

**SECTION 05 31 00
STEEL DECKING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. Section 05 12 00: Structural Steel Framing.

1.2 DESCRIPTION OF WORK

- A. This section includes steel deck units for floor and roof applications.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with latest edition of:
 - 1. American Iron and Steel Institute (AISI) "Specification for the Design of Cold Formed Steel Structural Members."
 - 2. Steel Deck Institute (SDI).
 - a. "Design Manual for Composite Decks, Form Decks, and Roof Decks."
 - b. "Diaphragm Design Manual."
 - 3. American Welding Society Inc. (AWS).
 - a. AWS D1.1 "Structural Welding Code - Steel."
 - b. AWS D1.3 "Structural Welding Code - Sheet Steel."
 - c. AWS C5.4 "Recommended Practices for Stud Welding."
- B. Qualifications for Welding Work
 - 1. Use qualified welding processes and welding operators in accordance with AWS Standards.
 - 2. Provide one of the following certifications for welders to be employed in work.
 - a. Certification of satisfactorily passing AWS qualification tests within previous 12 months to perform type of welding in work.
 - b. Work record signed by supervisor showing regular employment within previous 12 months to perform type of welding in work.
- C. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory," with each deck unit bearing the UL label and marking for specific system detailed.
- D. FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for Class 1, fire-rated construction.

1.4 SPECIAL INSPECTIONS

- A. Refer to Specification Section 01 45 29 and Schedule of Special Inspections.

1.5 MATERIAL EVALUATION/QUALITY CONTROL

- A. Preconstruction Testing: Contractor shall employ testing laboratory acceptable to Engineer and Architect to perform material evaluation tests.
- B. Submit testing service qualifications demonstrating experience with similar types of projects.

- C. See Part 3 Section "Shear Connectors" for testing of shear connector installation at the start of each day's production welding period and after welding equipment has been moved or changed. This testing is to be by the shear connector installer.
- D. The Registered Design Professionals (RDPs) for Structural Engineering and Architecture will visit the construction site at appropriate intervals to determine if work is in general conformance with the Contract Documents and specifications. Notify the RDPs 48 hours before the anticipated time of completion for a given section of work so that they may determine if site observations are required. If site observations are required, do not conceal the metal deck or place concrete slabs until the RDPs have had an opportunity to make observations.

1.6 SUBMITTALS

- A. General: Review of submittals is for general conformance only. Compliance with requirements for materials, fabricating, erection, and dimensions is Contractor's responsibility.
- B. Shop Drawings: Submit detailed drawings showing:
 - 1. Reference Contract Drawing number including addendum number on each shop drawing.
 - 2. Layout of panels.
 - 3. Anchorage details showing locations and size of welds.
 - 4. Each condition requiring closure panels.
 - 5. Location and attachment of accessories.
 - 6. Supplementary framing furnished and required.
 - 7. Special conditions; opening locations.
 - 8. Side-lap fastening.
 - 9. Thickness of material.
 - 10. Deck finish.
 - 11. Cross-section of panel with dimensions.
 - 12. Layout, size, material, and quantity of shear connectors.
 - 13. Panels requiring shoring from panel layout.
- C. Manufacturer's Data: Submit to Special Inspector and Engineer laboratory test reports and other data as required to show compliance with specifications. Submit producer's or manufacturer's specifications and installation instructions for the following products:
 - 1. Sheet steel deck, including certified copies of mill reports covering chemical and physical properties.
 - 2. Shop primer paint if used.
 - 3. Welding electrodes.
 - 4. Fasteners.
 - 5. Shear connectors.

D. LEED Submittal:

1. Recycled Content: Submit documentation that materials satisfy the requirements for recycled content as indicated in Division 1 - General Requirements. Product data shall indicate percentages, by weight, of post-consumer and pre-consumer recycled content.
 - a. Include cost for each product having a recycled content.
2. Regional Materials: Submit documentation that materials satisfy the requirements for regional materials as indicated in Division 1 - General Requirements. Product data shall indicate location and distance from project site of material manufacturer as well as point of extraction, harvest or recovery for each raw material.
 - a. Include cost for each regional material and the percentage or fraction of weight that is considered to be regional.

