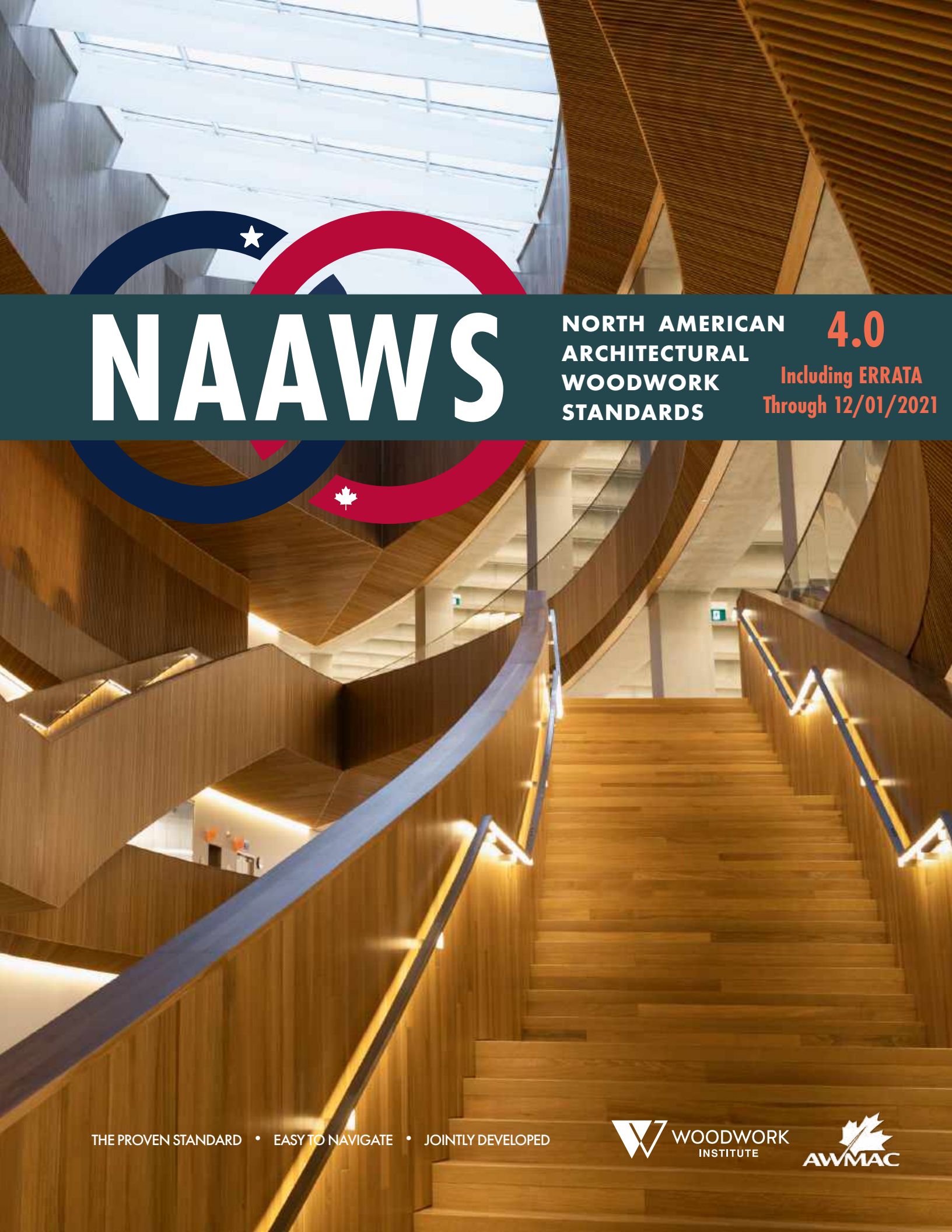

NAAWS

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS

4.0

Including ERRATA Through 12/01/2021

THE PROVEN STANDARD • EASY TO NAVIGATE • JOINTLY DEVELOPED

WOODWORK INSTITUTE

AWMAC

THANK YOU

The NAAWS Committee and Sponsor Associations offer their sincere appreciation to Eric Allard and Freddie Centeno for the services offered and dedication shown to our industry in assisting the NAAWS Committee in making French and Spanish translations of NAAWS 4.0 a reality.

