



## Facilities Planning and Construction Design and Construction Standards

### **DIVISION 05 - Metals**

#### **Preface**

The Texas Tech University System's 'Design and Construction Standards', as administrated by Facilities Planning and Construction, are intended to serve as guidelines to the Design Professional and Construction Management teams for design development and construction administration of Texas Tech University System (TTUS) Capital Projects. They communicate the minimum expectations and requirements relative to specific building systems, design provisions, general specification requirements, and administrative procedures for new facilities being constructed on Texas Tech University System (ASU, MSU, TTU, TTUHSC, and TTUHSC El Paso) campuses. Several, but not all requirements for each component Institution or Agency within the TTU System are covered. Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall also refer to provisions covered in their service Agreements, as well as within the project's Basis of Design (BOD) document.

In addition, the 'Design and Construction Standards' shall also be utilized in conjunction with the approved project specific Program and Schematic Design development. In the event of conflict between this document and specific project requirements, Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall contact Facilities Planning & Construction for clarification.

The guidelines within the 'Design and Construction Standards' are not intended to prohibit the use of alternative design solutions, methods, systems, products or devices not covered in this document. Offered alternatives deviating from or not covered in these standards shall be documented by the Design Professional and/or Construction Management teams and submitted to Facilities Planning & Construction for approval prior to implementation.

Throughout the 'Design and Construction Standards' there are references to manufacturer specific products. These are to be considered the 'Basis of Design' to establish the expected

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minimum quality requirements. Design Professionals are encouraged to identify and include equivalent products and/or manufacturers offering comparable products to facilitate open bidding environments.

***General Requirements for Metals and Steel Construction***

Preparation of construction documents, design calculations, geotechnical investigations and other structural analysis are to be performed by, or under the supervision of a qualified Professional Engineer registered in the State of Texas. The Structural Engineer of Record must be legally qualified to practice the engineering services required for the project.

Texas Tech will engage a qualified independent testing and inspecting agency to perform tests and inspections on reinforcement steel for concrete foundations and structural steel (field-welded and bolted connections). Special testing may include but is not limited to visual, ultrasonic (UT), x-ray, or radiographic. Third-party independent testing and inspecting does not preclude the Structural Engineer of Record from fulfilling their obligation to review construction progress for conformance to design requirements and acceptance to quality.

Steel fabrication is to be performed by a qualified fabricator with a minimum of five (5) years of documented experience. Steel fabricators are required to participate in the AISC Quality Certification Program and is designated an AISC Certified Plant, Category STD. Exceptions may be granted by Facilities Planning and Construction if the awarded steel fabricator has a demonstrated history of performance with Facilities Planning and Construction.

Specify steel erection to be performed by a qualified erector with a minimum of 5 years documented experience. References will be made available upon request.

Qualify procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel, AWS D1.2/D1.2M, Structural Welding Code - Aluminum, and AWS D1.6, Structural Welding Code - Stainless Steel, and AWS D1.3 Structural Welding Code – Sheet Steel.

**Comply with the latest editions and applicable provisions of the following specifications and documents:**

1. AISC 303 Code of Standard Practice for Structural Steel Buildings and Bridges.
2. AISC 341 and AISC 341s1 Seismic Provisions for Structural Steel Buildings.
3. AISC 360 Specifications for Structural Steel Buildings.
4. RCSC's Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
5. AISC 325-05 Steel Construction Manual.

**Specify submittals to include but not be limited to:**

1. Shop drawings.
2. Product data and certificates.
3. Welding certificates.
4. Qualification data for fabricators and installers.
5. Mill test reports.
6. Research/evaluation reports.

***05 12 00 Structural Steel Framing***

Structural steel design for conventional steel building primary structures is not permitted to be executed as 'Delegated Design'. The Structural Engineer of Record is responsible for all aspects of design of the building's foundation and primary steel structure.

Structural steel design for Pre-Engineered Metal Buildings (PEMB) may be executed as 'Delegated Design', at the Structural Engineer of Record choice, as long as the structural loads and performance design criteria are defined by the Structural Engineer of Record in advance. The Structural Engineer of Record is responsible for all aspects of design of the PEMB building's foundation and verifying the PEMB steel structure design conforms with the requirements of the International Building Code (current version), American Institute of Steel Construction (current version), and FM Global Approvals.

