
USACE / NAVFAC / AFCEA UFGS-06100 (May 2005)

Preparing Activity: NAVFAC Superseding
UFGS 06100N (September 1999)
UFGS 06100A (February 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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SECTION 06100

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SECTION 06100

ROUGH CARPENTRY 05/05

NOTE: This guide specification covers framing, grounds, nailers, blocking, and sheathing of light wooden structures and includes the use of preassembled components. Wood finished flooring, trim, millwork, siding, heavy timber work, custom woodwork, and finish carpentry are specified in other sections.

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

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: The following information should be shown on the project drawings:

1. Sizes and spacing of all wood framing members including trussed rafters and trusses
2. Location, size, type, and thickness of all materials
3. Size and spacing of anchor bolts
4. Details of all connections and anchorage where special conditions exist such as high wind, hurricane, and earthquake areas
5. Design loads

6. Design unit stresses for structural lumber

7. Details of depressed floors to receive ceramic tile.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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 T10 (2001) Wood Frame Construction Manual for One- and Two-Family Dwellings

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

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 111 (1979) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection

AITC A190.1 (2002) Structural Glued Laminated Timber

AITC OT-01 (2004) Timber Construction Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard

ANSI B18.2.1 (1996; Errata 2003) Square and Hex Bolts and Screws Inch Series

ANSI B18.5.2.1M (1981; R 1995) Metric Round Head Short Square Neck Bolts

ANSI B18.6.1 (1981; R 1997) Wood Screws (Inch Series)

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1	(2000) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C2	(2001) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA C20	(1999) Structural Lumber Fire-Retardant Treatment by Pressure Processes
AWPA C27	(1999) Plywood - Fire-Retardant Treatment by Pressure Processes
AWPA C28	(1999) Standard for Preservative Treatment of Structural Glued Laminated Members and Lamination Before Gluing of Southern Pine, Coastal Douglas Fir, Hemfir and Western Hemlock by Pressure Processes
AWPA C9	(2000) Plywood - Preservative Treatment by Pressure Processes
AWPA M2	(2001) Standard for Inspection of Treated Wood Products
AWPA M6	(1996) Brands Used on Forest Products

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30	(2003) Engineered Wood Construction Guide
APA E445S	(2001; R 2002) Performance Standards and Policies for Structural-Use Panels (APA PRP-108)
APA EWS R540C	(1995; R 1996) Builder Tips Proper Storage and Handling of Glulam Beams
APA EWS T300E	(2002) Technical Note: Glulam Connection Details
APA F405L	(1999) Performance Rated Panels

ASME INTERNATIONAL (ASME)

ASME B18.2.2	(1987; R 1999) Square and Hex Nuts
ASME B18.5.2.2M	(1982; R 2000) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A 307	(2004) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 653/A 653M	(2004a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated

	(Galvannealed) by the Hot-Dip Process
ASTM A 687	(1993) High-Strength Nonheaded Steel Bolts and Studs
ASTM C 1136	(2003a) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 208	(1995; R 2001) Cellulosic Fiber Insulating Board
ASTM C 79/C 79M	(2004a) Treated Core and Nontreated Core Gypsum Sheathing Board
ASTM D 2898	(1994; R 2004) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D 3498	(2003) Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
ASTM E 96	(2000e1) Water Vapor Transmission of Materials
ASTM F 1667	(2003) Driven Fasteners: Nails, Spikes, and Staples
ASTM F 547	(2001) Nails for Use with Wood and Wood-Base Materials
FM GLOBAL (FM)	
FM DS 1-49	(2000) Perimeter Flashing
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IBC	(2003) International Building Code
NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)	
NHLA Rules	(2003) Rules for the Measurement & Inspection of Hardwood & Cypress
NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)	
NELMA Grading Rules	(2003) Standard Grading Rules for Northeastern Lumber
REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)	
RIS Grade Use	(1998) Redwood Lumber Grades and Uses
SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)	
SCMA Spec	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI 1 (2002) National Design Standard for Metal Plate Connected Wood Truss Construction; Commentary and Appendices

TPI HIB (1991) Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses

U.S. DEPARTMENT OF COMMERCE (DOC)

PS-56 (1973) Structural Glued Laminated Timber

PS-58 (1974) Basic Hardboard

PS1 (1995) Construction and Industrial Plywood (APA V995)

PS2 (1992) Wood-Based Structural-Use Panels (APA 5350)

PS20 (1999) American Softwood Lumber Standard

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 1) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

CID A-A-1924 (Rev A; Notice 1) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)

CID A-A-1925 (Rev A; Notice 1) Shield Expansion (Nail Anchors)

FS FF-B-588 (Rev E) Bolt, Toggle: and Expansion Sleeve, Screw

FS FF-T-1813 (Basic) Tack

FS MM-T-371 (Rev E) Ties, Railroad, Wood (Cross and Switch)

FS UU-B-790 (Rev A) Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

1.2 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

[Structural glued laminated members; G]

[Trussed rafters; G]

[Trussed joists; G]

[Fabricated structural members; G]

Modifications of structural members; G

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

[Nailers and Nailing Strips; G

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.]

SD-05 Design Data

Modifications of structural members; G

Design analysis and calculations showing design criteria used to accomplish the applicable analysis.

SD-06 Test Reports

Preservative-treated lumber and plywood

[SD-07 Certificates

Certificates of grade

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements.
Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.]

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. [Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540C.] Remove defective and damaged materials and provide new materials.

1.4 GRADING AND MARKING

1.4.1 Lumber

NOTE: Finger-jointed lumber is not allowed for Air Force construction.

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks,

stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Structural Glued Laminated Timber

Mark each member with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of structural glued laminated timber products. The marking shall indicate compliance with AITC A190.1 and shall include all identification information required by AITC A190.1. [Structurally end-jointed lumber shall also be certified and grade marked in accordance with AITC A190.1.]

1.4.3 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with PS1. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.4.4 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel. The mark shall indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405L.

1.4.5 Preservative-Treated Lumber and Plywood

The Contractor shall be responsible for the quality of treated wood products. Each treated piece shall be inspected in accordance with AWPA M2 and permanently marked or branded, by the producer, in accordance with AWPA M6. The Contractor shall provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

1.4.6 Fire-Retardant Treated Lumber

**NOTE: Do not use fire-retardant treated plywood on
Navy projects.**

Mark each piece in accordance with AWPA M6, except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber shall be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6.

