
USACE / NAVFAC / AFCEC UFGS-05 51 33 (August 2024)

Preparing Activity: NAVFAC

Superseding
UFGS-05 51 33 (February 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025

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SECTION 05 51 33

METAL LADDERS

08/24

NOTE: This guide specification covers requirements for metal ladders.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: Show the following information on the drawings:

1. Location and configuration of all metalwork.
2. All sizes and dimensions.
3. Special fastenings, attachments or anchoring.
4. Location of products to be galvanized.
5. Location and support detail of ladders.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008; R 2018) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z359.16 (2016) Safety Requirements for Climbing Ladder Fall Arrest Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A47/A47M (1999; R 2022; E 2022) Standard Specification for Ferritic Malleable Iron Castings

ASTM A53/A53M (2024) Standard Specification for Pipe,

	Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A500/A500M	(2023) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2022a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209/B209M	(2021a) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM D1187/D1187M	(1997; R 2018) Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(2024) Power Tool Cleaning
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SSPC SP 6/NACE No.3

(2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-01

(2022; with Change 4, 2024) DoD Building Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23

(Nov 2016) Ladders

29 CFR 1910.25

(Dec 2019) Stairways

29 CFR 1910.28

(Nov 2016) Duty to Have Fall Protection and Falling Object Protection

29 CFR 1910.29

(Nov 2016) Fall Protection System and Falling Object Protection - Criteria and Practices

1.2 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the

"G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Ladders, Installation Drawings

Ship Stair / Ship Alternating Tread-Type Stair (With or Without Guards), Installation Drawings

SD-03 Product Data

Ladders

Ship Stair / Ship Alternating Tread-Type Stair (With or Without Guards)

Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

SD-07 Certificates

Fabricator Certification for Ladder Assembly

Fabricator Certification for Ship Stair / Ship Alternating Tread-Type Stair Assembly

1.3 CERTIFICATES

Provide fabricator certification for ladder assembly stating that the ladder and associated components have been fabricated according to the requirements of 29 CFR 1910.23.

Provide fabricator certification for Ship Stair / Ship Alternating Tread-Type Stair assembly stating that the Ship Stair / Ship Alternating Tread-Type Stair and associated components have been fabricated according to the requirements of 29 CFR 1910.25.

1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

NOTE: Product selections should be based on
esthetic values, reliability and cost. Delete
alternate requirements where they occur.

2.1 SUSTAINABILITY REQUIREMENTS AND REPORTING

See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for sustainable design requirements for the following, except as modified herein.

2.1.1 Recycled Content of Products

Provide products with post-consumer recycled content plus one-half of pre-consumer recycled content to the greatest extent possible, but not less than 10 percent

2.2 MATERIALS

2.2.1 Structural Carbon Steel

ASTM A36/A36M.

2.2.2 Structural Tubing

ASTM A500/A500M.

2.2.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.2.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.2.5 Aluminum Alloy Products

Conform to ASTM B209/B209M for sheet plate, ASTM B221M ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 3 mm 1/8 inch thick and aluminum plate or sheet at least 1.3 mm 0.050 inch thick.

2.3 FABRICATION FINISHES

NOTE: In the Safety Data Sheets (SDS) for coating materials show exclusion or replacement of the following materials as intended ingredients: asbestos, benzene, chromium compounds, coal tar, 2-ethoxyethanol and 2-methoxyethanol and their acetates, halogenated hydrocarbons, and lead compounds. The content of volatile organic compounds (VOC), and marking, must be in compliance with air quality regulations for the type of application and jurisdiction where used.

2.3.1 Galvanizing

NOTE: Specify galvanizing for items installed in exterior exposures subject to salt spray or corrosive fumes and interior areas subject to continual wetting or high humidity. Applicability

of material and finishes must be based on UFC 1-200-01, including but not limited to, identifying corrosion prone locations and their applicability within the specification, and ensuring current mitigation measures are captured within the guide specification.

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90, as applicable.

2.3.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

[2.3.3 Repair of Zinc-Coated Surfaces

NOTE: Delete this paragraph when no galvanized items are specified.

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

]2.3.4 Shop Cleaning and Painting

NOTE: Shop painting herein is for steel protected from the weather and not subjected to corrosive environments. For steel which will be exposed to the weather or corrosive environments, modify the shop painting accordingly.

2.3.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

2.3.4.2 Pretreatment, Priming and Painting

NOTE: Use manufacturers standard treatment when painting and finishing is required.

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.[On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm 1.0 mil. Tint additional prime coat with a small amount of tinting pigment.]

2.3.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.3.6 Aluminum Surfaces

2.3.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.3.6.2 Aluminum Finishes

Unexposed plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with[standard mill finish][hand sanded or machine finish to a 240 grit]. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45.[For selection of a specific finish or coating based on corrosion resistance requirements and environmental severity class (ESC) in UFC 1-200-01, refer to AA DAF45].

2.4 LADDERS

NOTE: Indicate on the drawings ladder locations and details of critical dimensions and materials, all which must meet 29 CFR 1910.23 and ALI A14.3. For ladders that require a "Safety Device", select the "dynamic loading" second option.

