

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Features:

- 1. Steel Roof Deck
- 2. Composite Steel Deck
- 3. Support Framing
- 4. Connections
- 5. Accessories

B. Related Sections:

- 1. 013300 – Submittal Procedures
- 2. 014500 – Structural Testing, Inspection, and Quality Assurance
- 3. 033000 – Cast-in-Place Concrete
- 4. 051200 – Structural Steel Framing
- 5. 078100 – Applied Fireproofing

1.3 REFERENCE STANDARDS

- A. General: Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

B. American Iron and Steel Institute (AISI):

- 1. AISI Specification for the Design of Cold-Formed Steel Structural Members

C. American Society for Testing and Materials (ASTM):

- 1. ASTM A36 Standard Specification for Carbon Structural Steel
- 2. ASTM A108 Standard Specification for Steel Bar, Carbon, and Alloy, Cold-Finished
- 3. ASTM A653 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- 4. ASTM A924 General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process
- 5. ASTM A1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

D. American Welding Society (AWS):

- 1. AWS D1.1 Structural Welding Code - Steel
- 2. AWS D1.3 Structural Welding Code - Sheet Steel

- E. Steel Deck Institute (SDI):
 - 1. SDI Design Manual for Composite Decks, Floor Decks, and Roof Decks
- F. Underwriters' Laboratories (UL) Fire Resistance Manual
- G. Factory Mutual (FM) Research Corporation Approval
- H. International Code Council, Evaluation Services (ICC-ES): Evaluation Reports
- I. International Association of Plumbing and Mechanical Officials: Uniform Evaluation Service (IAPMO-UES)

1.4 QUALITY ASSURANCE

- A. Qualification of Erector/Installer: Must have a minimum of 5 years' experience in the installation and/or erection of steel decking and accessories.
- B. All deck material and connections are to have current ICC-ES (or IAPMO-ES equivalent) Reports.
- C. Each welder performing work on this project shall be qualified in accordance with the American Welding Society before commencement of welding on this project.
- D. Unless otherwise noted, the materials of this Section are used as part of an assembly in which fire-resistive construction ratings are required. Demonstrate rated approval by Underwriter's Laboratories, Inc., and the governmental agencies having jurisdiction.
- E. See Section 014500, "Structural Testing, Inspection, and Quality Assurance," for testing and inspection.
- F. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- G. Factory Mutual (FM) Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings for the plan deck spans.
- H. Pre-Construction Conference: Schedule a job conference to review the Structural Documents prior to development of shop drawings. The conference shall be attended by all pertinent parties, which at a minimum is to include the Fabricator, Erector, Contractor, Owner's Testing Agency, and Structural Engineer.

1.5 SUBMITTALS

- A. Submit the following in accordance with Section 013300, "Submittal Procedures."
- B. Shop Drawings: Clearly indicate the following:
 - 1. Deck layout and orientation, type and gage, framing and supports, and unit dimensions and sections
 - 2. Size and location of holes and openings through deck
 - 3. Edge condition details and locations, including type and locations of all closures
 - 4. Additional deck support framing where required
 - 5. Types of welds and weld patterns, including weld washer requirements
 - 6. Types of connection fasteners and locations
 - 7. Location and patterns for button punching

- 8. Layout of steel shear connector studs
- 9. Shoring locations, if required

- C. Manufacturer's Product Data: Clearly indicate all technical information that specifies full compliance with requirements of this Section and contract documents, including manufacturer's published installation recommendations.
- D. Copies of each welder's qualification records shall be made available to the Architect for inspection.
- E. Mill Test Reports: Submit mill test reports.
- F. Submit ICC-ES (or IAPMO-ES equivalent) Report confirming compliance of steel deck with regulatory fire-resistance requirements.