1.4.7 Hardboard, Gypsum Board, and Fiberboard

Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

1.5 SIZES AND SURFACING

PS20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

- a. Framing lumber and boards - 19 percent maximum
- b. Timbers 125 mm 5 inches and thicker - 25 percent maximum
- [c. Roof planking - 15 percent maximum]
- d. Materials other than lumber - Moisture content shall be in accordance with standard under which the product is produced

1.7 PRESERVATIVE TREATMENT

NOTE: Water-borne preservative treatment with either ammoniacal copper arsenate (ACA), ammoniacal copper zinc arsenate (ACZA), or chromate copper arsenate (CCA), should be used in accordance with AWPA C1 and either AWPA C2, C9 or C28 for the appropriate product. Water-borne preservatives are leach resistant, paintable, and easily worked. Whenever certain exposed uses require minimized swelling, shrinking, or splitting, then require that a water repellent be added to the treatment. Requirement of an independent inspection agency report or the AWPA Quality Mark verifies that the product was prepared and treated in accordance with its appropriate AWPA Standard and other specification requirements. Consult the EFD applied biologist for further guidance regarding specific treatments listed or additional treatments that may be required for special use items. All lumber and woodwork in the Key West and South Florida areas shall be preservative treated.

Treat lumber and timber in accordance with AWPA C1 and AWPA C2, and plywood in accordance with AWPA C1 and AWPA C9. Treat structural glued laminated timber in accordance with AWPA C1 and AWPA C28.

- a. 4 kg per cubic meter 0.25 pcf intended for above ground use.
- b. 6.4 kg per cubic meter 0.40 pcf intended for ground contact and fresh water use. All wood shall be air or kiln dried after treatment. Specific treatments shall be verified by the report of an approved independent inspection agency, or the AWPA Quality Mark on each piece. [Do not incise surfaces of lumber that will

be exposed.] Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution. [All lumber and woodwork shall be preservative treated.] The following items shall be preservative treated:

1. Wood framing, woodwork, and plywood up to and including the subflooring at the first-floor level of structures having crawl spaces when the bottoms of such items are 600 mm 24 inches or less from the earth underneath.
2. Wood members that are in contact with water.
3. Exterior wood steps, platforms, and railings; and all wood framing of open, roofed structures.
4. Wood sills, soles, plates, furring, and sleepers that are less than 600 mm 24 inches from the ground, furring and nailers that are set into or in contact with concrete or masonry.
5. Nailers, edge strips, crickets, curbs, and cants for roof decks.

1.8 FIRE-RETARDANT TREATMENT

NOTE: Items to be treated should be listed in this paragraph. Fire-retardant treatment should be specified when necessary to provide required fire resistance for the structure. Where wood will be exposed to heat or high humidity, as well as where wood is exposed on the exterior of buildings, specify exterior fire retardant treatment. Do not use fire-retardant treated plywood on Navy projects.

Fire-retardant treated wood shall be pressure treated in accordance with AWPA C20 for lumber and AWPA C27 for plywood. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type [A] [and] [B] and Exterior Type. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898 prior to being tested for compliance with AWPA C20 or AWPA C27. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, shall receive exterior fire-retardant treatment. Items to be treated include the following:

- a. [____].

1.9 QUALITY ASSURANCE

1.9.1 Drawing Requirements

For fabricated structural members, trusses, glulam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of

structural members. Do not proceed with modifications until the submittal has been approved.

1.9.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

[1.9.3 Certificates of Grade

Submit certificates attesting that products meet the grade requirements specified in lieu of grade markings where appearance is important and grade marks will deface material.

]PART 2 PRODUCTS

2.1 LUMBER

2.1.1 Structural Lumber

NOTE: When the minimum allowable unit stresses for structural lumber are not indicated on the drawings, check with the structural engineer. The following minimum allowable unit stresses are commonly used:

1. 7200 kPa Fb, 4800 kPa Ft, 5400 kPa Fc with 8300 MPa E1050 Fb, 700 Ft, 780 Fc with 1,200,000E for engineered uses, i.e., structural lumber used in fabrication of bolted trusses and other fabricated structural members for engineered uses, except trussed rafters.

2. 8300 kPa Fb, with 8300 MPa E1200 Fb, with 1,200,000E for repetition member uses, i.e., joists, rafters including trussed type, decking, and headers.

[Except where a specific grade is indicated or specified,] Any of the species and grades listed in AF&PA T101 that have allowable unit stresses in kPa pounds per square inch (psi) not less than [[_____] Fb, [_____] Ft, [_____] Fc, with [_____] E] [allowable unit stresses indicated]. Use for joists, rafters, headers, trusses, beams (except collar beams), columns, posts, stair stringers, girders, and all other members indicated to be stress rated. [Structural lumber exposed to view in [_____] shall be appearance grade [of [_____] species] [of any species] meeting the allowable unit stresses [specified] [indicated].] Design of members and fastenings shall conform to AITC OT-01. Other stress graded or dimensioned items such as blocking, carriages, and studs shall be standard or No. 2 grade except that studs may be Stud grade.

2.1.2 Framing Lumber

NOTE: Finger-jointed lumber is not allowed for Air Force construction.

**NOTE: Except for projects requiring huge quantities
of lumber, delete species and grades not normally
used where project is located. Edit the listing to
suit the locality and the project.**

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed. [Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of PS-56.]

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen Douglas Fir-Larch Douglas Fir South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine -Sugar Pine Ponderosa Pine -Lodgepole Pine Subalpine Fir White Woods Western Woods Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	No. 2 Boards

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock -Tamarack Eastern Spruce Eastern White Pine Northern Pine Northern Pine Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: No. 3 Common except Stan- dard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen Douglas Fir-Larch Douglas Fir South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine -Sugar Pine Ponderosa Pine -Lodgepole Pine Subalpine Fir White Woods Western Woods	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
	Western Cedars Western Hemlock		
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock -Tamarack Eastern Spruce Eastern White Pine Northern Pine Northern Pine Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Stan- dard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.1.1.3 Structural Glued Laminated Timber

NOTE: Specify appearance grade of lumber in glued

laminated members when required by aesthetic considerations. Insert stress requirements necessary when not indicated on drawings. Wet condition should be specified when moisture content of member in service will exceed 16 percent for repeated and prolonged periods. Architectural or Premium Appearance Grade should be specified only when appearance is of major importance. Special stains and sealers may be specified in lieu of a penetrating sealer when required by aesthetic considerations. Individual wrapping should be specified when protection during erection is necessary. Preservative treatment in lieu of sealing should be specified for exposure conditions named in AITC A190.1.

AITC A190.1, allowable working stress values for loads of normal duration in kPa pounds per square inch (psi) not less than the following:

Bending Members, [] Fb, [] Fv, [] E.
Compression Members, [] Fc, [] E.
Tension Members, [] Ft, [] E.

Fabricated with wet-use adhesives. Members shall be [Industrial] [Architectural] [Premium] Appearance Grade, sealed with a penetrating sealer, and [individually wrapped] [bundle wrapped] as standard with the manufacturer and approved. Members shall be complete with hardware for joining laminated members and for their connection to other construction.