Quality Assurance: Qualify steel fabricators, plants and installers as members participating in the AISC Quality Certification Program. Texas Tech will engage a qualified testing agency to perform visual field welding inspections, and if required, non-destructive liquid penetration,

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magnetic particle, or ultrasonic testing.

Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, Code of Standard Practice for Steel Buildings and Bridges, and to AISC 360 Specification for Structural Steel Buildings. Qualify fabricators and their plant according to the requirements of AISC Quality Certification Program and AISC-Certified Plants.

Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, Structural Welding Code - Steel, for each welded joint. Welder's certifications are required to be submitted.

If required by the Design Professional, structural steel primer paint is to be fabricator's standard lead and chromate free, non-asphaltic, rust-inhibiting red zinc-oxide primer. The Construction Manager is required to perform paint touch-up in the field as required. Paint compatibility certificate are required.

Galvanize steel, masonry shelf angles and lintels as exposure dictates. Apply zinc coating by the hot-dip process to structural and support steel according to ASTM A 123/A 123M. Provide galvanizing repair paint to meet ASTM A 7890. Shelf angles and lintels are not to be painted to avoid long term maintenance costs.

A preinstallation conference is required to be performed prior to start of steel erection.

Qualify steel erectors according to the AISC Quality Certification Program. Installers must be a designated AISC-Certified Erector, or must be approved by Texas Tech, in advance, based on a proven performance record to Texas Tech.

Grout to be nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time. Grout strength to be specified by Design Professional. Third-party strength testing is required.

Per OSHA 1926 Regulations, steel erectors shall not erect steel unless it has received written notification that the concrete in the footings, piers, and walls or the mortar in the masonry piers

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and walls has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, either 75 percent of the intended minimum compressive design strength or sufficient strength, as dictated by the Structural Engineer of Record, to support the loads imposed during steel erection.

**05 21 00 Steel Joist Framing**

Structural Performance: Provide special joists and connections capable of withstanding design loads as designed and indicated by the Structural Engineer of Record.

Quality Assurance: Steel joist framing manufacturers must be certified by the Steel Joist Institute (SJI) to manufacture joists complying with applicable standard specifications and load tables in SJI's Specifications, Standard Specification for Composite Steel Joists, CJ-Series, and/or Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice, as applicable. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel.

Deliver, store, and handle joists as recommended in SJI's Specifications. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

Installation: A preinstallation conference is required to be performed prior to start of installation of the Work.

Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

### ***05 31 00 Steel Decking***

Performance Requirements: Comply with calculated structural characteristics of steel deck according to AISI's North American Specification for the Design of Cold-Formed Steel Structural Members.

Provide steel roof deck recommended by FM Global and listed in its Approval Guide, Building Materials for Class 1 fire rating and Class 1-90 windstorm ratings. Comply with ASTM E 119 for fire-resistance ratings, testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Quality Assurance: Testing Agency qualified according to ASTM E 329 for testing indicated. Welding, qualify procedures and personnel according to AWS D1.3/D1.3M, Structural Welding Code - Sheet Steel.

Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

Roof Deck and Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI Specifications and Commentary for Steel Roof Deck, in SDI Publication No. 31

Installation: A preinstallation conference is required to be performed prior to start of installation of the Work.

Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

### ***05 40 00 Cold-Formed Metal Framing***

Performance Requirements: Engage a qualified professional engineer to design cold-formed steel framing. Delegate design is permitted if the structural performance design criteria is defined by the Structural Engineer of Record in advance.

Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall be designed in conformance with the American Iron and Steel Institute (AISI) S100 North American Specification for the Design of Cold-Formed Steel Structural Members, S200 North American Standard for Cold-Formed Steel Framing, AISI S210 Floor and Roof Systems, AISI S211 Wall Studs, AISI S212 Headers, and AISI S213 Lateral Design.

Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.

Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

Quality Assurance: Testing Agency qualified according to ASTM E 329 for testing indicated. Provide Mill certificates or data from a qualified independent testing agency indicating steel sheets complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

Provide documentation that framing members (studs and tracks) are certified according to the product-certification program of the Certified Steel Stud Association, Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

Qualify welding procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel and AWS D1.3/D1.3M, Structural Welding Code - Sheet Steel.

