

SECTION 05 51 33

METAL LADDERS

PART 1 GENERAL

1.1 REFERENCES

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.

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

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS B 1048 (2007) Fasteners - Hot Dip Galvanized Coatings

JIS B 9713-4 (2004) Safety of machinery-Means of permanent access to machinery-Part 4: Fixed Ladders

JIS G 3101 (2020) Rolled Steels for General Structure

JIS G 3302 (2022) Hot Dip Zinc Coated Steel Sheet and Strip

JIS G 3444 (2021) Carbon Steel Tubes for General Structure

JIS G 3466 (2021) Carbon Steel Square and Rectangular Tubes for General Structure

JIS G 5705 (2018) Malleable Iron Castings

JIS H 4000 (2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)

JIS H 4100 (2015) Aluminum and Aluminum Alloy Extruded Profiles

JIS H 5202 (2010) Aluminum Alloy Castings

JIS K 2208 (2009) Asphalt Emulsion

JIS K 5553 (2006) Thick Film Zinc Rich Paint

JIS H 8641 (2021) Hot Dip Galvanized Coatings

JIS K 5674	(2019) Lead-Free, Chromium-Free Anticorrosive Paints
JIS Z 0310	(2016) Abrasive Blast Cleaning Methods for Surface Preparation
JIS Z 3410	(2013) Welding Coordination - Tasks and Responsibilities
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Standard Qualification Test and Acceptance Requirements for Semi-Automatic Welding Technique

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

29 CFR 1910.23	(Nov 2016) Ladders
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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Ladders, Installation Drawings

Ship's Ladder (With or Without Guards), Installation Drawings

SD-03 Product Data

Ladders

Ship's Ladder (With or Without Guards)

Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

SD-07 Certificates

Fabricator Certification for Ladder Assembly

Fabricator Certification for Ships Ladder 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 JIS B 9713-4.

Provide fabricator certification for ships ladder assembly stating that the ships ladder and associated components have been fabricated according to the requirements of JIS B 9713-4.

1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with JIS Z 3801, or JIS Z 3841. 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

2.1 MATERIALS

2.1.1 Structural Carbon Steel

JIS G 3101.

2.1.2 Structural Tubing

JIS G 3466.

2.1.3 Steel Pipe

JIS G 3444, STK400.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings JIS G 5705.

2.1.5 Aluminum Alloy Products

Conform to JIS H 4000 for sheet plate, JIS H 4100 for extrusions and JIS H 5202 for castings, as applicable. Provide aluminum extrusions at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: JIS B 1048, JIS H 8641, JIS G 3302, Z27, as applicable.

2.2.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper

installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to JIS K 5553 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.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with JIS Z 0310. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned with power tools. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

2.2.4.2 Pretreatment, Priming and Painting

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. Tint additional prime coat with a small amount of tinting pigment.]

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 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.

2.2.6.2 Aluminum Finishes

Unexposed plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium. 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.

2.3 LADDERS

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 per rung, or 4.45

kilonewtons point load, or 4.79 kilopascals per square foot load applied downward.[Use 65 by 10 mm steel flats for stringers and 20 mm 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 and not more than 400 mm wide (measured before installation of ladder safety system), spaced no more than 36 cm 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, except for the elevator pit ladders, which have a minimum perpendicular distance of 11 cm. Provide heavy clip angles riveted or bolted to the stringer and drilled[for not less than two 12 mm diameter expansion bolts] as indicated. Provide intermediate clip angles not over 1200 mm 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 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.

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

Conform to 29 CFR 1910.28 (Nov 2016).

Each newly installed fixed ladder over 6,000 mm 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).

2.3.2 Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

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 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. 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 apart but not more than 12.2 m 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.

2.3.3 Ship's Ladder

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 per tread. Provide railings as specified for metal handrails.

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. Grid smooth exposed welds. 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 JIS Z 3410. 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 JIS K 5674 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 JIS K 2208, asphalt-base emulsion.

3.5.2 Field Preparation

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

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 above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer.

3.6 LADDERS

Per 29 CFR 1910.28(b)(9)(i)(B), each fixed ladder installed on and after November 19, 2018, shall be equipped with a personal fall arrest system or a ladder safety system. 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 diameter expansion bolts.] Install intermediate clip angles not over 1200 mm 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].

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