UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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Preparing Activity: NASA

Superseding
UFGS-06 18 00 (August 2016)

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SECTION 06 18 00

GLUED-LAMINATED CONSTRUCTION
08/23

NOTE: This guide specification covers the requirements for fabrication and erection of laminated wood arches, beams, purlins, columns, and all metal shapes and hardware required for installation of wood components. The term "laminated wood" comprises suitably selected and prepared wood layers bonded together with adhesives, the grain of which is oriented in accord with engineered wood specifications.

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: Typically, do not use glue laminated members in humid locations or project locations with Environmental Severity Classifications (ESC) of C4 and C5 where exposed to the weather. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations. Where used, detail glue laminated members to prevent direct contact by rainfall.

PART 1 GENERAL

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NOTE: Include in drawings:

Details of all laminated wood members, showing cross sections and dimensions.

Engineered wood specifications including F_h and Modulus of Elasticity for Laminated Veneer Lumber, and F_h and grading for Glulam Members. Specifications to use ANSI/AWC National Design Specification for Wood Construction.

Design loads, including floor live load, roof live load, wind load, and concentrated loads (partitions, and equipment mounted on or suspended therefrom).

Layout, showing location of laminated members and floor elevations, and identification of Appearance Grades.

Details of hangers for suspended ceilings, pipes, light fixtures, or other construction, as required.

Details of metal shapes and hardware required for connections.

Associated work found in other sections includes pressure preservative treatment for protection against decay and insects per AITC 109 or APA EWS S580: It should be incorporated into specification when wet use conditions prevail.

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1.1 REFERENCES

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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.

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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 INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 109	(2007) Standard for Preservative Treatment of Structural Glued Laminated Timber
AITC 111	(2005) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
AITC 113	(2010) Standard for Dimensions of Structural Glued Laminated Timber
AITC 119	(1996) Standard Specifications for Structural Glued Laminated Timber of Hardwood Species

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-22	(2022) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(2009; R 2016) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN WOOD COUNCIL (AWC)

AWC NDS	(2015) National Design Specification (NDS) for Wood Construction

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA T1	(2023) Use Category System: Processing and Treatment Standard
AWPA U1	(2023) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

ANSI 117	(2008) Standard Specifications for Structural Glued Laminated Timber of Softwood Species
ANSI 405	(2012) Standard for Adhesives for use in Structural Glued Laminated Timber
ANSI A190.1	(2012) Standard for Wood Products - Structural Glued Laminated Timber

APA E30	(2016) Engineered Wood Construction Guide
APA EWS R540	(2013) Builder Tips: Proper Storage and Handling of Glulam Beams
APA EWS T300	(2007) Technical Note: Glulam Connection Details
APA S580	(2013) Preservative Treatment of Glued Laminated Timber

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A666	(2023) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A1011/A1011M	(2023) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM D2559	(2012a; E 2016) Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions
ASTM D3737	(2018; E2018) Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2021) International Building Code

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2014) Standard Grading Rules for Southern Pine Lumber

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)

QPL-19140	(2018) Lumber and Plywood, Fire-Retardant Treated

UNDERWRITERS LABORATORIES (UL)

UL 723	(2020) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(2017) Western Lumber Grading Rules

1.2 SUBMITTALS

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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, Air Force, and NASA projects.

Use the "S" Classification only in SD-11 Closeout Submittals. 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.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

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.][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

Fabrication Drawings

Installation Drawings; G[, [____]]

SD-04 Samples

Exposed-to-View Surfaces; G[, [____]]

SD-07 Certificates

Glued-Laminated Structural Members

Structural Members

Design Load Compliance

SD-08 Manufacturer's Instructions

Laminated Wood Materials

Adhesive

1.3 QUALITY CONTROL

1.3.1 Qualifications for Laminating Wood Manufacturer

Provide factory glued-laminated structural wood members produced by an American Institute of Timber Construction (AITC) or (APA) Engineered Wood Association licensed manufacturer. Factory mark every member of the structural glued-laminated timber with AITC Quality Mark or APA trademark and provide a certificate of conformance. Manufacture the laminated timber meeting the requirements of [AITC 119], APA E30, ASTM D3737, ANSI A190.1, and WWPA G-5.