1.6 HANDLING AND STORAGE

- A. Handling: Handle and stack all materials carefully in order to prevent deformation or damage. During unloading and hoisting, extra care shall be given to prevent damage to the ends and sides. Decking shall not be placed in direct contact with the ground. Store deck at a slope to prevent water from ponding. Where the underside of deck is architecturally exposed, it shall be free from visual defects such as scratches, dents, flame cut edges, holes, etc. All damaged deck shall be replaced.
- B. Damaged Units: The Contractor shall replace damaged deck units that are rejected by the Owner's Testing Agency. All rejected deck shall be immediately removed from the job site.

1.7 JOB CONDITIONS

- A. General: Conform to all local, state and federal safety regulations, especially where decking is used as planking prior to welding in place. Exercise extreme care so as to prevent decking from blowing off in wind.

1.8 CONDITION OF STEEL

- A. Pre-Fireproofing Inspection: The Contractor, steel decking erector, sprayed-on fireproofing applicator, and the Owner's Testing Agency shall conduct a visual inspection of all steel decking prior to receiving fireproofing. The purpose of this inspection is to check for foreign substances on the surfaces that could impair adhesion. Any cleaning that may be necessary as a result of this inspection shall be done at no additional cost to the Owner.
 - 1. All steel decking shall be free of oil, dirt, or other materials that will impair bond of concrete or fireproofing.
 - 2. Application of the sprayed-on fireproofing will not commence until all steel surfaces have been accepted by sprayed-on fireproofing subcontractor and material manufacturer. No additional compensation shall be granted to the Contractor, steel decking erector, or fireproofing applicator should it be determined at a later date that foreign substances that were allowed to remain on the steel surfaces will have a detrimental effect in obtaining total adhesion in accordance with the fireproofing Specification Section.

1.9 REQUIREMENTS AT EDGE CONDITIONS

- A. The Contractor shall make specific provisions to provide the necessary framing materials at slab and roof edge conditions. The Contractor shall provide and install all gage metal edge closures where required by the plans and specification and shall coordinate shoring requirements at composite slab edges. The Contractor shall provide and install all structural steel bent plate edge closures or structural steel edge materials and any corresponding bracing or shoring where required by the plans and specifications.

- B. At edge closures, provide necessary modifications to the edge closure to ensure that shear connector studs can be properly connected to the structural framing. Where possible, weld through the edge closure. Where this is not possible or where an inadequate weld occurs, cut the edge plate at each stud and connect the stud directly to the framing.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Galvanized Composite Steel Deck:

1. Material: Composite floor deck shall be galvanized steel conforming to ASTM A653 Grade 33 Fy (min) = 33,000 psi with a G60 coating of zinc prior to being formed. Furnish decking of depth and profile as indicated on the drawings.
2. Gage of deck and minimum connections shall be determined by the Contractor based on the span conditions, unshored condition, and the superimposed loads shown on the drawings, load diagrams, and notes. Minimum gage is 20. The capacities of the deck shall be based on current ICC-ES (or IAPMO-ES equivalent) Reports.
3. For floor deck indicated as part of a fire rated system, furnish decking listed in the UL "Fire Resistance Directory" and bearing the UL label for the system detailed.
4. Fabricate composite deck units with integral embossing or raised patterns to provide mechanical bond with concrete slabs.
5. Furnish deck panels of lengths required to span continuously over four or more supports (three spans) unless framing does not allow for such layout.
6. Furnish deck panels with butted end conditions and interlocking side laps, unless otherwise noted.
7. Furnish deck panels with provisions for venting through the deck ("vent deck") for slabs that are to receive impervious coatings such as roofing materials or waterproof membranes.

B. Roof Deck:

1. Material: Steel roof deck shall be galvanized steel conforming to ASTM A653 Grade 33 Fy (min) = 33,000 psi with a minimum G60 coating of zinc prior to being formed or ASTM A611 Grade C or D with Fy (min) = 33,000 psi with primed and painted surfaces where specified as being painted per the Architect. Furnish decking of depth, gage, and profile as indicated in drawings with all connections as indicated in the drawings and notes.
2. For deck indicated as part of a fire rated system, furnish decking listed in the UL "Fire Resistance Directory" and bearing the UL label for the system detailed.