2.2 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

NOTE: Thicknesses and index or Span Rating numbers 16 ratings are used at 400 mm (modular SI spacing). Thickness and index or Span Rating number are minimums for usual loading and support spacing. Specific job conditions such as unusual loading, support spacing, surfacing material, and exposure may necessitate using other types of plywood or structural-use panels. Refer to American Plywood Association construction guides for additional guidance on specifying structural panel products.

PS1, PS2, APA E445S, and APA F405L respectively.

2.2.1 Subflooring

NOTE: Plywood, structural-use, and OSB panels, to receive floor finishes may be applied as (1) subflooring only; (2) combination subfloor-underlayment; or (3) subflooring with underlayment applied over the subfloor.

Use subparagraph entitled "Plywood" or "Structural-Use and OSB Panels" for plywood or structural-use or OSB panel subflooring to receive

direct application of T&G finish wood flooring or to receive underlayment for floor covering such as carpet, resilient tile, linoleum, and other nonstructural floor finishes.

Use subparagraphs entitled "Plywood" and "Structural-Use and OSB Panels" in conjunction with paragraphs entitled "Underlayment" and "Hardboard Underlayment" when a separate underlayment application is desired.

2.2.1.1 Plywood

NOTE: Identification Index 32/16 or Span Rating 24/16 should be specified for supports 400 mm 16 inches o.c. and 48/24 should be specified for supports 600 mm 24 inches o.c. Plywood or structural-use panel subflooring to receive square-edge wood flooring shall be specified to have T&G edges or edges to be supported by approved blocking or framing.

C-D Grade, Exposure 1 durability classification, Span rating of [24/16] [48/24] or greater.

2.2.1.2 Structural-Use and OSB Panels

NOTE: Identification Index 32/16 or Span Rating 24/16 should be specified for supports 400 mm 16 inches o.c. and 48/24 should be specified for supports 600 mm 24 inches o.c. Plywood or structural-use panel subflooring to receive square-edge wood flooring shall be specified to have T&G edges or edges to be supported by approved blocking or framing.

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [32/16] [48/24] or greater. OSB, APA E445S, Rated Sturd-I-Floor.

2.2.2 Combination Subfloor-Underlayment

NOTE: Use subparagraph entitled "Plywood" "Structural-Use and OSB Panels" for combination subfloor-underlayment where application of an underlayment is not desired. This method is suitable for most types of finish flooring or floor covering and is normally more economical than an application of subflooring with an application of underlayment.

2.2.2.1 Plywood

[Underlayment Grade, Exposure 1] [, or] [Exterior Type, C-C (Plugged) Grade]. Minimum thickness shall be as listed below [except where indicated to have greater thickness].

<u>Support Spacing</u>	<u>Underlayment Minimum Thickness</u>
400 mm	12.7 mm for Group 1 species 15 mm for Group 2 and 3 species 18 mm for Group 4 species
600 mm	18 mm for Group 1 species 22 mm for Group 2 and 3 species 25 mm for Group 4 species

<u>Support Spacing</u>	<u>Underlayment Minimum Thickness</u>
16 inches	1/2 inch for Group 1 species 19/32 inch for Group 2 and 3 species 23/32 inch for Group 4 species
24 inches	23/32 inch for Group 1 species 7/8 inch for Group 2 and 3 species one inch for Group 4 species

2.2.2.2 Structural-Use Panel

Combination subfloor-underlayment grade with durability equivalent to [Interior plywood with Exterior glue (Exposure 1)] [Exterior plywood], Span Rating of [16] [20] [24] [48] or greater.

2.2.3 Wall Sheathing

2.2.3.1 Plywood

NOTE: Plywood wall sheathing 9.5 mm 3/8 inch thick should be specified for supports spaced 400 mm 16 inches on center, and 12.7 mm 1/2 inch thick plywood wall sheathing should be specified for supports spaced 600 mm 24 inches on center.

C-D Grade, Exposure 1, and a minimum thickness of [9.5] [12.7] mm [3/8] [1/2] inch [, except where indicated to have greater thickness].

2.2.3.2 Structural-Use and OSB Panels

NOTE: Structural-use panels 9.5 mm 3/8 inch thick with a Span Rating of 16/0 or greater should be specified for supports 400 mm 16 inches o.c. and panels 11 mm 7/16 inch thick with a Span Rating of 24/0 or greater should be specified for supports 600 mm 24 inches o.c.

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [16/0] [24/0] or greater. OSB, APA Rated Sheathing.

2.2.4 Roof Sheathing

2.2.4.1 Plywood

C-D Grade, Exposure 1, with an Identification Index of not less than [24/0] [_____].

2.2.4.2 Structural-Use Panel

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [24/0] [_____] or greater.

2.2.5 Diaphragms

2.2.5.1 Plywood

[Structural I] [Structural II], [C-C] [C-D] grade, Exposure 1, and a minimum thickness of [_____] mm inch.

2.2.5.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of [_____] mm inch.

2.2.6 Shear Walls

2.2.6.1 Plywood

[Structural I] [Structural II], [C-C] [C-D] [_____] Grade and a minimum thickness of [_____] mm inch.

2.2.6.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Interior plywood with Exterior glue (Exposure 1) and a minimum thickness of [_____] mm inch.

2.2.7 Other Uses

2.2.7.1 Plywood

Plywood for [_____].

2.2.7.2 Structural-Use and OSB Panels

Structural-use and OSB panels for [_____].

2.3 UNDERLAYMENT

NOTE: Underlayment will be limited to plywood in
areas of high moisture or occasional wetting of the
finished floor. Particle board is permitted on Army
projects only.

Underlayment shall conform to one of the following:

2.3.1 Hardboard

AHA A135.4 service class, sanded one side, 6 mm 1/4 inch thick, 1200 mm 4 feet wide.

[2.3.2 Particleboard

ANSI A208.1, Grade 1-M-1, 6 mm 1/4 inch thick, 1200 x 1200 mm. 4 x 4 feet.

]2.3.3 Plywood

Plywood shall conform to PS1, underlayment grade with exterior glue, or C-C (Plugged) exterior grade 9 mm 11/32 inch thick, 1200 mm 4 feet wide.

2.3.4 Oriented Strand Board

OSB underlayment grade 6 mm 0.225 inch.

2.4 OTHER MATERIALS

2.4.1 Hardboard Underlayment

PS-58, service class, sanded on one side, 6 mm 1/4 inch thick 1200 mm 4 feet wide.

2.4.2 Fiberboard Wall Sheathing

ASTM C 208, 600 mm wide by [13 mm thick for supports 400 mm (o.c.)] [20 mm thick for supports 600 mm o.c.] or 1200 mm wide by [13 mm thick for supports 400 mm o.c.] [20 mm thick for supports 600 mm o.c.], except only 1200 mm wide by 13 mm thick sheathing over supports at 400 mm o.c. may be applied without corner bracing of framing 2 feet wide by [1/2 inch thick for supports 16 inches (o.c.)] [25/32 inch thick for supports 24 inches o.c.] or 4 feet wide by [1/2 inch thick for supports 16 inches o.c.] [3/4 inch thick for supports 24 inches o.c.], except only 4 feet wide by 1/2 inch thick sheathing over supports at 16 inches o.c. may be applied without corner bracing of framing Sheathing shall be asphalt impregnated or asphalt coated to render the sheathing water resistant but vapor permeable.