1.7 PERFORMANCE REQUIREMENTS

- A. Anchor roof deck to resist uplift loading:
 1. Eave Overhangs: 45 pounds per square foot.
 2. Other Roof Areas: 30 pounds per square foot.
- B. Install and anchor roof deck to develop 500 pounds per linear foot factored (LRFD) diaphragm shear resistance.
- C. Install and anchor floor deck to develop 2100 pounds per linear foot factored (LRFD) diaphragm shear strength.

1.8 PRODUCT HANDLING

- A. Store materials in approximately horizontal position on supports above ground with one end elevated for drainage.
- B. Protect from weather, and keep free of dirt and debris.
- C. Ventilate to avoid condensation.
- D. Handle material carefully so it is not bent or marred.
- E. Replace damaged materials at no cost to Owner.

1.9 WORKMANSHIP

- A. Contractor shall be responsible for correction of work not conforming to specified requirements. Correct deficient work as directed by Architect.
- B. Remove work found to be defective. Replace with new acceptable work.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Materials shall be new and free from rust.
- B. Uncoated Steel Deck: ASTM A 1008.
- C. Galvanized Steel Deck: ASTM A 653, with galvanized coating Designation G 60. Minimum 40,000 psi yield strength.
- D. Shear Connectors: Headed stud-type, 3/4-inch-diameter, ASTM A 108 Grades 1010 through 1020, solid fluxed and in accordance with AWS. Provide Type B studs having a minimum yield strength of 50,000 psi, in accordance with AWS D1.1. An arc shield (ferrule) shall be used with each connector.
- E. Roof Deck:
 1. Type: Wide-rib, Type B U.S. Deck by Canam or accepted equivalent.
 2. Size: As shown in drawings.

3. Finish: Galvanized unless noted otherwise in drawings.

F. Floor Deck:

1. Type: Composite, Lok-Floor U.S. Deck by Canam or accepted equivalent.
2. Size: As shown in drawings.
3. Finish: Galvanized unless noted otherwise in drawings.

G. Sheet Metal Accessories: ASTM A 653, SS Grade 33, commercial-quality steel sheets with G 60 galvanized coating.

1. Provide 16-gauge-minimum thickness for pour stops unless noted otherwise.
2. Provide 20-gauge-minimum thickness for other accessories unless noted otherwise.

H. Structural Shapes, Bars, and Plates: ASTM A 36.

I. Electrodes: In accordance with AWS.

J. Welding Washers: As required by deck manufacturer.

K. Touch-up Material:

1. Cold-Galvanizing: Zinc-rich, cathodic-acting paint. "Tneme-Zinc 90-97" by Tnemec Inc.; "ZRC Galvalite" by ZRC Worldwide; or accepted equivalent for repair of damaged galvanized surfaces in accordance with procedures specified in ASTM A 780.

L. Flexible Cell Closures: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

2.2 LEED CRITERIA

- A. Recycled Content: Metal deck shall contain a minimum recycled content of 30% (post-consumer plus 1/2 pre-consumer recycled content).

2.2 FABRICATION

A. General: Form deck units in lengths to span three or more supports.

1. Provide flush or 2-inch nested end laps for roof deck.
2. Provide flush end laps for floor deck.
3. Use nested side laps.
4. Minimum end bearing is 2 inches unless noted otherwise.
5. Prior to shipping decking to job site, manufacturer shall wire-brush, grind, clean, and paint scarred areas (weld marks on cellular deck, scratches, rust spots, etc.) on top and bottom surfaces of decking units.
 - a. Touch up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
 - b. Unrepaired scarred areas will be evaluated by Architect and may be cause for rejection of deck units.

B. Composite Steel Floor Deck: Fabricate deck units with integral embossing or raised pattern to furnish mechanical bond with concrete slabs. Fabricate open-beam deck units with fluted section having interlocking side laps.

C. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6 inches wide.