ERIC ALLARD

Teacher / Industry Specialist
INOVEM / Quebec's National School of Furniture and Cabinetmaking (ENME)
AWMAC Quebec - Board Member

FREDDIE CENTENO

Engineering Manager
S & H Cabinets
Woodwork Institute - Millwork Professional

The **NAAWS** Committee and Sponsor Associations also thank the **CANADIAN WOOD COUNCIL** (CWC), for their support throughout the French translation process for NAAWS 4.0 and **NATURAL RESOURCES CANADA** (NRCan), for their generous funding of the French translation for NAAWS 4.0.

FRONT COVER

New Central Library, Calgary, Alberta
Executive Millwork Inc.
Designers: Snøhetta and DIALOG
AWMAC GIS project
Photo Credit: Michael Grimm

BACK COVER (lower)

ATCO Park, Calgary, Alberta
Cambium Woodwork (2005) Ltd.
Architects: Gibbs Gage Architects
Interior Design: Louise Middleton Design
AWMAC GIS project
Photo Credit: Jason Dziver

North American Architectural Woodwork Standards 4.0

Effective September 01, 2021

Including ERRATA through 12/01/2021

Sponsor Associations

Architectural Woodwork Manufacturers Association of Canada (AWMAC)
P. O. Box 36525, PRO MacTaggart, Edmonton, AB T6R 0T4, Canada
Phone: 403-981-7300 / Email: info@awmac.com
awmac.com

Woodwork Institute
1455 Response Rd., Ste. 110, Sacramento, CA 95815
Phone: 916-372-9943 / Email: info@woodinst.com
woodworkinstitute.com

A Specification of Qualities, Methodologies, and Workmanship
Requisite to the Production and Installation of Architectural Woodwork

Adopted and Published Jointly,
As our Successor and Replacement of the
North American Architectural Woodwork Standards 3.1, and predecessors

North American Architectural Woodwork Standards Committee

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Kerry DePape - Past Chair & Member Emeritus

Executive Editor:
Stanley R. (Rob) Gustafson

Retail Price: $1,250.00

DEDICATION

Kerry DePape

July 11, 1963 - June 1, 2019

This 2021 Edition of NAAWS 4.0 is dedicated to Kerry DePape who tragically passed away before his time. Chairman of the NAAWS Committee, Kerry was admired for his enthusiasm, outstanding achievements and noble qualities. He was passionately devoted to his family, his friends, his company, AWMAC, NAAWS and the woodwork industry. Kerry was heavily involved in the development of industry standards, joining the NAAWS Committee in 2014 and elected as Chair 2017. Kerry continued to Chair the committee admirably until his passing.