C. Connections: Connections shall be as noted on the drawings. Alternate connections, when proposed, shall be determined by the Contractor based on the more stringent of the manufacturer's minimum recommendations for the plan configurations and loading or as specified in the contract documents. Connections designed by the Contractor may be made by any method recommended by the manufacturer, except that button punching of side laps shall not be allowed at roof decks unless indicated specifically as being required per the Structural Plans. Connection materials shall be as follows:

1. Welded Shear Connectors: Shall be Type B in accordance with AWS D1.1 and comply with ASTM A29, Grade 1010 or 1020; of dimensions complying with AISC specifications and the contract drawings; through deck stud welded shear connectors. Install in such a manner as to provide complete fusion between the end of the stud and structural steel base material.
2. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
3. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

4. Welding Materials: Applicable AWS D1.1 and D1.3 type required for materials being welded.
 5. Weld Washers: Provide as required per manufacturer's recommendations.
- D. Support Framing: Where necessary to provide support of the deck, additional support framing shall be provided by the Contractor per the typical details so that the deck flutes are supported with a minimum 2 inches of bearing. Where no details are provided or are not applicable, the Contractor shall design and provide secondary structural steel framing consisting of ASTM A36 steel to support the deck. The secondary framing shall satisfy the requirements of Section 051200, "Structural Steel Framing."
- E. Accessories: At roof and composite floor slab conditions, the Contractor is to design and provide all accessories of types required to complete the installation of steel decking in the system shown, including edge forms, end closures, sump pans, closure strips, cover plates, etc. Finish sheet steel items to match deck. Include the following items:
1. Metal cover plates to close gaps at changes in deck direction, columns, walls, and openings; 20 gage minimum.
 2. Continuous sheet metal edging at openings and concrete slab edges, 20 gage minimum or as required per plan.
 3. Sealed closures for ends of cells on single-unit decking, 20 gage minimum.
 4. Fabricate metal closure strips of 20-gage sheet steel for openings between decking and other construction. Form to provide tight fitting closures at open ends of cells or flutes, sides of decking, and between decking.
- F. Shear Connectors: Where the deck capacity is determined based on the installation of shear studs, the shear studs required on the framing plans for composite beams or other connections to structural framing shall not be considered to be effective in determining the deck capacity. Shear studs, which are in addition to those required per plan, shall be provided as required by the deck manufacturer to achieve the required deck capacity, provided these additional studs can be placed on the beam without adversely affecting the shear value of the studs that are required per plan.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 TOLERANCES

- A. Unless otherwise noted, edge materials shall be field installed to the minimum tolerances of this Section, Section 017100, "Construction Tolerance," or as required for the installation of the cladding system, whichever is more stringent.
1. Edge Location: ± 1 inch from established building working lines.
 2. Edge Height: $\pm 1/8$ inch from established slab thickness

3.3 INSTALLATION

- A. General: Install decking in accordance with approved shop drawings and manufacturer's recommendations. Where steel deck is to be welded to steel framing with puddle welds or shear studs, the steel framing shall be free of dirt and debris prior to laying the steel deck. Any water in the deck's valley shall be released so it does not become entrapped between the deck and the

beam. The deck shall be installed so that the bottom rib is in continuous contact with the steel framing.