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Installation: A preinstallation conference is required to be performed prior to start of installation of the Work. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected. Install cold-formed metal framing according to AISI's Standard for Cold-Formed Steel Framing, General Provisions, and to manufacturer's written instructions unless more stringent requirements are indicated.

**05 44 00 Cold-Formed Metal Trusses**

Performance Requirements: Engage a qualified professional engineer to design cold-formed steel framing. Delegate design is permitted if the structural performance design criteria is defined by the Structural Engineer of Record in advance.

Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall be designed in conformance with the American Iron and Steel Institute (AISI) S100 North American Specification for the Design of Cold-Formed Steel Structural Members, S200 North American Standard for Cold-Formed Steel Framing, AISI S210 Floor and Roof Systems, AISI S211 Wall Studs, AISI S212 Headers, and AISI S213 Lateral Design.

Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 degrees F.

Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.



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Quality Assurance: Testing Agency qualified according to ASTM E 329 for testing indicated.

Provide Mill certificates or data from a qualified independent testing agency indicating steel sheets complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

Provide documentation that framing members (studs and tracks) are certified according to the product-certification program of the Certified Steel Stud Association, Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

Qualify welding procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel and AWS D1.3/D1.3M, Structural Welding Code - Sheet Steel.

Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements.

Installation: A preinstallation conference is required to be performed prior to start of installation of the Work.

Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet.

Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected. Install cold-formed metal framing according to AISI's Standard for Cold-Formed Steel Framing, General Provisions, and to manufacturer's written instructions unless more stringent requirements are indicated.

### **05 50 00 Metal Fabrications**

This section encompasses metal fabrications related to elevator hoist beams, steel framing and supports for miscellaneous construction (toilet partitions, operable partitions, overhead and coiling doors, countertops, partial height partitions, mechanical/electrical equipment, etc.), shelf angles, lintels, elevator pit ladders, safety ladders, alternating tread devices, ships ladders, elevator pit sump covers, abrasive stair nosings, miscellaneous steel trims and guard, steel bollards, metal grates, and other metal fabricated specialties.

Performance Requirements: Engage a qualified professional engineer for delegated design ladders and alternating tread devices.

Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

Quality Assurance: Qualify welding procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel; AWS D1.2/D1.2M, Structural Welding Code – Aluminum; AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel.

Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Unless otherwise indicated, fasteners, bolts, and bolting hardware shall be of the same metal make-up as the fabricated metal component.

Avoid specifying dissimilar metals that must be in contact with one another to prevent galvanic

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action. Whenever different metals contact one other, separate the metals with an approved spacer or insulator. Zinc plated fasteners or galvanized metal will not be allowed to secure aluminum or copper. Use copper or aluminum anchors.

All ferrous metals used at exterior conditions and not scheduled for protection by other materials shall be hot dip galvanized after fabrication.

Ferrous gratings shall be hot dip galvanized. Galvanized hardware cloth shall be installed under all areaway gratings.

The Contractor is responsible for obtaining and retaining welder certifications for any person performing on-site welded steel fabrication or erection. The certifications must be current and validated by welding logs or certification test(s). Welding shall not be performed without the proper certifications.

**Bollards:** Quick release removable bollards for restricting vehicle access shall be specified as the preferred Gorilla Post system. Comparable system may be submitted to TTU Grounds Maintenance for consideration and approval to specify. Removable bollards shall be 48" X 7" diameter Gorilla Post Quick Release Bollard with white reflective stripes and black base.

<https://gorillapost.com/>

<https://gorillapost.com/products/quick-release-base-7-inch-bollards/>

If steel bollards set in concrete are specified, follow the TTU Grounds Maintenance standard details. Provide 6" or 8" round steel pipes (Schedule 40), set in ground a minimum 48" deep (flow filled with 3,000psi concrete) and extend to three feet above grade. Provided with fully welded steel dome caps. Bollards are to be painted or powder coated Texas Tech Bronze and striped with 2" wide red / white reflective tape at 12" below top elevation of bollard. Bollards are to be specified in service drive are at dumpster screening areas, transformers, generators, and various in ground equipment for protection.

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**Sign Poles:** Schedule 40 steel poles 2” – painted Texas Tech Bronze

**Drainage Channels & Lids – Neenah Foundry or East Jordan Iron Works**

<https://www.nfco.com/>

**Installation:** A preinstallation conference is required to be performed prior to start of installation of the Work.

Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot dip galvanized after fabrication and are for bolted or screwed field connections.

Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with bituminous paint (cast aluminum) or two coats of clear lacquer (extruded aluminum).

### ***05 51 13 Metal Pan Stairs***

Performance Requirements: Engage a qualified professional engineer for delegated design of stairs.

Metal stairs shall withstand the effects of gravity loads and the loads and stresses within limits and under conditions as defined by the Design Professional. Metal stairs shall withstand the effects of seismic motions determined according to ASCE/SEI 7, where applicable.

Railings, including attachment to building construction, shall withstand the effects of gravity loads and loads and stresses within limits and under conditions as defined by the Design Professional.

Allow for thermal movements from ambient and surface temperature changes.

Quality Assurance: Qualify welding procedures and welding personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel and AWS D1.3/D1.3M, Structural Welding Code - Sheet Steel.

Installation: A preinstallation conference is required to be performed prior to start of installation of the Work.

### ***05 52 13 Pipe and Tube Railings***

This section encompasses metal fabrications related to pipe and tube railings for steel, aluminum, and stainless steel.

Performance Requirements: Engage a qualified professional engineer for delegated design of railings; include analysis data, signed and sealed by the professional engineer responsible for their preparation. At a minimum, structural performance of railings, including attachments to building construction, shall, at a minimum, withstand the effects of gravity and lateral loads and stresses as defined in the International Building Code. Handrail and railing design shall comply with 2021 Texas Accessible Standards (TAS).

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Obtain each type of railing from single source, and from a single manufacturer. Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

Allow for thermal movements from ambient and surface temperature changes (120 degrees F).

Steel and Iron Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. All connections in steel railings including splices, must be shop welded. No welding shall be allowed in the field. For exterior railings, hot dip galvanized after fabrication. Weep holes shall be provided in hollow sections.

Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B.

Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

Stainless Steel: Type 304

Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes. Brackets, flanges, and anchors, cast or formed metal, are to be of same type of material and finish.

Quality Assurance: Qualify welding procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code – Steel; AWS D1.2/D1.2M, Structural Welding Code – Aluminum; AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel.

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Welding certificates, Mill certificates, and paint compatibility certificates are required to be submitted. Provide Product Test Reports for pipe and tube railings for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

Provide Evaluation Reports for post-installed anchors, from ICC-ES.

Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

After fabrication, apply powder coating system to match campus standard finishes. Contractor will provide a 5-year warranty on powder coating systems, and a 20-year special warranty for finish on two-coat fluoropolymer coating systems.

Installation: A preinstallation conference is required to be performed prior to start of installation of the Work.

Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

**05 54 20 Steel or Cast-Iron Frames, Grates, Rings, and Covers**

This Section covers the furnishing and installation of frames, grates, rings and covers for inlets, manholes and other structures in accordance with those details. Steel shall conform to the requirements of ASTM A36 Standard Specification for Carbon Structural Steel.

Welded steel grates and frames shall conform to the member size, dimensions and details shown in the drawings and specifications and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A36.

Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron, shall conform to the shape and dimensions shown in the drawings and specifications and shall be clean substantial castings, free from burnt-on sand or blow holes, and shall be reasonable smooth. Runners, risers, fins, and other cast-on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or

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machined with such precision that uniform bearing shall be provided throughout the perimeter contact area. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation.

Steel castings shall conform to the requirements of ASTM A 27 Standard Specification for Steel Castings, Carbon, for General Application. Grade 70-36 shall be furnished unless otherwise specified.

Cast Iron castings shall conform to the requirements of ASTM A 48 Standard Specification for Gray Iron Castings, Class 30.

Ductile iron castings shall conform to the requirements of ASTM A 536 Standard Specification for Ductile Iron Castings. Grade 60-40-18 shall be used otherwise specified.

Frames, grates, rings and covers shall be constructed of the materials as specified and in accordance with the details shown in the drawings and specifications and shall be placed carefully to the lines and grades indicated on the plans or as directed by the Engineer.

All welding shall conform to the requirements of the latest American Welding Society Specifications.

**Trench Drain Covers**

Trench drains shall be from East Jordan, Neenah Foundry, or Reliance Foundry. The Basis of Design is EJCO V7500 Series solid trench drain cover rated for vehicular travel. Trench drain covers shall be flush with the adjacent walking surfaces.