2.4.3 Gypsum Wall Sheathing

ASTM C 79/C 79M, 12.7 mm 1/2 inch thick [fire retardant (Type X) 16 mm 5/8 inch thick]; 1200 mm 4 feet wide with square edge [for supports 400 mm 16 inches o.c. with or without corner bracing of framing] [or] [for supports 600 mm 24 inches o.c. with corner bracing of framing]; 600 mm 2 feet wide with V-tongue and groove (T&G) edge for supports [400] [or] [600] mm [16] [or] [24] inches o.c. with corner bracing of framing.

2.4.4 Foil-Faced Insulative Sheathing

Wood fiber core, chemically treated for water resistance, with aluminum foil laminated under pressure to both sides with water-resistant adhesive; 1200 mm 48 inches or 48 3/4 inches wide; 2 mm 0.078 inch thick when used with corner bracing, 2.9 mm 0.115 inch thick with studs up to 400 mm 16 inches o.c. without corner bracing, or 3.5 mm 0.137 inch thick with studs up to 600 mm 24 inches o.c. without corner bracing. The sheathing and installation shall have been accepted by ICBO as conforming to ICC IBC.

The sheathing alone shall have a thermal resistance value (R value) of not less than 0.20.

2.4.5 Building Paper

FS UU-B-790, Type I, Grade D, Style 1.

2.4.6 Trussed Rafters

Metal plate connected trusses designed in accordance with TPI 1 and TPI HIB and fabricated in accordance with TPI 1.

2.4.7 Trussed Joists

Metal plate connected parallel chord wood trusses designed and fabricated in accordance with TPI 1.

2.4.8 Roof Decking

NOTE: Delete this paragraph if the design does not include exposed decking. Commercial grade decking with minimum design value of 7.6 MPa 1100 psi in bending will normally be used unless higher strength is required. If a specific species is required for architectural purpose, the paragraph or drawings should reflect such a requirement. Roof decking is permitted on Army projects only.

[Roof decking shall be [commercial] [select] grade with minimum design value of [0.9] [7.6] MPa [130] [1100] psi in bending. Decking shall be [50 mm 2 inches thick with single tongue and groove] [100 mm 4 inches thick with double tongue and groove]; V-jointed, matched and dressed. As an option, fabricated laminated lumber decking with interlocking tongue and groove joints may be provided.]

2.4.9 Miscellaneous Wood Members

2.4.9.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm (inch)
Bridging	25 x 75 (1 x 3) or 25 x 100 (1 x 4) for use between members 50 x 300 (2 x 12) and smaller; 50 x 100 (2 x 4) for use between members larger than 50 x 300 (2 x 12).
Corner bracing	25 x 100 (1 x 4).
Furring	25 (1) x [50 (2)] [75 (3)]
Grounds	Plaster thickness by 38.

Member	Size mm (inch)
Nailing strips	25 x 75 (1 x 3) or 25 x 100 (1 x 4) when used as shingle base or interior finish, otherwise 50 mm (2 inch) stock.

Member	Size (inch)
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x [2] [3].
Grounds	Plaster thickness by 1-1/2.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2.4.9.2 Wood Bumpers

FS MM-T-371, Type I, Form A or B, and shall be oak.

2.4.9.3 Sill Plates

Sill plates shall be standard or number 2 grade.

2.4.9.4 Blocking

Blocking shall be standard or number 2 grade.

2.4.9.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.5 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be zinc-coated. [Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather shall be copper alloy.]

2.5.1 Bolts, Nuts, Studs, and Rivets

ANSI B18.2.1, ANSI B18.5.2.1M, ASME B18.5.2.2M, ASME B18.2.2, and ASTM A 687.

2.5.2 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.5.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 10 mm 3/8 inch.

2.5.4 Lag Screws and Lag Bolts

ANSI B18.2.1.

2.5.5 Toggle Bolts

FS FF-B-588.

2.5.6 Wood Screws

ANSI B18.6.1.

2.5.7 Nails [and Staples]

NOTE: Staples are permitted for Army projects only.

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 25 mm 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 25 mm 1 inch thick lumber and for toe nailing 50 mm 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 50 mm 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T10. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T101. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.5.8 Wire Nails

ASTM F 1667.

2.5.9 Tacks

FS FF-T-1813.

2.5.10 Timber Connectors

Unless otherwise specified, timber connectors shall be in accordance with TPI 1, APA EWS T300E or AITC OT-01.

2.5.11 Clip Angles

Steel, 5 mm 3/16 inch thick, size [as indicated] [best suited for intended

use]; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.5.12 Joist Hangers

Steel or iron, zinc coated, sized to fit the supported member, of sufficient strength to develop the full strength of the supported member in accordance with ICC IBC, and furnished complete with any special nails required.

2.5.13 Tie Straps

For joists supported by the lower flange of steel beams, provide 3 by 40 mm 1/8 by 1 1/2 inch steel strap, 600 mm 2 feet long [, except as indicated otherwise].

2.5.14 Joist Anchors

For joists supported by masonry walls, provide anchors 5 by 40 mm 3/16 by 1 1/2 inch steel tee or strap, bent and of length to provide 100 mm 4 inches embedment into wall and 300 mm 12 inches along joist [except as indicated otherwise]. For joists parallel to masonry or concrete walls, provide anchors 6 by 30 mm 1/4 by 1 1/4 inch minimum cross-sectional area, steel strap, length as necessary to extend over top of first three joists and into wall [100] [200] mm [4] [8] inches, and with wall end of bend or pin type [, except as indicated otherwise].

2.5.15 Door Buck Anchors

Metal anchors, 3 by 30 mm 1/8 by 1 1/4 inch steel, 300 mm 12 inches long, with ends bent 50 mm 2 inches [, except as indicated otherwise]. Anchors shall be screwed to the backs of bucks and built into masonry or concrete. Locate 200 mm 8 inches above sills and below heads and not more than 600 mm 24 inches intermediately between. [Anchorage of bucks to steel framing shall be [as indicated] [as necessary to suit the conditions].]

2.5.16 Metal Bridging

[Where not indicated or specified otherwise,] No. 16 U.S. Standard gage, cadmium-plated or zinc-coated.

2.5.17 Toothed Rings and Shear Plates

AF&PA T101.

2.5.18 Beam Anchors

Steel U-shaped strap anchors 6 mm 1/4 inch thick by 40 mm 1 1/2 inches wide [, except as indicated otherwise].