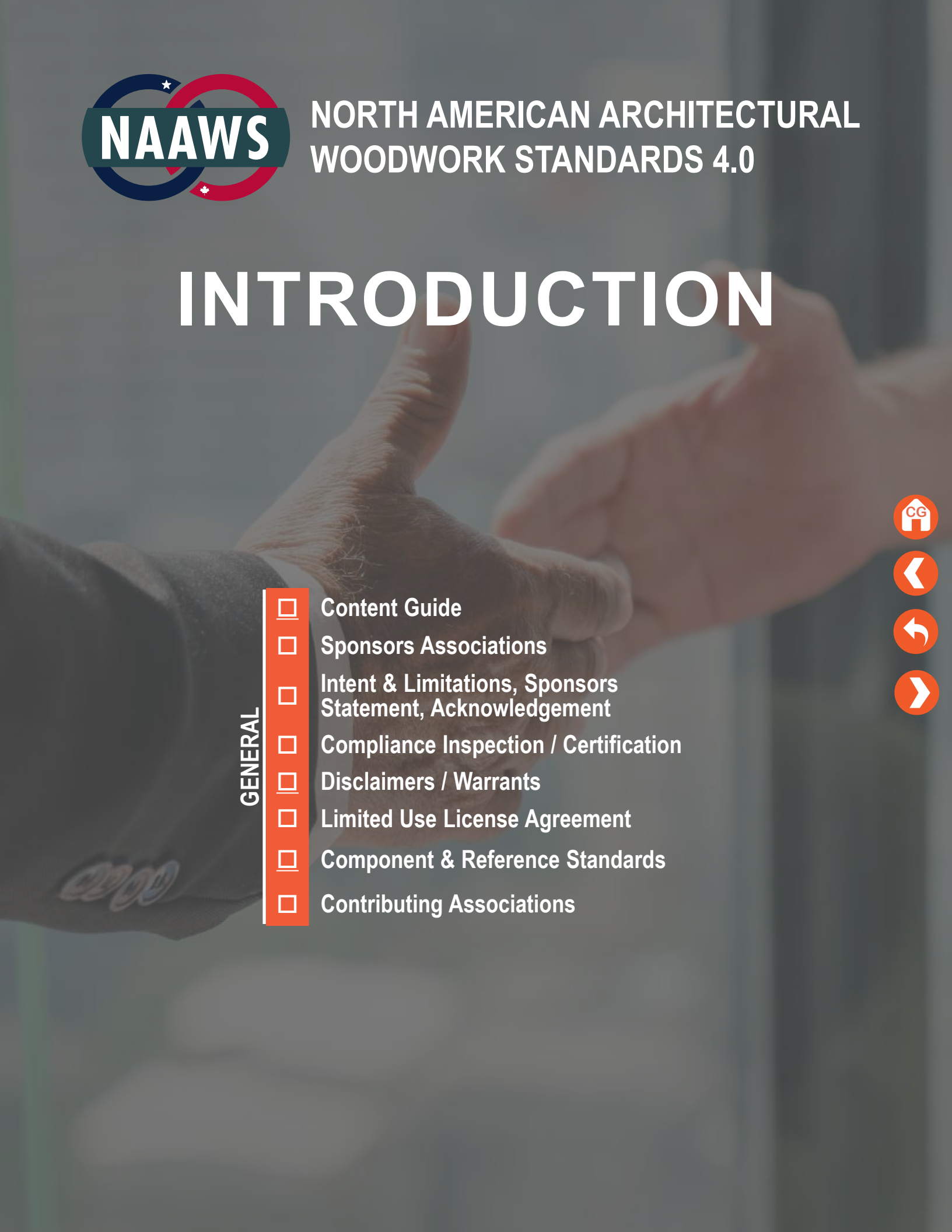
The architectural woodwork community is like a family; Kerry's friendship and support is irreplaceable. Kerry exemplified his commitment to excellence and worked tirelessly to improve our standards. His intelligent devotion to the entire industry was exemplary.

Kerry was truly a champion and a force of nature, one whose passing leaves an unimaginable gap in our woodworking industry, as well as in the lives of his family, friends, and colleagues. However, he leaves us with a deep determination to honor his legacy of compassion and focus. He dedicated his life to improving the woodworking industry and he left us with a desire to rally together like never before to ensure that his work was seen through to completion.

NAAWS

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

INTRODUCTION



GENERAL

CONTENT GUIDE

	Introduction	Preface	Design Professional Guide	User's Guide	Submittals	Fundamental Requirements	Lumber	Sheet Products	Finishing	Millwork	Stairwork & Rails	Wall / Ceiling Surfacing & Partitions	Passage Doors	Casework	Countertops	Historic Restoration	Care & Storage	Installation	Tolerances	Appendix	Glossary	Resource Guide
	I	P	DP	UG	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	A	G	RG
Information, General																						
Component & Reference Standards	●																					
Contributing Associations	●																					
Dimensional Change		●																				
Disclaimers & Warrants	●																					
Introduction		●		●																		
License Agreement, Limited Use	●																					
Measurement, System of		●																				
Moisture & Architectural Woodwork		●																				
NAAWS Review		●		●																		
Non-Standards Information	●	●	●	●																		●
Variations in Natural Wood Products		●																				
Warranty Language		●																				
Information for Design Professionals																						
Advisories			●																			
Recommendations			●																			
Specification Considerations			●																			
Specification Guidelines			●																			
Sponsor Associations		●																				
Sponsor Association Offerings		●	●																			
Information for Users of the Standards																						
Formatting				●																		
Introduction				●																		
Sections				●																		
Standards - Sections 01-15 & Appendix																						
Adhesive Usage Guidelines																				●		
Assembly / Application Requirements										●	●	●	●	●	●	●						
Casework Refinishing / Refacing / Refurbishing Guidelines																						●
Cabinet Design Series (CDS) Directory																				●		
Casework Integrity / Testing																				●		
Chemical / Stain Resistance																				●		
Default Stipulations									●	●	●	●	●	●	●	●						
Drawing Requirements					●																	
Finishing Defects & Workmanship									●													

(continued)

