be permitted for systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

2205.2.2 Seismic Design Category D, E or F. Structural steel structures assigned to *Seismic Design Category* D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1.

SECTION 2206
COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

2206.1 General. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 22. Where required, the seismic design of composite steel and

concrete systems shall be in accordance with the additional provisions of Section 2206.2.

2206.2 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, *R*, in accordance with ASCE 7, Table 12.2-1 is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

SECTION 2207
STEEL JOISTS

2207.1 General. The design, manufacture and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute (SJI) specifications:

1. SJI CJ-1.0
2. SJI K-1.1
3. SJI LH/DLH-1.1
4. SJI JG-1.1

Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205.2 or 2211.6.

2207.2 Design. The *registered design professional* shall indicate on the *construction documents* the steel joist and/or steel joist girder designations from the specifications listed in Section 2207.1 and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, non-SJI standard bridging, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
    1.1. Concentrated loads;
    1.2. Nonuniform loads;
    1.3. Net uplift loads;
    1.4. Axial loads;
    1.5. End moments; and
    1.6. Connection forces.
2. Special considerations including:
    2.1. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog);
    2.2. Oversized or other nonstandard web openings; and
    2.3. Extended ends.
3. Deflection criteria for live and total loads for non-SJI standard joists.

2207.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and/or steel joist girders in accordance with the current SJI specifications and load tables to support the load requirements of Section 2207.2. The *registered design professional* may require submission of the steel joist and joist girder calculations as prepared by a *registered design professional* responsible for the product design. If requested by the *registered design professional*, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's *registered design professional*. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g.for cantilevered conditions, net uplift, etc.).
2. Connection details for:
    2.1. Non-SJI standard connections (e.g.flush-framed or framed connections);
    2.2. Field splices; and
    2.3. Joist headers.

2207.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the *construction documents* and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207.2. Steel placement plans shall include, at a minimum, the following:

1. Listing of all applicable loads as stated in Section 2207.2 and used in the design of the steel joists and joist girders as specified in the *construction documents*.
2. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog).
3. Connection requirements for:
    3.1. Joist supports;
    3.2. Joist girder supports;
    3.3. Field splices; and
    3.4. Bridging attachments.
4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location and connections for all bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's *registered design professional*.

2207.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a *certificate of compliance* stating that work was performed in accordance with *approved construction documents* and with SJI standard specifications.

SECTION 2208
STEEL CABLE STRUCTURES

2208.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

2208.2 Seismic requirements for steel cable. The design strength of steel cables shall be determined by the provisions of ASCE 19 except as modified by these provisions.

1. A load factor of 1.1 shall be applied to the prestress force included in T_3 and T_4 as defined in Section 3.12.
2. In Section 3.2.1, Item (c) shall be replaced with "1.5 T_3" and Item (d) shall be replaced with "1.5 T_4."

SECTION 2209
STEEL STORAGE RACKS

2209.1 Storage racks. The design, testing and utilization of industrial steel storage racks made of cold-formed or hot-rolled steel structural members, shall be in accordance with RMI/ANSI MH 16.1. Where required by ASCE 7, the seismic design of storage racks shall be in accordance with the provisions of Section 15.5.3 of ASCE 7, except that the mapped acceleration parameters, S_s and S_1, shall be determined in accordance with Section 1613.3.1.

SECTION 2210
COLD-FORMED STEEL

2210.1 General. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall also comply with Section 2211. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210.2.

2210.1.1 Steel decks. The design and construction of cold-formed steel decks shall be in accordance with this section.

2210.1.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

2210.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0.

2210.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C, *Standard for Composite Steel Floor Deck-Slabs*.

2210.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, R, in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ASCE 8, and, for cold-formed steel special-bolted moment frames, AISI S110.

SECTION 2211
COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211.1 General. The design and installation of structural members and nonstructural members utilized in cold-formed steel light-frame construction where the specified minimum base steel thickness is between 0.0179 inches (0.455 mm) and 0.1180 inches (2.997 mm) shall be in accordance with AISI S200 and Sections 2211.2 through 2211.7, as applicable.

2211.2 Header design. Headers, including box and back- to-back headers, and double and single L-headers shall be designed in accordance with AISI S212 or AISI S100.

2211.3 Truss design. Cold-formed steel trusses shall be designed in accordance with AISI S214, Sections 2211.3.1 through 2211.3.4 and accepted engineering practice.