- B. Accurately align and adjust steel panel units in place before permanently fastening. Provide butt end spliced, do not overlap ends of deck. Inaccuracies in alignment or level shall be brought to the attention of the Architect and corrected by the Contractor before steel panels are finally placed.
- C. Provide proper bearing on support framing of 2-inch minimum to steel and 4-inch minimum to CMU or concrete. Where shear connector studs are used, place deck so that the stud can be placed on top of the framing. If the stud falls within the top of the flute, cut a slot through the deck and provide closure so that fresh concrete will not leak.
- D. Reinforce openings in accordance with structural framing details and manufacturer's recommended details.
- E. Install strip closures at slab edges of the thickness of slab, as required to contain poured concrete. Ensure closures are of sufficient strength to remain in place without distortion.
- F. Install closure strips and angle flashings as required to close openings between deck and walls, columns, and openings and gaps between deck, to prevent concrete leakage.
- G. Connections: After deck has been aligned, provide permanent connections to the support framing with welds, shear connector studs, screw fasteners, or powder driven fasteners as required by the manufacturer or per plan. All closures, edge forms, plates, etc. shall be securely connected to the support framing per the manufacturer's recommendations and per plan.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting work. Use welding washers where recommended by deck manufacturer.
- I. Furnish shoring as required to maintain position of structures and prevent deflection beyond allowable limits. Ensure construction loads do not exceed deck carrying capacity per manufacturer.
- J. Shear Connectors: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions.
 - 1. General: Shear studs may be used in lieu of 3/4-inch puddle welds. The studs shall be installed only by certified operators approved by the manufacturer and who are thoroughly familiar with the installation equipment. A copy of the operating instructions for the equipment shall be at the job site at all times. Interchanging of studs and welding equipment of different manufacturers is not permitted.
 - a. Installation, inspection, and qualification of weld base metal shall conform to the requirements of AWS D1.1.
 - b. The first two studs, at the start of each production period (the interval between start-up and shut-down of equipment) and at the start of each new welding procedure, shall be tested by bending to an angle of 30° by striking the stud with a hammer (in lieu of the first sentence in Paragraph a of the AWS code). If failure occurs in the weld, the procedure shall be corrected and the next two studs shall be welded and tested prior to welding of any more studs.
 - c. If after welding, visual inspection reveals that a sound weld or a full 360° flash has not been obtained for a particular stud, the stud shall be replaced. At Contractor's option, the weld may be repaired by AWS D1.1.
 - d. Studs that show no signs of failure shall be accepted as shear connectors provided they meet the dimensional limitations of the drawings, provided no portion is less than 1 inch from a proposed concrete surface, and provided any bends or out-of-plumbness

does not exceed 15°. In addition, all studs shall extend not less than 1-1/2 inches above the top of the decking. If thru-deck stud welding is not practical, provide pre-punched holes in deck.

- e. The studs shall have complete fusion to the steel beams underlying the decking. Where repairs are made by fillet welding, such welding shall be between stud and beam with removal of portions of the decking as required.
 - f. Ferrules shall be removed after completion.
- 2. Do not weld shear connectors through two layers (lapped ends) of decking units.
 - 3. Weld only on clean, dry deck surfaces.
 - 4. Space and align shear connectors as shown or, if not shown, as recommended by manufacturer.
 - 5. On steel beam supporting steel deck with concrete or cast-in-place concrete, shear studs shall be placed at a maximum spacing of at 2'-0" on center.
- K. Hanging Loads: Do not hang concentrated loads exceeding 50 pounds from steel roof deck. Do not hang concentrated loads exceeding 250 pounds from composite slab on deck. Loads shall be located no closer than 5'-0" from any adjacent hanging load. See Structural Drawings for other requirements.
- L. Cleaning: Prior to placement of concrete or other finish materials, the deck shall be cleaned to be free of debris and water.

3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Repair galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions at cut edges or locations where coating has been damaged.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- C. Provide protection against concrete splatter or spillage for all materials that would be adversely affected by this occurrence.

3.5 CONSTRUCTION LOADING

- A. The Contractor shall assume complete responsibility for the loading of composite floor deck due to construction loads. The Contractor shall verify when it is acceptable to place loads on the composite floor deck with the deck supplier, who shall substantiate that the slab deck will not be damaged or have a reduced capacity as a result of the proposed construction loads.
- B. The Contractor shall be responsible to repair any damage that occurs to the deck due to construction loads.

END OF SECTION