1.3.2 Certifications

Submit certificates for glued-laminated structural members include a product report or laboratory report issued by a US Product certification Agency under ISO 17065 or a US inspection agency accredited under ISO 17020. Include the following information:

a. Glulam manufacturers' name

b. Glulam grade

Include in report the results of tests, shear strength, and durability of the glue line. Ensure compliance with the requirements of ASTM D3737. Ensure material tested is typical of a production run of the same material used in the project. Ensure tests are conducted from the same product lot prior to delivery of the wood.

Provide certification that structural members meet the requirements of ANSI A190.1 and ANSI 117.

Submit signed and sealed documentation prepared by a licensed professional [Engineer][Architect] verifying design load compliance with ASCE 7-22 and ICC IBC.

1.3.3 Surfaces

Submit three samples; 300 millimeter 12 inches long of sufficient width and thickness to illustrate the quality and color of exposed-to-view surfaces.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver the glued-laminated wood structural members in quantities indicated and at construction scheduled times to ensure the continuity of the installation of the structural members and the progress of the erection schedules. Reference AITC 111 and APA EWS R540 for further information.

Deliver packaged or wrapped materials in their original, undamaged wrapping, bearing label clearly identifying manufacturer's name, grade and species of lumber, type of glue, and other pertinent data. Use nonmarring slings for loading, unloading, and handling members to prevent damage to surfaces or wrapping.

Store wrapped materials in their original wrapping until ready for installation.

Place members on level supports off ground, spaced and braced to allow through ventilation. Cover wood and keep free of dirt, grease, moisture, or foreign matter that could cause staining.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Drawings

Verify all field measurements prior to preparation of fabrication and installation drawings to ensure proper fitting of the work.

Submit fabrication drawings for glue-laminated structural units consisting of fabrication and assembly details performed in the factory.

2.2 MATERIALS

2.2.1 General

Provide structural glued-laminated timber complying with AITC 113, ANSI 117, and ANSI A190.1, AWC NDS,[and AITC 119].

Provide structural glued-laminated timber manufactured in accordance with ANSI 117, and ANSI A190.1.

****

NOTE: Designer should determine the species and grade based on the design application and use, and delete the non-applicable selections below.

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2.2.1.1 Lumber

[Species and grade: [Insert Hardwood Species selected] in accordance with the provisions of AITC 119.

][Species and grade: [Douglas fir] [larch], graded in accordance with the grading provisions of WWPA G-5.

][Species and grade: Southern Pine, graded by the same basic provisions as used for solid sawn lumber in SPIB 1003.

][Provide species and grade meeting the structural requirements of ASTM D3737, AITC 113, [ANSI 117] [AITC 119] and [applicable building codes] [ASCE 7-22] [ICC IBC].

][Provide glued-laminated kiln-dried and stress-graded lumber meeting the requirements of [ANSI 117] [AITC 119].

][Determine species and grade combination by the design requirements for each component and as designated on the shop drawings. Use AITC lumber combination symbols for this identification.

] Use only glued-laminated structural members having a maximum moisture content of 15-percent throughout the entire piece before surfacing and bonding.

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NOTE: Select one of the following appearance grades:

Premium grade has the finest appearance with a smooth surface free of knot holes and voids.

Architectural grade contains normal growth characteristics such as tight knots and medium seasoning checks.

Industrial grade has a greater number of open defects, including knot holes. Industrial grade is appropriate for industrial installations, floor beams, concealed construction, or other applications where appearance is not an important consideration.

Framing grade is used only in concealed constructions.

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Provide glued-laminated structural members of ANSI A190.1 [Premium] [Architectural] [Industrial] [Framing] Grade,conforming to the applicable standards.

2.2.2 Preservative and Fire-Retardant Treatment

****

NOTE: Include heading and following paragraphs when fire-retardant treatment is required to achieve a specified flame spread rating. Fire-retardant treatment is intended and recommended only for interior use and in locations not subject to alternate wetting or drying action.

****

Pressure impregnate fire-retardant treated wood with an approved process in accordance with AITC 109, APA S580, AWPA T1, and AWPA U1.