2211.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section B2.3 of AISI S214 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section B6(a) or B 6(c) of AISI S214 where these methods are utilized to provide restraint/bracing.

2211.3.2 Deferred submittals. AISI S214 Section B4.2 shall be deleted.

2211.3.3 Trussses spanning 60 feet or greater. The owner shall contract with a *registered design professional* for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater.

2211.3.4 Truss quality assurance. Reserved.

2211.4 Wall stud design. Wall studs shall be designed in accordance with either AISI S211 or AISI S100.

2211.5 Floor and roof system design. Framing for floor and roof systems in buildings shall be designed in accordance with either AISI S210 or AISI S100.

2211.6 Lateral design. Light-frame shear walls, diagonal strap bracing that is part of a structural wall and diaphragms used to resist wind, seismic and other in-plane lateral loads shall be designed in accordance with AISI S213.

2211.7 Prescriptive framing. Detached one- and two-family *dwellings* and *townhouses*, less than or equal to three *stories above grade plane*, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

SECTION 2212
GABLE ENDWALLS

2212.1 Gable endwalls. Gable endwalls shall be structurally continuous between points of lateral support.

2212.1.1 Cathedral endwalls. Gable endwalls adjacent to cathedral ceilings shall be structurally continuous from the uppermost floor to the ceiling diaphragm or to the roof diaphragm.

SECTION 2213
RESERVED

SECTION 2214
HIGH-VELOCITY HURRICANE ZONES—GENERAL—STEEL CONSTRUCTION

2214.1 Design. Steel and iron members shall be designed by methods admitting of rational analysis according to established principles or methods.

2214.2 The design, fabrication and erection of iron and steel for buildings and other structures shall be as set forth in this chapter. The requirements set forth in Sections 2215 through 2221 herein, inclusive, apply to structural steel for buildings and other structures. Sections 2222 and 2223, apply to cold-formed members of sheet or strip steel and light-gauge steel construction.

2214.3 The following standards, as set forth in Chapter 35 of this code, are hereby adopted.

1. American Institute of Steel Construction, AISC.
   a. Reserved.
   b. Serviceability Design Considerations for Low-Rise Buildings, AISC.
   c. Engineering for Steel Construction, AISC.
   d. Detailing for Steel Construction, AISC.
   e. Iron and Steel Beams - 1873 to 1952, AISC.
   f. Torsional Analysis of Steel Members, AISC.
2. American Iron and Steel Institute, AISI.
   a. Reserved.
   b. Reserved.
   c. Reserved.
   d. Reserved.
   e. Cold-Formed Steel Design Manual, AISI.
   f. Specifications for the Design of Light-Gage Cold-Formed Stainless Structural Members, AISI.
   g. Specification for the Criteria for Structural Application of Steel Cables for Buildings, AISI.
   h. Reserved.
   i. Design Manual for Structural Tubing, AISI.
3. American National Standards Institute/American Society of Civil Engineers, ANSI/ASCE.
   a. Reserved.
   b. Specifications for the Design of Cold-Formed Stainless Steel Structural Members, ANSI/ASCE 8.
   c. Reserved.
4. American National Standards Institute/American Welding Society, ANSI/AWS.
   a. Standard Welding Procedure and Performance Qualification, AWS B2.1.
   b. Recommended Practice for Stud Welding, AWS C5.4.
   c. Structural Welding Code—Steel, ANSI/AWS D1.1.
   d. Structural Welding Code—Sheet Metal, AWS D1.3.
   e. Structural Welding Code—Reinforcing Steel, ANSI/AWS D1.4.
   f. Specification for Welding of Sheet Metal, AWS D9.1.
   g. Standard for Qualification of Welding Procedures and Welders for Piping and Tubing, AWS D10.9.
5. American Society for Testing and Materials, ASTM.
   a. Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use, ASTM A 6.
   b. Standard Specifications for High-Strength Bolts for Structural Steel Joints, ASTM A 325.
   c. Standard Specification for Heat-Treated Steel Structural Bolts. 150 KSI Minimum Tensile Strength, ASTM A 490.
   d. Standard Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, ASTM A 525.
6. National Association of Architectural Metal Manufacturers, NAAMM.
   a. Metal Grating Manual, NAAMM.
7. Reserved.
8. Research Council on Structural Connections of the Engineering Foundation, RCSCEF.
   a. Specification for Structural Joints Using ASTM A 325 or A 490 Bolts, RCSCEF.
9. Reserved.
10. Steel Deck Institute, Inc., SDI.
    a. Reserved.
    b. Reserved.
    c. Reserved.
    d. Reserved.
    e. Reserved.
    f. Diaphragm Design Manual, SDI.
    g. SDI-C-2011 Standard for Composite Steel Floor Deck Slabs.
11. Steel Joist Institute, SJI.
    a. Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, SJI.
    b. "Structural Design of Steel Joist Roofs to Resist Ponding Loads," *Technical Digest No. 3*, SJI.
    c. "Vibration of Steel Joist-Concrete Slab Floors," *Technical Digest No. 5*, SJI.
    d. "Structural Design of Steel Joist Roofs to Resist Uplift Loads," *Technical Digest No. 6*, SJI.

