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USACE / NAVFAC / AFCEA / NASA UFGS-06 18 00 (May 2009)  
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Preparing Activity: NASA Superseding  
UFGS-06 18 00 (July 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2009

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### SECTION 06 18 00

#### GLUED-LAMINATED CONSTRUCTION

05/09

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NOTE: This 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.

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 and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

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#### PART 1 GENERAL

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NOTE: Include in drawings:

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

Include in designs engineered wood specifications including  $F_b$  and Modulus of Elasticity for Laminated Veneer Lumber and  $F_b$  and grading for Glulam Members. Specifications to use National Design

Standards per National Forest Products Association.

Assumed 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: It should be incorporated into specification when wet conditions of use 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 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 FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T101 (2001) National Design Specification  
(NDS)for Wood Construction

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 109 (1998) Standard for Preservative Treatment

	of Structural Glued Laminated Timber
AITC 110	(2001) Standard Appearance Grades for Structural Glued Laminated Timber
AITC 111	(2005) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
AITC 113	(2001) Standard for Dimensions of Structural Glued Laminated Timber
AITC 117	(2004) Standard Specifications for Structural Glued Laminated Timber of Softwood Species, Design and Manufacturing Requirements
AITC 119	(1996) Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
AITC 200	(2004) Inspection Manual
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)	
ANSI B18.22.1	(1965; R 2003) Plain Washers
ANSI B18.22M	(1981; R 2005) Metric Plain Washers
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 7-05	(2006; Errata 2007) Minimum Design Loads for Buildings and Other Structures
AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)	
AWPA T1	(2004; R 2005) Use Category System: Processing and Treatment Standard
AWPA U1	(2004; R 2005) Use Category System: User Specification for Treated Wood
APA - THE ENGINEERED WOOD ASSOCIATION (APA)	
APA E30	(2005) Engineered Wood Construction Guide
APA EWS R540C	(1995; R 1996) Builder Tips Proper Storage and Handling of Glulam Beams
APA EWS T300E	(2005) Technical Note: Glulam Connection Details
ASTM INTERNATIONAL (ASTM)	
ASTM A 1011/A 1011M	(2008) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 276	(2008a) Standard Specification for Stainless Steel Bars and Shapes
ASTM A 307	(2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 666	(2003) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM D 3737	(2008) Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)
ASTM E 84	(2009) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2006; Errata 2006; Errata 2007; Supplement 2007; Errata 2007) International Building Code
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SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2002) Standard Grading Rules for Southern Pine Lumber
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-L-19140	(Rev E; Am 2) Lumber and Plywood, Fire-Retardant Treated
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UNDERWRITERS LABORATORIES (UL)

UL 723	(2008) Standard for Test for Surface Burning Characteristics of Building Materials
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WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Tech Guide	(2005) Lumber Technical Guide, Standards and Grading
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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 to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

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

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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.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Submit [Fabrication Drawings](#) and [Installation Drawings](#) in accordance with paragraph entitled, "Drawings," of this section.

#### SD-03 Product Data

Submit [Manufacturer's Catalog Data](#) in accordance with paragraph entitled, "Manufacturer's Information," of this section.

#### SD-04 Samples

Submit three samples of [Exposed-to-View Surfaces](#) in accordance with paragraph entitled, "Surfaces," of this section.

#### SD-07 Certificates

Submit Certificates for [Glued-Laminated Structural Members](#) in accordance with paragraph entitled, "Quality Control."

#### SD-08 Manufacturer's Instructions

Submit [Manufacturer's Instructions](#) for the following items in accordance with paragraph entitled, "Quality Control," of this section.

[Laminated Wood Materials](#)  
[Adhesive](#)

### 1.3 FIELD MEASUREMENTS

Verify all field measurements prior to preparation of shop drawings [Fabrication Drawings](#) and [Installation Drawings](#) to ensure proper fitting of the work.

### 1.4 QUALIFICATIONS FOR LAMINATING WOOD MANUFACTURER

Provide factory glued-laminated structural wood members produced by an American Institute of Timber Construction (AITC) or American Plywood Association (APA) licensed manufacturer. Factory mark every member of the structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark and provide a certificate of conformance. Manufacture the laminated timber meeting the requirements of [[AITC 117](#)] [[AITC 119](#)], [APA E30](#), [ASTM D 3737](#), and [WWPA Tech Guide](#).