2.5.19 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A 653/A 653M, Z275 G90. [Except where otherwise shown,] Steel shall be not lighter than 18 gage. Special nails supplied by the manufacturer shall be used for all nailing.

2.5.20 Panel Edge Clips

Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.6 AIR INFILTRATION BARRIER

**NOTE: The drawings will indicate the location and
extent of air infiltration barrier.**

Air infiltration barrier shall be building paper meeting the requirements of ASTM C 1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of [125] [] g per square meter per 24 hours [125] [] g per square meter per 24 hours in accordance with ASTM E 96, Desiccant Method at [23] [] degrees C or with a moisture vapor transmission rate of [670] [] g per square meter per 24 hours [670] [] g per square meter per 24 hours in accordance with ASTM E 96, Water Method at [23] [] degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to AF&PA T10 unless otherwise indicated or specified. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise shall be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts shall be drawn up tight. [Timber connections and fastenings shall conform to AF&PA T101.] [Provide 50 mm 2 inch minimum clearance between chimneys and wood framing; provide 100 mm 4 inch minimum clearance at fireplaces. Fill the spaces with strips of approved noncombustible material.] Use slate or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into the pocket and leveled with a steel shim.

3.1.1 Sills

Set sills level and square and wedge with steel or slate shims; point or grout with non-shrinking cement mortar to provide continuous and solid bearing. Anchor sills to the foundations as indicated. [Where sizes and spacing of anchor bolts are not indicated, provide not less than 16 mm 5/8 inch diameter bolts at all corners and splices and space at a maximum of 1800 mm 6 feet o.c. between corner bolts. Provide at least two bolts for

each sill member. Lap and splice sills at corners and bolt through the laps or butt the ends and through-bolt not more than 150 mm 6 inches from the ends.] Provide bolts with plate washers and nuts. Bolts in exterior walls shall be zinc-coated.

3.1.1.1 Anchors in Masonry

[Except where indicated otherwise,] Embed anchor bolts not less than 400 mm 15 inches in masonry unit walls and provide each with a nut and a 50 mm 2 inch diameter washer at bottom end. Fully grout bolts with mortar.

3.1.1.2 Anchors in Concrete

[Except where indicated otherwise,] Embed anchor bolts not less than 200 mm 8 inches in poured concrete walls and provide each with a nut and a 50 mm 2 inch diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend shall be not less than 90 degrees. Powder-actuated fasteners spaced 900 mm 3 feet o.c. may be provided in lieu of bolts for single thickness plates on concrete.

3.1.2 Beams and Girders

Set beams and girders level and in alignment and anchor to bearing walls, piers, or supports with U-shaped steel strap anchors. Embed anchors in concrete or masonry at each bearing and through-bolt to the beams or girders with not less than two bolts. Provide bolts not less than 12 mm 1/2 inch in diameter and with plate washers under heads and nuts. Install beams and girders [not indicated otherwise] with 200 mm 8 inch minimum end bearing on walls or supports. Install beams and girders into walls with [12 mm 1/2 inch clearance at the top, end, and sides] [or] [standard steel wall-bearing boxes]. Provide joints and splices over bearings only and bolt or spike together.

3.1.3 Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Valley, ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters and nominally 50 mm 2 inches thick. Rafters shall [be notched and] have full and solid bearing on plates. Valleys, hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip and valley rafters, shall be [spiked to wall plate and to ceiling joists with no less than three 8-penny nails] [bolted by angles]. Rafters shall be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed. Valley rafters longer than the available lumber shall be double, with pieces lapped not less than 1200 mm 4 feet and well spiked together. Trussed rafters shall be installed in accordance with TPI HIB. Engineered wood joists shall be installed in accordance with distributor's instructions.

3.1.4 Joists

Provide joists of the sizes and spacing indicated, accurately and in

alignment, and of uniform width. Joists shall have full bearing on sills, [plates,] [beams,] [girders,] [and] [trusses]; provide laps over bearing only and spike. Where joists are of insufficient length to produce a 300 mm

12 inch lap, butt joists over bearing and provide wood scabs 2 nominal inches thick by depth of joists by 600 mm 24 inches long or metal straps 6 by 40 mm 1/4 by 1 1/2 inch by not less than 450 mm 18 inches long nailed to each joist with not less than four 10-penny nails, or approved sheet metal connectors installed in accordance with the manufacturer's recommendations.

Provide joists built into masonry with [a beveled fire cut so that the top of the joist does not enter the wall more than 25 mm one inch] [or] [standard steel wall bearing boxes]. Provide metal hangers for joists framing into the side of headers, beams, or girders. [When a portion of the joist extends above the top flange of a steel beam or girder, provide a 10 mm 3/8 inch space between the top flange and the extended portion of the joists to allow for shrinkage of joists.] The minimum joist end bearing shall be 100 mm 4 inches, and joists built into concrete or masonry shall have a 12 mm 1/2 inch minimum clearance at the top, end, and sides. For joists approved to be bored for the passage of pipes or conduits, bore through the neutral axis of the joist. [Provide steel joist hangers of proper size and type to receive the ends of all framed joists.]

[3.1.4.1 Floor (Ceiling) Framing

Except where otherwise indicated joists shall have bearings not less than 100 mm 4 inches on concrete or masonry and 40 mm 1-1/2 inches on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels shall be carried on joist hangers. Joists shall be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors shall be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist shall be doubled, unless otherwise indicated. Joists built into masonry shall be provided with [a beveled fire cut so that the top of the joist does not enter the wall more than 25 mm 1 inch] [or] [standard steel wall bearing boxes]. Engineered wood joists shall be installed in accordance with distributor's instructions.

]3.1.4.2 Doubled Joists

Provide under bearing walls and partitions running parallel with the floor joists[, around [stairways,] [chimneys,] [fireplaces,]] and at other openings where joists are cut and framed. Double, space for clearance, block apart 1200 mm 4 feet on center, rigidly frame, and spike together joists under partitions that are to receive ducts, pipes, and conduits.

3.1.4.3 Tie Straps

For joists supported by the lower flange of steel beams, provide straps at every fourth joist and the corresponding fourth joist on the opposite side. Tie joists across the top of the steel beam with a steel strap. Form straps to lie flat across the top of the beam and twist at the ends to provide flat contact with the side of each joist. Nail each strap at each end with three 10-penny nails spaced 50 mm 2 inches o.c.

3.1.4.4 Joist Anchors

Provide anchors for each fourth joist supported by a masonry wall. Build wall end of anchors into the wall. Nail anchor to the joist with three 10-penny nails spaced 50 mm 2 inches o.c. Anchor the first three joists

parallel to concrete or masonry walls at bridging points, but not less than 2400 mm 8 feet o.c. from end walls. Let anchors into the tops of each joist and spike to the top of joist with one 10-penny nail. Extend anchors at least [100] [200] mm [4] [8] inches into the wall.