e. "Welding of Open Web Steel," *Technical Digest No. 8*, SJI.

f. "Handling and Erection of Steel Joists and Joist Girders," *Technical Digest No. 9*, SJI.

g. *60-Year Steel Joist Manua*l, SJI.

12. Reserved.

a. Reserved.

b. Reserved.

13. Reserved.

14. Welded Steel Tube Institute, Inc., WSTI.

a. *Manual of Cold Formed Welded Structural Steel Tube*.

2214.4 Workmanship. Reserved.

2214.5 Statements of the structural responsibilities of architects and professional engineers on the design of structural steel systems. Reserved.

SECTION 2215
HIGH-VELOCITY HURRICANE ZONES—MATERIAL

2215.1 Steel. Reserved.

2215.2 High-strength steel bolts. Reserved.

2215.3 Used and damaged material. All steel shall be straight and true, and any section damaged to be out of shape shall not be used. Steel previously used or fabricated for use or fabricated in error shall not be used except with the approval of the building official. Filled holes or welds shall not be concealed. Straightened or retempered fire-burned steel shall not be used except with the approval of the building official.

2215.4 Tests. Reserved.

2215.5 Ribbed bolts. Ribbed bolts shall be made from carbon manganese steel with a minimum tensile strength of 70,000 per square inch (482.7 MPa).

SECTION 2216
HIGH-VELOCITY HURRICANE ZONES—DESIGN LOADS

2216.1 Design shall be based on the dead, live, wind and other loads set forth in Chapter 16 (High-Velocity Hurricane Zones) and the additional stress considerations set forth in this chapter.

SECTION 2217
HIGH-VELOCITY HURRICANE ZONES—MINIMUM THICKNESS OF MATERIAL

2217.1 The minimum thickness of material shall not be less than as set forth in the applicable standards listed in Section 2214.3, except as otherwise set forth herein.

SECTION 2218
HIGH-VELOCITY HURRICANE ZONES—CONNECTIONS
RESERVED

SECTION 2219
HIGH-VELOCITY HURRICANE ZONES—TUBULAR COLUMNS

2219.1 Tubular columns and other primary compression members, excluding secondary posts and struts not subject to bending and whose design load does not exceed 2,000 pounds (8900 N), shall have a minimum least dimension of $2^1/_2$ inches (64 mm) and a minimum wall thickness of $^3/_{16}$ inch (4.8 mm).

2219.2 Tubular members when filled with concrete shall have $^1/_4$-inch diameter (6.4 mm) pressure relief holes drilled through the shell, within 6 inches (152 mm) of the top and bottom of the exposed length of the member and one hole at midheight.

2219.3 Concrete fill in tubular members shall not be assumed to carry any of the load except in compression members having a least dimension of 8 inches (203 mm) or greater and having a 1 inch (25 mm) inspection hole in the plate at each end.

SECTION 2220
HIGH-VELOCITY HURRICANE ZONES—PROTECTION OF METAL
RESERVED

SECTION 2221
HIGH-VELOCITY HURRICANE ZONES—GENERAL—OPEN WEB STEEL JOISTS

2221.1 Standards. Open web steel joists shall comply with the standards set forth in Section 2214.3.

2221.2 Reserved.

2221.3 Design. Reserved.

2221.4 Connections. Reserved.

2221.5 Bridging. Reserved.

2221.6 End supports and anchorage.

2221.6.1 Joists shall not bear directly on unit masonry unless masonry is designed as engineered unit masonry with properly reinforced, grout-filled continuous bond beam.