- D. Metal Cell Closures: Fabricate metal closure strips for cell raceways and openings between decking and other construction of not less than 0.045-inch-minimum (18 gauge) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.
- E. Roof Sump Pans: Fabricate from single piece of 0.071-inch-minimum (14 gauge) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide. Recess pans not less than 1½ inches below roof deck surface unless otherwise shown or required by deck configuration. Holes for drain will be field cut by others.
- F. Roof Deck Reinforcement (unless noted otherwise):
 - 1. For deck openings less than 15 inches wide and not supported by structural members, fabricate from minimum 18-gauge, galvanized sheet metal. Fusion-weld to bottom surface of deck and extend at least 12 inches wider and longer than opening. Weld at each corner, and provide two welds to each rib crossed. Weld edges parallel with deck at 12 inches on center.
 - 2. For deck openings from 15 inches to 24 inches wide and not supported by structural members, weld 2-inch x 2-inch x 1/4-inch steel angle to underside of deck at right angles to deck ribs. Extend angles three ribs beyond each side of opening and puddle weld. Reinforce side of opening parallel to ribs with 18-gauge sheet metal 12 inches wide placed on bottom surface of decking. Weld plate at each corner and at 12 inches on center along edges.
 - 3. For deck openings greater than 24 inches wide, provide structural steel for edge support around entire opening. Frame into adjacent structural members.
 - 4. For sleeved penetrations smaller than rib width, no reinforcing is required.
- G. Composite Floor Deck Reinforcement (unless noted otherwise):
 - 1. For deck openings up to 24 inches wide and not supported by structural members, provide additional two, No. 5 bar slab reinforcing each side of openings as shown in drawings.
 - 2. For deck openings greater than 24 inches wide, provide structural steel for edge support around entire opening. Frame into adjacent structural members.
 - 3. For sleeved penetrations smaller than rib width, no reinforcing is required.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Examine conditions under which work shall be erected. Do not proceed until unsatisfactory conditions are corrected.

3.2 ERECTION

- A. General: Install deck and accessories in accordance with manufacturer's recommendations and shop drawings.
- B. Cut and fit units and accessories around projections through decking. Make cuts neat and square.
- C. Do not use cutting torches.
- D. Position deck on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned

end to end before being permanently fastened.

- E. Do not stretch or contract side-lap interlocks.
- F. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.
- G. Place deck units flat and square, secured to adjacent framing without warp or deflection.
- H. At beams to receive shear connectors and pour stops, lap pour stop 2 inches onto beam flange and butt deck to pour stop. Do not lap deck onto pour stop. Locate shear connectors on the opposite side of the beam flange from pour stop.
- I. Do not place deck units on concrete supporting structure until concrete has cured and dried.
- J. Coordinate and cooperate with structural steel erector in locating deck bundles to prevent overloading of structural members.
- K. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members to resist forces listed under Performance Requirements. Minimum fastening shall be by nominal 5/8-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches on center with minimum of three welds a unit at each support.
 - 2. Tack weld or No. 10 or larger self-tapping screws at 4 feet on center for fastening end closures.
 - 3. Fasten roof deck units to steel supporting members to resist forces listed in drawings or under performance requirements. Minimum fastening shall be by nominal 5/8-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches at every support and closer where indicated. In addition, secure deck to each supporting member in ribs where side laps occur.
 - 4. Comply with AWS requirements and procedures for manual shielded metal arc- welding, appearance and quality of welds, and methods used in correcting welding work.
 - a. Use welding washers where recommended by deck manufacturer.
 - 5. Mechanical fasteners, either powder-actuated or pneumatically-driven, may be used in lieu of welding. Locate mechanical fasteners, and install in accordance with deck manufacturer's instructions.
 - 6. Mechanically fasten side laps of adjacent deck units between supports at intervals not exceeding 18 inches on center using No. 10 or larger self-tapping screws. Button punching not permitted.
 - 7. Keep the interiors of cells that will be used as raceways free of welds having sharp points or edges.
 - 8. Fasten pour stops at 6 inches on center. Butt joints tight and weld top and bottom.
- L. Cell closures: Install metal cell closures at open uncovered ends and edges of decking and in voids between decking and other construction.
 - 1. Fasten into position to provide complete decking installation.
 - 2. At Contractor's option, provide flexible cell closures instead of metal cell closures wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

- M. Hanger Slots or Clips: Provide UL-approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
 - 1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
 - 2. Locate slots or clips at not more than 14 inches on center in both directions, not over 9 inches from walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.
 - 3. Provide manufacturer's standard hanger attachment devices.
- N. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units except where taped joints are required.
- O. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches on center with at least one weld at each corner.
- P. At small openings in composite decks not supported by structural members, form openings in slab, but do not cut deck until slab strength reaches 75 percent of its design strength or until needed by trade requiring the opening.