### 1.5 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 R540C](#) 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.

### 1.6 DRAWINGS

Submit [Fabrication Drawings](#) for glue-laminated structural units consisting of fabrication and assembly details performed in the factory.

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

Submit signed and sealed documentation prepared by a licensed professional verifying compliance with [ASCE 7-05](#) and [ICC IBC](#).

## 1.7 MANUFACTURER'S INFORMATION

Include [Manufacturer's Catalog Data](#) for erection procedure of laminated structural members, including the sequence of erection, temporary supports and bracing, and lifting and handling equipment.

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.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 General

Provide structural glued-laminated timber complying with [AITC 113](#) and [AF&PA T101](#) and [[AITC 119](#)].

Provide structural glued-laminated timber manufactured from a single species and solid laminations; do not use laminated veneer lumber.

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**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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##### 2.1.1.1 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 WWP A Tech Guide.]

[ 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 D 3737](#), [AITC 113](#), [[AITC 117](#)] [[AITC 119](#)] and [applicable building codes] [[ASCE 7-05](#)] [[ICC IBC](#)].]

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

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Provide glued-laminated structural members of AITC [Premium] [Architectural] [Industrial] Grade, conforming to standards as established in AITC 110.

#### 2.1.2 Preservative and Fire-Retardant Treatment

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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.

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Pressure impregnate fire-retardant treated wood with an approved process in accordance with AITC 109, 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 E 84.

Ensure penetration of fire-retardant material in treated wood in accordance with MIL-L-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 wood after treatment to remove the moisture injected during treatment yielding an average moisture content of not more than 19 percent.

#### 2.1.3 Adhesive

Bond glued-laminated members with a waterproof adhesive conforming to the test requirements of ASTM D 3737 for waterproof glue, shear strength and durability.

#### 2.1.4 Finishes

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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 varnish 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].]

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**NOTE: Delete the following paragraphs when timber hardware is not required**  
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#### 2.1.5 Timber Hardware

[Provide structural steel shapes, plates, and flat bars as indicated for assembly and connection of members conforming to [ASTM A 36/A 36M](#).]

[Provide hot-rolled steel sheet complying with [ASTM A 1011/A 1011M](#), structural steel, Type SS, Grade 33.]

[Provide stainless steel bars and shapes complying with [ASTM A 276](#) [Type 304] [Type 316].]

[Provide stainless steel plate, flat bars, and sheet complying with [ASTM A 666](#) [Type 304] [Type 316].]

\*\*\*\*\*  
**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 A 307](#).

Provide plain washers conforming to [ANSI B18.22.1](#) [ANSI B18.22M](#).

Clean oil, dirt, rust, and foreign matter from all metal surfaces. For exterior locations, provide hot-dipped galvanized hardware in accordance with [ASTM A 153/A 153M](#), with coating weight as required for Class A, B, C, or 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](#).

## 2.2 QUALITY CONTROL

Submit Certificates for [Glued-Laminated Structural Members](#) include a laboratory report for the laminated wood and for the laminating adhesives as follows:

- a. Checking of moisture content
- b. Surfacing
- c. Temperature of lumber at time of gluing
- d. Adhesive mixing and spread
- e. Adhesive pressure and curing conditions during the manufacturing process

Include in report the results of tests, shear strength, and durability of the glue line. Comply with the requirements of [ASTM D 3737](#). Ensure material tested is typical of a production run of the same material used in the project. Conduct tests within 6 months prior to delivery of the wood.

Provide Certification that structural members meet the requirements of [ASTM D 3737](#) and [AITC 200](#).

## 2.3 SURFACES

Submit three samples, [300 millimeter 12-inches](#) long by sufficient width and thickness to illustrate the quality and color of [Exposed-to-View Surfaces](#).

## PART 3 EXECUTION

### 3.1 INSTALLATION

Conform spacing and placement of members and installation methods as indicated and approved in accordance with [APA EWS T300E](#).

### 3.2 PROTECTION AGAINST MOISTURE LOSS

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 --