2221.6.2 The ends of every joist shall be bolted, welded or encased in concrete at each point of bearing to provide not less resistance in any direction than 50 percent of the Steel Joist Institute (SJI) rated end reaction horizontally and 100 percent of the net uplift reaction specified in the structural construction documents.

2221.6.3 The ends of joists shall have a minimum bearing, on reinforced concrete and steel supports as specified in the standard set forth in Section 2214.3(11).

2221.7 Fabrication. Reserved.

2221.8 Shop standards. Reserved.

SECTION 2222
HIGH-VELOCITY HURRICANE ZONES—COLD-FORMED STEEL CONSTRUCTION

2222.1 Cold-formed steel construction shall include individual structural members, structural decks or wall panels, and nonstructural roofing, siding and other construction elements formed from sheet or strip steel and as set forth in Section 2214.3, Item 2.

2222.2 Standards. Cold-formed steel used in structural applications shall conform to the standards set forth in Section 2214.3, Item 2.

2222.2.1 Galvanizing as referred to herein is to be zinc coating conforming to the standard set forth in Section 2214.3, Item 5d.

2222.3 Individual structural members. Design, fabrication and erection of individual cold-formed steel structural members shall be as set forth herein.

2222.3.1 All structural members shall be positively connected to resist the loads set forth in Chapter 16 (High-Velocity Hurricane Zones).

2222.3.2 All connections shall be by welding, riveting, bolting or other approved fastening devices or methods providing positive attachment and resistance to loosening. Fasteners shall be of compatible material.

2222.3.3 Cables and rods shall not be used as lateral bracing in habitable structures. Lateral bracing, when used, shall have a slenderness ratio of 300 or less, unless restricted by any other section of this code.

2222.3.4 All doors shall be anchored as part of the frame in the closed position.

2222.3.5 No increase in strength shall be allowed for the effect of cold work.

2222.4 Structural sheets. Decks and panels with or without an approved fill material may be designed as diaphragms in accordance with the *Diaphragm Design Manual* of the Steel Deck Institute, provided other limitations in this code are complied with.

2222.4.1 Poured fill on roof and floor decks shall not be assumed to have any structural value to support or resist vertical or lateral loads or to provide stability or diaphragm action unless so designed, and poured fill and/or applied materials do not degrade when subjected to moisture.

2222.4.2 Positive attachment of sheets shall be provided to resist uplift forces. Attachment shall be as set forth in Section 2222.3.1 and as required by rational analysis, and/or tests, but not less frequently than the following maximum spacing:

1. One fastener shall be placed near the corner of each sheet or at overlapping corners of sheets.
2. Along each supporting member, the spacing of fasteners shall not exceed 8-inches (203 mm) on centers at ends of sheets or 12-inches (305 mm) on center.
3. The spacing of edge fasteners between panels, and between panels and supporting members, parallel to the direction of span, where continuous interlock is not otherwise provided shall be not more than 12-inches (305 mm) on center.
4. Fastening shall be by bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per lineal foot (5838 N/m).
5. Poured lightweight concrete fill will be acceptable as continuous interlock.
6. Attachment to the supporting structure shall be provided at all perimeters and discontinuities by fasteners spaced at no more than 8-inches (203 mm) on center.
7. Wall panels shall be attached as set forth in Section 2222.4.2, Items 1, 2 and 3.

2222.4.3 Metal siding and roof panels shall be not less than 24 gauge.

Exception: Roof panels having an approved fill material designed to act as a diaphragm may use a lighter deck gauge, provided that the product approval for the fill material allows its use over the same deck gauge, but in no case shall the deck be less than 26 gauge. The permit applicant shall provide the building official with signed and sealed structural calculations for the diaphragm design prepared by a licensed architect or engineer proficient in structural design. The diaphragm design shall comply with the applicable requirements of Chapter 16 and Chapter 22 (High-Velocity Hurricane Zones).

2222.4.4 Deflection of metal siding and roof panels shall not exceed L/240.

2222.4.5 The bending stress of metal siding and roof panels shall be designed using a safety factor of not less than 2.5.