3.1.5 Bridging

Provide bridging for floor and ceiling joists and for roof rafters having slopes of less than 1/3. Locate bridging as indicated and as specified herein. Provide bridging for spans greater than 1800 mm 6 feet, but do not exceed 2400 mm 8 feet maximum spacing between rows of bridging. Install rows of bridging uniformly. Provide metal or wood cross-bridging, except where solid bridging is indicated. Do not nail the bottom end of cross-bridging until the subfloor has been laid.

3.1.5.1 Wood Cross-Bridging

Provide wood cross-bridging not less than [1 by 3] [2 by 3] [2 by 4] nominal size. Nail wood cross-bridging at each end with [two 8-penny nails for one by thick material] [and] [three 8-penny nails for 2 by thick material.]

3.1.5.2 Metal Cross-Bridging

Shall be the manufacturer's standard product, not less than 16 gage before forming and coating. Metal bridging shall be the compression type, lodged into or nailed to the wide faces of opposite joists at points diagonally across from each other near the bottoms and tops of joists.

3.1.6 Subflooring

3.1.6.1 Plywood, Structural-Use, and OSB Panels

NOTE: Edges shall be supported with blocking for square-edged wood finish flooring, unless a separate underlayment layer is installed.

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists. [Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking.] Allow 3 mm 1/8 inch spacing at panel ends and 6 mm 1/4 inch at panel edges. Panels shall be continuous over two or more spans. Nail panels 150 mm 6 inches o.c. at supported edges and 250 mm 10 inches o.c. over intermediate bearing. Nails shall be 8-penny common or 6-penny threaded. Provide at least 12 mm 1/2 inch clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D 3498 and nails spaced at 300 mm 12 inches on center unless otherwise shown.

3.1.6.2 Combination Subfloor-Underlayment

NOTE: Edges shall be supported with blocking for square-edged wood finish flooring, unless a separate underlayment layer is installed.

Apply with the grain of the face plies or the long dimension at right angles to joists. Panels shall be continuous over two or more spans. Stagger end joints of adjacent panels. Panel edges shall be T&G or supported by 2 by 4 members framed between joists so the edge joints of subfloor-underlayment occur over the centerline of blocking. Provide end joints of panels over the centerline of joists. Allow 3 mm 1/8 inch spacing between panel edge and end joints. Nail panels 150 mm 6 inches o.c. at ends and edges and 250 mm 10 inches o.c. along intermediate bearings unless they are glue-nailed in accordance with APA E30. Nails shall be 8-penny coated common or 6-penny threaded. Provide at least 12 mm 1/2 inch clearance between subfloor-underlayment and masonry or concrete walls. [Lightly sand all joints to receive [resilient flooring] [____].]

3.1.6.3 Wood

Subflooring shall be applied diagonally with end joints made over supports. Each board shall bear on at least three supports and shall be nailed at each support using two nails for boards 150 mm 6 inches and less in width and three nails for boards more than 150 mm 6 inches in width.

3.1.6.4 Depressed Subfloors

Provide depressed subfloors to receive [ceramic] [and] [quarry] tile floors. Nail cleats or ledgers of one by four material to the sides of joists to support the flooring material. Place the cleats at a depth below the top of the joists sufficient to allow the installation of the subflooring below the tops of joists. Snugly fit subflooring as specified herein between joists.

3.1.7 Underlayment

Install underlayment over subfloor just prior to laying of [resilient flooring] [____] and protect from water and physical damage. Underlayment shall be [hardboard] [or] [particleboard] [or] [plywood] [or] [OSB]. Stagger end joints of underlayment with respect to each other, and stagger all joints with respect to paralleling panel joints in subfloor. Space panels 2 mm 1/16 inch apart at ends and 3 mm 1/8 inch apart at edges and at least 12 mm 1/2 inch from concrete or masonry walls. Nail panels 150 mm 6 inches o.c. along edges and 150 mm 6 inches o.c. each way throughout panel, but not closer than 10 mm 3/8 inch to panel edges. Nails shall be 4-penny annular ring or screw type and shall be countersunk 2 mm 1/16 inch. [Lightly sand all joints to receive [resilient flooring] [____].]

3.1.7 Columns and Posts

Set columns and posts, plumb, in alignment, and with full and uniform bearing. Do not embed the bottom and bearing surfaces of [posts] [columns] in concrete or set in direct contact with concrete slabs on grade. [Provide post and beam construction with [wood bolsters] [steel post caps] in such a manner that the post above will tier directly over the one below; fabricate the assembly in a rigid and substantial manner using bolts or lag screws.]

3.1.8 Wall Framing

3.1.8.1 Studs

Select studs for straightness and set plumb, true, and in alignment. In walls and partitions more than 2400 mm eight feet tall, provide horizontal

bridging at not more than 2400 mm 8 feet o.c. using nominal 50 mm 2 inch material of the same width as the studs; install the bridging flat. Sizes and spacing of studs shall be [_____] [as indicated]. Double studs at jambs and heads of openings and triple at corners to form corner posts. Frame corner posts to receive sheathing, lath, and interior finish. Truss over openings exceeding 1200 mm 4 feet in width or use a header of sufficient depth. Toe-nail studs to sills or sole plates with four 8-penny nails or fasten with metal nailing clips or connectors. Anchor studs abutting concrete or masonry walls thereto near the top and bottom and at midheight of each story using expansion bolts or powder-actuated drive studs.

3.1.8.2 Plates

Use plates for walls and partitions of the same width as the studs to form continuous horizontal ties. Splice single plates; stagger the ends of double plates. Double top plates in walls and bearing partitions, built up of two nominal 50 mm 2 inch thick members. Top plates for nonbearing partitions shall be single or double plates of the same size as the studs. Nail lower members of double top plates and single top plates to each stud and corner post with two 16-penny nails. Nail the upper members of double plates to the lower members with 10-penny nails, two near each end, and stagger 400 mm 16 inches o.c. intermediately between. Nail sole plates on wood construction through the subfloor to each joist and header; stagger nails. Anchor sole plates on concrete with expansion bolts, one near each end and at not more than 1800 mm 6 feet o.c., or with powder-actuated fasteners, one near each end and at not more than 900 mm 3 feet o.c. Provide plates cut for the passage of pipes or ducts with a steel angle as a tie for the plate and bearing for joist.

3.1.8.3 Firestops

Provide firestops for wood framed walls and partitions and for furred spaces of concrete or masonry walls at each floor level and at the ceiling line in the top story. Where firestops are not automatically provided by the framing system used, they shall be formed of closely fitted wood blocks of nominal 50 mm 2 inch thick material of the same width as the [studs] [and] [joists]. [Lightweight concrete units may be used at the first-floor level to serve jointly as firestopping and ratproofing.]