Treat structural members to attain a UL flame spread rating not greater than 25, showing no evidence of progressive combustion when tested for 30 minutes in accordance with UL 723 and ASTM E84.

Ensure penetration of fire-retardant material in treated wood in accordance with QPL-19140. Determine depth of penetration by borer cores taken from 20 pieces of each charge and test. If 80 percent of the borings meet the penetration requirements, the charge is acceptable.

Kiln dry the wood after treatment to remove the moisture injected during treatment. Average moisture content is not to exceed 19 percent.

2.2.3 Adhesive

Bond glued-laminated members with a waterproof adhesive conforming to the test requirements of ASTM D2559 and ANSI 405 for exterior glue, shear strength and durability.

2.2.4 Finishes

****

NOTE: Delete the following paragraphs when finishes are not required

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[Provide glued-laminated members with manufacturer's standard wiped stain finish, dry-appearance, penetrating acrylic stain and sealer; oven dried with mildew and fungus resistance.

][Provide glued-laminated members with manufacturer's standard clear finish, two-coat, clear conversion vanish finish; oven dried with mildew and fungus resistance.

][Provide glued-laminated members with one factory-applied coat of sealer to the ends of members immediately after trimming, and other surfaces dressed with one coat of penetrating clear sealer.

][Provide glued-laminated members with one factory-applied coat of sealer to the ends of members immediately after trimming. No other sealer is required.

][Provide unfinished glued-laminated members after final surfacing and sanding.

][Provide glued-laminated members with standard factory wiped stain and clear varnish finish[as indicated by manufacturer's designations] [match sample] [as selected from manufacturer's full range] [insert color].
]

****

NOTE: Delete the following paragraphs when timber hardware is not required

****

2.2.5 Timber Hardware

[Provide structural steel shapes, plates, and flat bars as indicated for assembly and connection of members conforming to ASTM A36/A36M.

][Provide hot-rolled steel sheet complying with ASTM A1011/A1011M, structural steel, Type SS, Grade 33.

][Provide stainless steel bars and shapes complying with ASTM A276/A276M [Type 304] [Type 316].

][Provide stainless steel plate, flat bars, and sheets complying with ASTM A666 [Type 304] [Type 316].
]

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NOTE: Delete the following paragraphs when anchor bolts are not required. Anchor bolts are normally required for column base connections.

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Provide low carbon steel anchor bolts with regular hexagon nuts and carbon steel washers. Provide anchor bolts and nuts conforming to ASTM A307.

Provide plain washers conforming to ASME B18.22MASME B18.21.1.

Clean oil, dirt, rust, and foreign matter from all metal surfaces. For exterior locations, provide hot-dipped galvanized hardware in accordance with ASTM A153/A153M, with coating weight as required for Class [A][B][C][D] material as described therein. Coat other metal surfaces with one coat of manufacturer's standard rust-resisting metal primer applied at a minimum dry-film thickness of 0.038 millimeter 1.5 mils.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Manufacturer's Information

Submit manufacturer's instructions for laminated wood materials and adhesive including special provisions required to install equipment components and system packages. Detail with special notices all impedances, hazards and safety precautions.

3.1.2 Installation Drawings

Submit installation drawings for glue-laminated structural units showing dimensions of laminated wood members, location, size, and type of reinforcement. Include any reinforcement necessary for safe handling and erection of structural members. Identify each structural member and the corresponding sequence and procedure followed during installation. Identify location and details of anchorage devices that are embedded in other construction on layout drawings.

3.1.3 Construction

Conform spacing and placement of members and installation methods in accordance with APA EWS T300.

Plan and execute erection procedures so that close fit and neat appearance

of joints and structure as a whole is not impaired. When hoisting members into place, use padded or non-marring slings. Protect corners with wood blocking. Brace members as they are placed to maintain a safe position until full stability is achieved.

Avoid cutting Glulam members during erection to the greatest extent possible. Except for fastener drilling and other minor cutting, coat cuts with end sealer.

3.1.4 Protection

After installation, cover each member with a temporary waterproof protection to maintain the moisture content of the wood. Maintain protection until members are enclosed within the building and final coats are ready for application. Elevate initial building heat gradually to the desired level. To minimize checking do not reduce the relative humidity of the building rapidly.

-- End of Section --