2222.4.6 Minimum roof decking uplift loads shall comply with the design requirements of Chapter 16 (High-Velocity Hurricane Zones) utilizing rational analysis, but not less than UL 580 Class 90.

2222.4.7 Reserved.

2222.4.8 Metal siding and roof panels shall be designed, where possible, to be continuous over two or more spans.

2222.5 Nonstructural sheets. Steel sheet sections not suitable by rational analysis for self-supporting structural sheets shall be termed roofing and siding. Roofing and siding shall be used only over solid wood sheathing or equivalent backing.

2222.5.1 Attachment of sheets shall be as set forth in Section 2222.4.2

2222.6 Protection of metal. All members shall be treated with protective paint coatings or equivalent protection except as permitted in Sections 2222.6.1 or 2222.6.2.

2222.6.1 All steel sheets having a thickness of less than 20 gauge, i.e., materials of higher gauge, shall be galvanized in accordance with the standards of Section 2214.3, Item 5d herein to provide a minimum coating designation of G90.

2222.6.2 Abrasions or damages to the protective coating shall be spot-treated with a material and in a manner compatible to the shop protective coating.

2222.7 Welding shall conform to the requirements of Section 2214.3.

SECTION 2223
HIGH-VELOCITY HURRICANE ZONES—PREENGINEERED, PREFABRICATED METAL BUILDING SYSTEMS AND COMPONENTS (PREENGINEERED STRUCTURES)

2223.1 Scope. Metal buildings (preengineered structures) shall include, but not be limited to, tapered or straight web structural steel frames and predominantly cold formed steel secondary components, including, but not limited to, girts, purlins, roof sheets, wall sheets, etc.

2223.2 Standards. Frames and components shall comply with the standards set forth in Section 2214.3.

2223.3 Structural construction documents for preengineered structures shall indicate the necessary measures for adapting the structures to the specific site. The structural construction documents shall indicate all openings, concentrated loads and other special requirements. Foundation conditions assumed in the design shall be indicated as well as the location and magnitude of building reactions on that foundation under all design conditions.

2223.4 Structural submittals. Reserved.

2223.5 Design. A building or component system in this section shall have a structural engineer of record and/or architect of record responsible for the overall design and performance of the entire building including the foundation and the anchorage of the preengineered metal systems buildings thereto. The structural engineer of record and/or the architect of record shall provide the structural construction documents necessary for permitting.

2223.5.1 Calculations for drift and deflection of the metal system building shall be by the specialty engineer.

2223.5.2 Calculations for deflection shall be done using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed. Drift shall follow AISC serviceability design considerations for low-rise buildings. The use of composite stiffness for deflection calculations shall be permitted only when actual calculations for the stiffness are included with the design for the specific project. When maximum deflections are specified by the structural construction documents, calculations shall be included in the design data.

2223.5.3 The manufacturer shall design the metal system building and/or component system in accordance with the provisions of Chapter 16 (High-Velocity Hurricane Zones), and the design shall be signed, dated and sealed by the specialty engineer and reviewed by the structural engineer of record and/or the architect of record. The manufacturer of the metal system building and or component system shall be responsible to provide all reactions to the structural engineer of record and/or the architect of record.

2223.5.4 Fastenings shall be by bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per lineal foot (5838 N/m).

2223.6 Permitting. Reserved.

2223.7 Fabrication and erection.

2223.7.1 Reserved.

2223.7.2 Temporary bracing shall be provided during erection and shall remain in place until all structural frames, purlins, girts, flange braces, cable or rod bracing and sheets used as diaphragms have been installed.

2223.8 Roof sheets, wall sheets, roof panels and wall panels.

2223.8.1 Reserved.

2223.8.2 The fusion welding of structural members and structural sheets defined in Section 2222.4 and less than 22 gauge (0.0299 inch nominal) in thickness shall have minimum of $^{5}/_{8}$-inch (17 mm) diameter welds through weld washers not less than 14-gauge in thickness and 1 inch (25 mm) in diameter, contoured if necessary to provide continuous contact, or an equivalent device.

2223.8.3 Clip-mounted standing-seam roof sheets shall not be used as diaphragms nor shall they be considered as adequate lateral bracing of the flange of the secondary member to which they are attached unless one or both of these features are designed into the sheathing system and the manufacturer can certify by testing and/or analysis that such capabilities exist and are appropriately defined.