3.1.8.4 Diagonal Bracing

Provide diagonal bracing at all external corners and internal angles and at maximum 1200 mm 40 foot centers in stud walls, except that bracing may be omitted where diagonally applied wood sheathing, plywood or structural-use panel sheathing, 1200 by 2400 mm 4 by 8 foot fiberboard sheathing, or gypsum board sheathing is used. Bracing shall be of 1 by 6 material, let into the exterior face of studs. Extend bracing from top plates to sill at an angle of approximately 45 degrees and double nail at each stud. When openings occur near corners, provide diagonal knee braces extending from the corner post above headers to top plates and from below window sills to the main sill. Nail bracing at each bearing with two 8-penny nails.

3.1.9 Wall Sheathing

3.1.9.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 3

mm 1/8 inch spacing between panels and 3 mm 1/8 inch at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 150 mm 6 inches o.c. along edges of the panel and 300 mm 12 inches o.c. over intermediate supports. Keep nails 10 mm 3/8 inches away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

3.1.9.2 Fiberboard Wall Sheathing

Apply fiberboard wall sheathing allowing a 3 mm 1/8 inch joint at edges to permit expansion, except at frames and openings where sheathing shall be fitted snugly. Pre-expand sheathing before application, allowing sheathing to condition for humidity as recommended by the sheathing manufacturer. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

- a. Fiberboard wall sheathing used with diagonal-braced framing shall be either 60 or 1200 mm 2 or 4 feet wide. Sheathing 600 mm 2 feet wide shall have T&G or shiplapped edges and shall be applied horizontally with vertical joints staggered. Apply sheathing with tongued edge up and nail at edges and intermediate bearings with 45 mm 1 3/4 inch long, zinc-coated steel roofing nails spaced on maximum 115 mm 4 1/2 inch centers. Apply sheathing 1200 mm 4 feet wide either horizontally or vertically. Nail sheathing with 45 mm 1 3/4 inch long, zinc-coated steel roofing nails spaced 100 mm 4 inches maximum o.c. at edges and 200 mm 8 inches maximum o.c. at intermediate bearings.
- b. Fiberboard wall sheathing used with unbraced framing shall be 1200 mm 4 feet wide. Apply sheathing vertically. Extend sheathing over and nail to sill and top plates. Locate joints over centerlines of supports. Nail sheathing with 40 mm 1 1/2 inch long, zinc-coated steel roofing nails with 9.5 mm 3/8 inch diameter heads. Space nails 75 mm 3 inches o.c. at edges and ends and 150 mm 6 inches o.c. at intermediate bearings.

3.1.9.3 Gypsum Sheathing Board

Apply gypsum sheathing board either horizontally or vertically. Butt joints and locate over the centerlines of supports. Horizontally applied sheathing shall be T&G, applied with tongued edge up. Stagger vertical joints and abut sheet closely to frames of openings. Nail sheathing with 11 gage, 9.5 mm 3/8 inch head, zinc-coated nails 40 mm 1 1/2 inches long for 12.7 mm 1/2 inch sheathing and 45 mm 1 3/4 inches long for 16 mm 5/8 inch sheathing, spaced 10 mm 3/8 inch minimum from edges. Provide 2 by 4 blocking for horizontal edges of 1200 mm 4 foot wide panels not otherwise supported.

- a. Gypsum Sheathing Board Used with Diagonal-Braced Framing: Sheathing shall be either 600 or 1200 mm 2 or 4 feet wide. Apply sheathing 600 mm 2 feet wide horizontally. Nail 100 mm 4 inches maximum o.c. at edges and over intermediate bearings. Apply sheathing 1200 mm 4 feet wide either horizontally or vertically. Nail 150 mm 4 inches maximum o.c. at edges and 200 mm 8 inches maximum o.c. at intermediate bearings.
- b. Gypsum Sheathing Board Used with Unbraced Frames: Sheathing shall be 1200 mm 4 feet wide and applied vertically. Extend sheathing over and nail to both sill and top plates. Nail 100 mm 4 inches maximum o.c. at edges and 200 mm 8 inches maximum o.c. at

intermediate bearings.

3.1.9.4 Foil-Faced Insulative Sheathing

Apply sheathing vertically. Butt or overlap joints and locate over centerline of supports. Attach sheathing to framing with 30 mm 1 1/4 inch, large, flat-head, 11 gage, galvanized roofing nails or 16 gage, 11 mm 7/16 inch minimum crown, galvanized staples with 30 mm 1 1/4 inch legs. For nonstructural application (with corner bracing), space fasteners 150 mm 6 inches o.c. on all panel edges and 300 mm 12 inches o.c. on intermediate supports, regardless of sheathing thickness, for studs not more than 600 mm 24 inches o.c. For structural application (without corner bracing), for studs not more than 400 mm 16 inches o.c., space fasteners 75 mm 3 inches o.c. on all edges and 150 mm 6 inches o.c. on intermediate members using minimum 2.9 mm 0.115 inch thickness; for studs up to 600 mm 24 inches o.c., space fasteners 75 mm 3 inches o.c. on all edges and 75 mm 3 inches o.c. on intermediate supports using minimum 3.5 mm 0.137 inch thickness.

3.1.10 Wood Sheathing

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 150 mm 6 inches and less in width and three nails for boards more than 150 mm 6 inches in width. Roof sheathing shall not be installed where roof decking is installed.

3.1.11 Building Paper

Provide building paper [where indicated] [on wood board sheathing for all types of exterior siding]. Apply paper shingle fashion, horizontally, beginning at the bottom of the wall. Lap edges 100 mm 4 inches, and nail with 25 mm one inch, zinc-coated roofing nails, spaced 300 mm 12 inches o.c. and driven through tin discs.

3.1.12 Ceiling Joists

Size as indicated and set accurately and in alignment. Toe-nail joists to all plates with not less than three 10-penny nails. Frame openings in ceilings with headers and trimmers.

3.1.13 Metal Framing Anchors

Provide framing anchors at every [other] [rafter] [or] [trussed rafter] to fasten [rafter] [or] [trussed rafter] to plates and studs against uplift movement and forces as indicated. Anchors shall be punched and formed for nailing so that nails will be stressed in shear only. Nails shall be zinc-coated; drive a nail in each nail hole provided in the anchor.

3.1.14 Trusses

Metal plate connected wood trusses shall be handled, erected, and braced in accordance with TPI HIB and as indicated.

3.1.15 Structural Glued Laminated Timber Members

Brace members before erection. Align members and complete all connections before removal of bracing. Unwrap individually wrapped members only after adequate protection by a roof or other cover has been provided. Treat

scratches and abrasions of factory applied sealer with two brush coats of the same sealer used at the factory.