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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CONTENT GUIDE (continued)

	Introduction	Preface	Design Professional Guide	User's Guide	Submittals	Fundamental Requirements	Lumber	Sheet Products	Finishing	Millwork	Stairwork & Rails	Wall / Ceiling Surfacing & Partitions	Passage Doors	Casework	Countertops	Historic Restoration	Care & Storage	Installation	Tolerances	Appendix	Glossary	Resource Guide
	I	P	DP	UG	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	A	G	RG
Standards - Sections 01-15 & Appendix (continued)																						
Assembly Requirements										●	●	●	●	●	●	●						
Fundamental Requirements, General						●																
Fundamental Requirements, Product						●																
General Requirements					●		●	●	●	●	●	●	●	●	●	●	●	●	●			
Historic Stripping / Finishing Requirements																●						
Laboratory Casework														●								
Material Requirements							●	●	●	●	●	●	●	●	●							
Softwood lumber							●															
Hardwood lumber							●															
Sheet Products								●														
Scope					●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
Surface Definitions							●	●	●	●	●	●	●	●	●	●						
Resource Guide																						
Care & Storage																						●
Casework																						●
Code Resources, Miscellaneous																						●
Conversions, Miscellaneous																						●
Countertops																						●
Doors																						●
Finishing																						●
Fraction / Decimal / Millimeter Table																						●
Historic Restoration																						●
Joinery Details																						●
Lumber																						●
Millwork																						●
Reference Resource Directory																						●
Reference Resource Listings																						●
Sheet Products																						●
Specific Gravity / Weight of Hardwoods																						●
Stairwork & Rails																						●
Submittals																						●
Wall / Ceiling Surfacing & Partitions																						●

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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Architectural Woodwork Manufacturers Association of Canada (AWMAC)

AWMAC
ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA
ASSOCIATION DES MANUFACTURIERS DE MENUISERIE ARCHITECTURALE DU CANADA

ABOUT AWMAC

The Architectural Woodwork Manufacturers Association of Canada (AWMAC) is the National voice of Canada's architectural woodwork industry. For more than half a century, AWMAC has been promoting the long-term growth and financial stability for the country's diverse woodwork manufacturing sector.

AWMAC's membership includes architectural woodwork manufacturers, installers, material and service suppliers, design professionals, and allied members such as educational institutions. It is comprised of more than 400 companies and industry professionals in eight regional Chapters across Canada. Together, our National association and Chapters share a strong vision: to continually design, engineer, manufacturer and install the highest quality of architectural woodwork.

AWMAC'S COMMITMENT

- Partnering with other associations to define and improve architectural woodwork standards;
- Collaborating with educational institutions to enhance their apprentice and technical programs to ensure a quality human resource for the architectural woodwork industry; and,
- Communicating traditional, new and innovative architectural woodwork assembly methods and materials to governments, industry, design professionals and their associations.

VISION AND MISSION

Vision - To be the architectural woodwork industry authority in Canada.

Mission - To develop and promote the use of AWMAC's STANDARDS for the manufacturing and installation of architectural woodwork and promote assurance of adherence to those quality standards and sustainable practices in the woodwork industry.

HISTORY

AWMAC's roots go back to the 1920s. Millwork operators around Vancouver, British Columbia came together to improve conditions in the industry. Years later, their continued success resulted in the founding of the Mainland Millwork Association in 1948.

In the late 1960s, Gary Nikolai traveled from Vancouver across Canada, working tirelessly to promote a new national woodworkers association: the Architectural Woodwork Manufacturers Association of Canada. In short, AWMAC.

AWMAC held its first official meeting in Vancouver on September 25, 1970, with representation from British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Nova Scotia.

AWMAC's eight Chapters now include:

- Atlantic
- Quebec
- Ontario (serving the Nunavut Territory)
- Manitoba
- Saskatchewan
- Southern Alberta
- Northern Alberta (serving the Northwest Territories)
- British Columbia (serving the Yukon Territory)

QUALITY ASSURANCE PROGRAMS

EXPERT OPINION SERVICE - An Expert Opinion is available to those who are not satisfied with the supply and installation of the architectural woodwork on a project and would like an evaluation for any of the following reasons:

- Either part or all the work has failed
- You believe the work does not meet industry standards
- Specifications and/or contract documents were not followed

An expert will review your project's specifications, shop drawings, and contract documents and follow up with a site inspection of the architectural woodwork. An objective report will be issued at the end of the inspection. For more information, visit awmac.com/gis/expert-opinions.