2223.8.4 Structural standing-seam roof sheets shall be a minimum of 24 gauge [0.0239 inch (0.6 mm) nominal] in thickness.

2223.8.5 Direct screw attached roof and wall sheets may be used as diaphragms provided the sheets are a minimum of 24 gauge [0.0239 inch (0.6 mm) nominal] in thickness. Additionally, these sheets shall be considered to laterally brace the flange of the secondary member to which they are attached.

2223.8.6 See Section 2222 for additional requirements for roof sheets, wall sheets, roof panels and wall panels.

2223.9 Roof purlins and wall girts.

2223.9.1 Adequate bracing shall be provided to the compression flanges of secondary members with special attention to those members subject to uplift or outward pressures where no roof or wall sheets are attached to provide such bracing. Sag rods shall not be considered brac-

ing when located in the neutral axis of the web of the secondary members.

2223.9.2 Roof purlins and wall girts shall be laterally braced in addition to relying on deck and panel diaphragm action.

2223.9.3 The ends and bearing points of secondary members shall be designed to carry 100 percent of dead, live and collateral loads superimposed on them by wind.

2223.9.4 Upward or outward forces of wind are to be calculated without live and collateral loads. When downward or inward forces caused by wind are involved, the dead forces plus collateral load forces must be combined but the roof live load may be omitted.

2223.10 Individual structural members.

2223.10.1 Cables and rods shall not be used as lateral bracing in habitable structures. Lateral bracing, when used, shall have a slenderness ratio of 300 or less, unless restricted by any other section of this code.

2223.10.2 Reserved.

2223.10.3 All doors shall be anchored as part of the frame in the closed position.

2223.10.4 See Section 2222 for additional requirements for metal building systems and components.

2223.11 Inspection. Reserved.

SECTION 2224
HIGH-VELOCITY HURRICANE ZONES—CHAIN LINK FENCES

2224.1 Chain link fences in excess of 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones).

2224.2 Chain link fences less than 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones) or may be constructed to meet the minimum requirements specified in Table 2224.

TABLE 2224
CHAIN LINK FENCE MINIMUM REQUIREMENTS

Fence Height (ft)	Terminal Post Dimensions (o.d. x wall thickness) (in inches)	Line Post Dimensions (o.d. x wall thickness) (in inches)	Terminal Post Concrete Foundation Size (diameter x depth) (in inches)	Line Post Concrete Foundation Size (diameter x depth) (in inches)
Up to 4	$2\,{}^{3}/_{8} \times 0.042$	$1\,{}^{5}/_{8} \times 0.047$	10×24	8×24
Over 4 to 5	$2\,{}^{3}/_{8} \times 0.042$	$1\,{}^{7}/_{8} \times 0.055$	10×24	8×24
Over 5 to 6	$2\,{}^{3}/_{8} \times 0.042$	$1\,{}^{7}/_{8} \times 0.065$	10×24	8×24
Over 6 to 8	$2\,{}^{3}/_{8} \times 0.110$	$2\,{}^{3}/_{8} \times 0.095$	10×36	10×36
Over 8 to 10	$2\,{}^{7}/_{8} \times 0.110$	$2\,{}^{3}/_{8} \times 0.130$	12×40	10×40
Over 10 to 12	$2\,{}^{7}/_{8} \times 0.160$	$2\,{}^{7}/_{8} \times 0.120$	12×42	12×42

For SI: 1 inch = 25.4 mm.

NOTES:

1. This table is applicable only to fences with unrestricted airflow.
2. Fabric: $12\,{}^{1}/_{2}$ gauge minimum.
3. Tension bands: Use one less than the height of the fence in feet evenly spaced.
4. Fabric ties: Must be minimum the same gauge of the fabric.
5. Fabric tie spacing on the top rail: Five ties between posts, evenly spaced.
6. Fabric tie spacing on line posts: One less than height of the fence in feet, evenly spaced.
7. Either top rail or top tension wire shall be used.
8. Braces must be used at terminal posts if top tension wire is used instead of top rail.
9. Post spacing: 10 foot (3 m) on center maximum.
10. Posts shall be embedded to within 6 inches (152 mm) from the bottom of the foundation.
11. In order to follow the contour of the land, the bottom of the fence may clear the contour of the ground by up to 5 inches (127 mm) without increasing table values to the next higher limit.