3.1.16 Plywood and Structural-Use Panel Roof Sheathing

NOTE: The following requirements for size, type, and spacing of nails represent the minimum recommended by APA for roof sheathing. Modify these requirements to agree with UL or FM requirements for wind-tested roof assemblies.

Install with the grain of the outer plies or long dimension at right angles to supports. Stagger end joints and locate over the centerlines of supports. Allow 3 mm 1/8 inch spacing at panel ends and 6 mm 1/4 inch at panel edges. Nail panels with 8-penny common nails or 6-penny annular rings or screw-type nails spaced 150 mm 6 inches o.c. at supported edges and 300 mm 12 inches o.c. at intermediate bearings. Do not use staples in roof sheathing. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

3.1.17 Stair Framing

Cut carriages to exact shape required to receive treads and risers, with risers of uniform height and treads of uniform width. Provide trimmers, nailers, and blocking as required to support finish materials.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.1.1 Roof Nailing Strips

Provide roof nailing strips for roof decks as [indicated] [and] [specified herein]. Apply nailing strips in straight parallel rows in the direction and spacing[indicated][specified in [____]]. Strips shall be[surface applied][embedded in concrete].

- a. Surface-Applied Nailers: Shall be 75 mm 3 inches wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 600 mm 24 inches o.c. [On decks with slopes of 25 mm one inch or more, provide surface applied wood nailers for securing insulation [and for nailing of roofing felts].]
- b. Embedded Nailers: Shall be nominal 50 by 75 with 20 mm 2 by 3 with 2 inch sides beveled. Set and anchor nailers to finish flush with the roof deck surface.

3.2.1.2 Roof Edge Strips and Nailers

NOTE: For SOUTHNAVFACENGCOM, indicate the anchorage

**type and spacing for all nailer attachments on the
project drawings.**

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers shall be 150 mm 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM DS 1-49. [Strips shall be grooved [as indicated] for edge venting; install at walls, curbs, and other vertical surfaces with a 6 to 12 mm 1/4 to 1/2 inch air space.]

3.2.1.3 Crickets, Cants, and Curbs

Provide wood saddles or crickets, cant strips, [curbs for scuttles and ventilators,] [and wood nailers bolted to tops of concrete or masonry curbs] [and at expansion joints,] as indicated, specified, or necessary and of [lumber] [or [_____] mm inch thick exterior plywood].

3.2.2 Rough Wood Bucks

[Size as indicated] [50 mm2 inch nominal thickness]. Set wood bucks true and plumb. Anchor bucks to concrete or masonry with steel straps extending into the wall 200 mm 8 inches minimum. Place anchors near the top and bottom of the buck and space uniformly at 600 mm 2 foot maximum intervals.

3.2.3 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

3.2.4 Wood Grounds

Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 2400 mm 8 foot straightedge.

3.2.5 Wood Furring

Provide where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips shall be nominal one by 3, continuous, and spaced 400 mm 16 inches o.c. Erect furring vertically or horizontally as necessary. Nail furring strips to masonry. Do not use wood plugs. Provide furring strips around openings, behind bases, and at angles and corners. Furring shall be plumb, rigid, and level and shall be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Form furring for [cornices,] offsets and breaks in walls or ceilings on 1 by 4 wood strips spaced 400 mm 16 inches o.c.

3.2.6 Wood Bumpers

Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.

3.2.7 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise

closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

3.2.8 Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work during construction as specified in Section [____]. Forms and centering for cast-in-place concrete work are specified in Section 03300N CAST-IN-PLACE CONCRETE.

3.2.9 Wood Sleepers

Run wood sleepers in lengths as long as practicable and stagger end joints in adjacent rows. [Sleepers for gymnasium floors are specified in Section entitled "Gymnasium-Type Hardwood Strip Flooring Systems."]

3.2.10 Diaphragms

NOTE: For plywood, select laying pattern, nail size, and spacing based on Table 25J of Uniform Building Code. For structural-use panels and OSB refer to APA Construction Guide.

Install plywood, structural-use, or OSB panels with the long dimension [parallel] [perpendicular] to supports. End joints shall be [continuous] [staggered] and located over the centerline of supports. Longitudinal joints shall be [continuous] [staggered] [and provided with blocking]. Nail panels with [6] [8] [10]-penny nails spaced not more than [____] mm inches on centers around the diaphragm boundaries [and along continuous panel edges] and [____] mm inches on centers at all other supported edges and 300 mm 12 inches o.c. over intermediate bearings.

3.2.11 Shear Walls

NOTE: For plywood, select nail size and spacing based on Table 25K of Uniform Building Code. For OSB and structural-use panels refer to APA Construction Guide.

Install plywood or structural-use panels with long dimension parallel or perpendicular to supports. Provide blocking behind edges not located over supports. Nail panels with [6] [8] [10]-penny nails spaced not more than [____] mm inches on centers along panel edges and 150 mm 6 inches o.c. over intermediate bearings.

3.2.12 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.2.13 Corner Bracing

Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.2.14 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 1800 mm 6 feet on centers and not more than 300 mm 12 inches from end of each piece. A minimum of two anchors shall be used for each piece.

3.3 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirements of AF&PA T101.

3.4 ERECTION TOLERANCES

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:

(1) Layout of walls and partitions: 6 mm 1/4 inch from intended position;

(2) Plates and runners: 6 mm in 2400 mm 1/4 inch in 8 feet from a straight line;

(3) Studs: 6 mm in 2400 mm 1/4 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 6 mm in 2400 mm 1/4 inch in 8 feet from a true plane.

- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:

(1) Layout of walls and partitions: 6 mm 1/4 inch from intended position;

(2) Plates and runners: 3 mm in 2400 mm 1/8 inch in 8 feet from a straight line;

(3) Studs: 3 mm in 2400 mm 1/8 inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: 3 mm in 2400 mm 1/8 in 8 feet from a true plane.

[3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by paragraph 3.2 of FEMA 302, NEHRP

RECOMMENDED PROVISIONS FOR SEISMIC REGULATIONS FOR
NEW BUILDINGS AND OTHER STRUCTURES.

This paragraph will be applicable to both new buildings designed according to TI 809-04, SEISMIC DESIGN FOR BUILDINGS, and to existing building seismic rehabilitation designs done according to TI 809-05, SEISMIC EVALUATION AND REHABILITATION FOR BUILDINGS.

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with Chapter 3 of FEMA 302. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.

NOTE: Use this paragraph regarding special inspection and testing for Army projects only.

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

]3.6 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements. Typical conversion is as shown:

<u>PRODUCTS</u>	<u>INCH-POUND</u> <u>Nominal</u>	<u>METRIC</u> <u>Conversion</u>
Sawn lumber	2 x 4 1 by	38 x 89 mm 19 mm by
Stud spacing	16 inches If not 48 inches panel	400 mm 406 mm
Plywood	48 by 96 inches	1200 by 2400 mm

-- End of Section --