CONSULTATION SERVICE - Was this part of your latest specification: "Supply and/or install architectural woodwork in accordance with the AWMAC Architectural Woodwork Standards, current edition" and now you perceive that the architectural woodwork on the project is not correct? Contact AWMAC and ask about our Consultation Service. We will send one our qualified AWMAC Certified Inspectors to do a site inspection and provide you with a written inspection report. For more information, visit: awmac.com/gis/consultations.

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NAAWS

SPONSOR ASSOCIATIONS (continued)

Architectural Woodwork Manufacturers Association of Canada (AWMAC)

ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA

ASSOCIATION DES MANUFACTURIERS DE MENUISERIE ARCHITECTURALE DU CANADA

GUARANTEE AND INSPECTION SERVICE (GIS). AWMAC's Guarantee and Inspection Service (GIS) is a national program designed to ensure that quality architectural woodwork is delivered on every GIS specified project.

AWMAC's GIS guarantees architectural woodwork meets or exceeds industry standards through expert guidance and inspections by qualified industry specialists. Your project will be supported, reviewed and approved by an AWMAC Certified Inspector from the initial shop drawings through final installation.

HERE IS HOW IT WORKS

STEP 1: Specify the GIS.

STEP 2: Specify the AWMAC grade required.

STEP 3: The Manufacturer will email the project to the regional AWMAC Chapter. The cost of the GIS will be part of the tendered lump sum. Once the Chapter is notified, tracking begins, inspections and reports are completed, and follow-up on compliance is conducted.

STEP 4: Once the supply and/or install of the completed architectural woodwork on a project complies with AWMAC's STANDARDS, a two-year guarantee on the architectural woodwork will be issued by the AWMAC Chapter and AWMAC National to the AWMAC Manufacturer Member.

Once specified, AWMAC's Guarantee and Inspection Service is a three-step process with a written report issued for each step.

In addition, if a design professional is interested, they can contact the Chapter office in advance of tender for a pre-tender review. An AWMAC Certified Inspector will review the specifications and architectural drawings to flag any errors, omissions or contradictions resulting in confusion during tender, manufacturing, or installation.

1. SHOP DRAWING REVIEW

This review is in addition to the usual review by the Architect. The AWMAC Certified Inspector determines whether or not the methods and materials indicated in the shop drawings submitted by the Manufacturer conform to the specified AWMAC STANDARDS and will also indicate deviation from architectural drawings and specifications.

2. SAMPLE UNIT INSPECTION

If specified, or otherwise required by AWMAC, a sample unit is inspected for compliance with AWMAC's STANDARDS in the manufacturing facility or on-site.

3. FINAL SITE INSPECTION

Upon project completion, the architectural woodwork is inspected on-site for compliance with AWMAC's STANDARDS. If it is a large project, more than one inspection may be necessary.

Learn more about the GIS at awmac.com/gis.

CONTACT AWMAC

AWMAC National | awmac.com

AWMAC British Columbia Chapter | bc.awmac.com

AWMAC Northern Alberta Chapter | nab.awmac.com

AWMAC Southern Alberta Chapter | sab.awmac.com

AWMAC Saskatchewan Chapter | sk.awmac.com

AWMAC Manitoba Chapter | mb.awmac.com

AWMAC Ontario Chapter | on.awmac.com

AWMAC Quebec Chapter | qc.awmac.com

AWMAC Atlantic Chapter | atl.awmac.com

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SPONSOR ASSOCIATIONS (continued)

Woodwork Institute

WOODWORK INSTITUTE

ABOUT THE WOODWORK INSTITUTE

The Woodwork Institute is a United States based organization whose primary purpose is to assure excellence and craftsmanship in architectural woodwork. It works with both millwork fabricators and architects though its Quality Assurance Programs.

The Woodwork Institute was established in 1951 as a not-for-profit trade organization dedicated to the preservation of the use of wood as a building material.

As the Institute has grown, so too has its Quality Assurance Programs. As a means of establishing the basis for quality assurance, the Woodwork Institute and AWMAC have collaborated on the North American Architectural Woodwork Standards (NAAWS). NAAWS is an industry standard to be used in specifying quality materials, fabrication and installation methods.