3.3 SHEAR CONNECTORS

- A. General: Installation shall be in accordance with AWS Code, using automatically timed connector welding equipment.
- B. Clean welding surface before installing connectors.
- C. Lay out shear connectors prior to welding.
- D. For beams perpendicular to deck span, distribute shear connectors as follows unless noted otherwise:
 - 1. Equally space (approximately) connectors in one row along beam at a maximum spacing of 2 feet on center. Notify Engineer if there are insufficient connectors to space at 2 feet on center throughout the length of the beam.
 - 2. If there are connectors remaining, assign one connector to every other rib without a connector starting at each end of beam.
 - 3. If there are still connectors remaining, assign one connector to each rib without a connector, again starting at each end of beam.
 - 4. If number of connectors exceeds number of ribs, assign one connector to each rib. Assign a second connector to each rib starting at each end of beam until all connectors are used. Weld connectors only after assigning is completed.
- E. For beams parallel to deck span, distribute shear connectors as follows unless noted otherwise:
 - 1. Equally space total number of connectors in one row along beam.
 - 2. Connector spacing along beam shall not be closer than 4 1/2 inches on center.
 - 3. For one row of connectors, locate connectors over beam web. For two rows of connectors, locate each row 1½ inches from center of beam web (3 inch gauge).

- F. At start of each day's production welding period and after welding equipment has been moved or changed, weld and test two test connectors. These connectors shall be bent to an angle of 30 degrees from vertical by striking with a hammer. If failure occurs in weld zone of either connector, correct or adjust welding operation. Two consecutive connectors shall be welded and found satisfactory before production welding can begin.
 - 1. Where connectors are welded through metal deck, ten connectors shall be tested as described above. Connectors shall be on the same beam and through the same deck type and thickness. Ten consecutive connectors shall be welded and found satisfactory before production welding can begin.
 - 2. Connector tests shall be performed each time conditions change (i.e., no deck to through deck, through one thickness or layer of deck to another thickness or multiple layers of deck, change of deck types).
- G. Replace connectors that fail inspection by Testing/Inspecting Agency at no expense to Owner.
- H. Break ferrules away from connectors.
- I. Do not weld when air temperature is below 0 degrees F or when welding surface is wet.
- J. Beam top flange shall not be painted or galvanized in area of connector welding. Remove paint, galvanized coating, rust, and debris prior to welding connectors.
- K. Number of shear connectors shown in drawings is based on deck type and size specified. Should deck be installed with characteristics different than specified deck, number of shear connectors shall be increased to provide equivalent capacity at no additional expense to Owner.

3.4 TOLERANCES

- A. Maximum variation in unit alignment shall be 1/4 inch in 40 feet.

3.5 TOUCH-UP PAINTING

- A. After installing decking, wire-brush, clean, and paint scarred areas (scratches, weld burn marks, etc.), welds (shop and field), and rust spots on top and bottom surfaces of decking units and supporting steel members.
 - 1. Touch-up paint damaged galvanized surfaces and welded areas with cold-galvanizing paint applied in accordance with manufacturer's instructions.

3.6 PROTECTION AND LOADING

- A. Do not use units for storage or for work platforms until permanently secured.
- B. Do not exceed load capacity of deck with construction loads.
- C. Before concrete placement, check welds. Reweld broken or damaged welds.
- D. Do not suspend mechanical, electrical, or plumbing items from roof deck. Suspend loads directly from main framing or from supplemental framing installed between main framing.
 - 1. Refer to mechanical, electrical, and plumbing specifications for hangers and supplemental framing required to attach these items to main framing.

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