Fabricate vertical ladders conforming to 29 CFR 1910.23 and Section 5 of ALI A14.3. Design assembly, including rung connections and methods of attachment, to support a live load of 1.33 kilonewtons 1300 N 300 pounds per rung, or 4.45 kilonewtons 1000 pounds point load, or 4.79 kilopascals 100 pounds per square foot load applied downward.[Use 65 by 10 mm 2 1/2 by 3/8 inch steel flats for stringers and 20 mm 3/4 inch diameter steel rods for rungs.][Ladders requiring a "Safety Device" must have stringers and rungs that meet the minimum strength requirements of the Safety Device anchor points dynamic loading.] Ladder rungs, step and cleats must be spaced not less than 25 cm 10 inches and not more than 400 mm 16 inches wide (measured before installation of ladder safety system), spaced no more than 36 cm 14 inches apart, plug welded or shouldered and headed into stringers. Install ladders so that the maximum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in the back of the ladder or to the finished wall surface will not be less than 175 mm 7 inches, except for the elevator pit ladders, which have a minimum perpendicular distance of 11 cm 4.5 inches. Provide heavy clip angles riveted or bolted to the stringer and drilled[

for not less than two 12 mm 1/2 inch diameter expansion bolts] as indicated. Provide intermediate clip angles not over 1200 mm 48 inches on centers. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 105 centimeters 42 inches above the access level. Provide ladder access protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

2.4.1 Phasing out of Ladder Cages and Wells (29 CFR 1910.28, Nov 2016)

NOTE: Delete this paragraph when the length of climb is 6000 mm 20 feet or less. Cages or wells are not considered adequate fall protection regardless of climb height for Navy/ Marine Corps facilities.

Conform to 29 CFR 1910.28 (Nov 2016).

NOTE: For Navy projects refer to Department of the Navy Fall Protection Guide, July 2017, section 8.2.4.6 "Ladder Cages." Ladder cages are not an acceptable form of fall protection in Navy projects. OSHA also does not consider ladder cages an acceptable form of fall protection. Any existing ladder that has a safety cage is to be provided with a ladder safety system if the ladder or the safety cage is being replaced.

Each newly installed fixed ladder over 6,000 mm 20 feet in length must be equipped with a personal fall arrest system or climbing ladder fall arrest system (ladder safety device), cages and wells can still be utilized, but will not qualify as fall protection. When a fixed ladder, cage, or well, or any portion of a section thereof, is replaced, a personal fall arrest system or climbing ladder fall arrest system (ladder safety device) must be installed in at least that section of the fixed ladder, cage, or well where the replacement is located. The minimum strength requirements of the safety device anchor points dynamic loading must be coordinated with existing rungs and stringers to confirm they have capacity. On and after November 18, 2036, all fixed ladders must only be equipped with a personal fall arrest system or a ladder safety device (climbing ladder Fall Arrest System).

2.4.2 Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

NOTE: Delete this paragraph when the length of climb is 6000 mm 20 feet or less.

Conform to 29 CFR 1910.29, Section 7 of ALI A14.3 and ASSP Z359.16. Install ladder safety devices on ladders over 6000 mm 20 feet long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of

sustaining a minimum static load of four personnel that may be attached to the fall safety device and climb the ladder at one time. The ladder must have ladder members or anchor points that meet the minimum loading requirements as defined by the safety device and the ladder must be designed to handle the dynamic load being applied in the event of a fall. Each ladder safety system must allow the worker to climb up and down using both hands and does not require the employee continuously, hold, push, or pull any part of the system while climbing. The connection between the carrier or lifeline and the point of attachment to the body harness does not exceed 23 cm 9 inches. The ladder safety system consists of a rigid or flexible carrier. Mountings for the rigid carriers are attached at each end of the carrier, with intermediate mountings spaced as necessary, along the entire length of the carrier. Mountings for flexible carrier are attached at each end of the carrier and cable guides for flexible carriers are installed at least 7.6 m 25 feet apart but not more than 12.2 m 40 feet apart along the entire length of the carrier. The design and installation of mountings and cable guides does not reduce the design strength of the ladder.

2.4.3 Ladder Security Gate

For ATEP Security Upgrade projects, provide existing ladders with either a ladder security guard door or ladder cage security guard gate. Ladder guard doors and gates are to be a minimum height of 1829 mm 6 feet 0 inches and constructed of 16 gauge galvanized steel. Provide a minimum of two hinges that are 100 mm by 100 mm by 3 mm 4 inches by 4 inches by 1/8 inch zinc-coated plates steel with a 6 mm 1/4 inch minimum diameter pin.

2.4.4 Ship Stair / Ship Alternating Tread-Type Stair

Fabricate stringers and framing of steel plate or shapes. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads. [Aluminum ladders may be provided, subject to approval of treads, materials, and shop drawings. Requirements shown or specified for steel apply. Provide anchor items of zinc-coated steel.] Design assembly, including tread connections and methods of attachment, to support a live load of 1300 N 300 pounds per tread. Provide railings as specified for metal handrails.

2.4.5 Existing Roof Access Ladder ATEP Security Upgrade (Ladder Security Door or Ladder Cage Security Gate)

Fabricate security door of steel plate or shapes to be 1829 mm 6 feet 0 inch long minimum, match width and anchor to existing ladder stringers with hinges and a hasp for locking in the closed position. Fabricate cage security gate of steel plate or shapes with a 152 mm 6 inch maximum gap between bars and sized to match the diameter of existing cage. Gate to be attached to the cage with hinge(s) and a hasp for locking in the closed position.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts

necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack weld exposed connections of work in place. Grind exposed welds smooth. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with [AWS D1.1/D1.1M](#). Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [MPI 79](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

[3.5.2 Field Preparation

**NOTE: Delete this paragraph when Section 09 90 00,
PAINTS AND COATINGS is included in the project
specifications.**

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

]3.5.3 Environmental Conditions

NOTE: Delete this paragraph when Section 09 90 00,
PAINTS AND COATINGS is included in the project
specifications.

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 15 degrees C 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

]3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer.[Secure to masonry or concrete with not less than two 12 mm 1/2 inch diameter expansion bolts.] Install intermediate clip angles not over 1200 mm 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Ends of ladders must not rest upon[finished roof][floor].

-- End of Section --