Unique to the Woodwork Institute are its Quality Assurance Programs — the Certified Compliance Program (CCP), the Monitored Compliance Program (MCP) and the Certified Seismic Installation Program (CSIP).

The Woodwork Institute also provides an Independent Inspection Service (IIS) for projects and an Expert Witness Service (EWS), when requested by a party to the contract.

ARCHITECTURAL SERVICES REPRESENTATIVES

The Woodwork Institute's programs and services can be accessed through its Architectural Service Representatives. These representatives have been qualified by the Woodwork Institute to inspect and certify to NAAWS, and are experts available to both millwork firms and architectural firms to provide guidance and knowledge in the planning and execution of woodwork. Their primary focus is quality assurance.

For Architects — Architectural Services Representatives are available to review specifications, answer architectural woodwork related requests for information, consult on design issues, and present seminars for continuing education units as required by the American Institute of Architects (AIA). As well, the Architectural Services Representatives are available to assist design professionals should they need an impartial opinion about architectural woodwork fabricated or installed on a project.

For Fabricators — Architectural Services Representatives are available to fabricators and installers for unbiased consultation regarding specification interpretation, compliance issues, shop-drawing protocol, standards interpretation and other matters at no cost.

QUALITY ASSURANCE PROGRAMS

For the purpose of maintaining the reliability and integrity of work purporting to conform to NAAWS, only the NAAWS Sponsor Associations, consisting of AWMAC and the Woodwork Institute, and their assignees, are authorized to inspect and certify conformance of architectural woodwork to the NAAWS. Architectural woodwork that has been inspected or certified to conform to NAAWS by persons or entities other than the NAAWS Sponsor Associations and/or their assignees is not recognized and not in conformance with NAAWS.

CERTIFIED COMPLIANCE PROGRAM (CCP)

Certified Compliance Quality Assurance

Provides an unbiased means of verifying the quality of shop drawings, fabrication / installation, through the inspection / certification of non-affiliates and the self-inspection / certification of Accredited Millwork Companies • Assures shop drawings will contain the necessary documentation to confirm the specified design and level of quality • Advises fabricator / installer of quality concerns and requirements • No restriction to bidders

For more information visit:
woodworkinstitute.com/services/certified-compliance-program

MONITORED COMPLIANCE PROGRAM (MCP)

Monitored Compliance Quality Affirmation

Ensures strict conformance to specifications throughout the project via continuous reviews / inspections during the planning, fabrication and installation process • Written status reports are issued during the project's progression, giving timely notification of non-compliant findings thereby allowing for correction of issues on an ongoing basis • No restriction to bidders

For more information visit:
woodworkinstitute.com/services/monitored-compliance-program

CERTIFIED SEISMIC INSTALLATION PROGRAM (CSIP)

Seismic Compliance Casework Installation

Provides Woodwork Institute-engineered and OSHPD pre-approved methods for seismic installation of casework • Relieves the architect of the need to provide calculations for casework attachment and provides a significant savings in both engineering costs and detailing time • Verification is provided for in-wall blocking, casework installation and fasteners • Includes a review of shop drawings for blocking location requirements • No restriction to bidders

For more information visit:
woodworkinstitute.com/services/certified-seismic-installation-program

SPONSOR ASSOCIATIONS (continued)

Woodwork Institute

SPECIALITY SERVICES

NAAWS COMPLIANCE INSPECTION/CERTIFICATION - The Woodwork Institute is authorized to assure conformance of architectural woodwork to NAAWS. Additionally, the Woodwork Institute may, in its respective discretion, certify qualified individuals within its respective jurisdiction - persons domiciled in the United States and all other jurisdictions worldwide - (excluding those of AWMAC, persons domiciled in Canada, and its jurisdictions), to assure conformance of architectural woodwork to NAAWS. Said third parties shall have met the criteria and requirements for certifying architectural woodwork as set forth and administered by the Woodwork Institute.

INDEPENDENT INSPECTION SERVICE (IIS)

Available on a fee basis

Provided to a contractual party to a project in which no certification program has been specified yet compliance to the specifications is desired

Inspection report made available to all parties

For more information visit:
woodworkinstitute.com/services/specialty-services

EXPERT WITNESS SERVICE (EWS)

Available on a fee basis, retainer required

Provided to a contractual party to a project in which litigation is imminent.

Inspection report of architectural woodwork provided to contractually paying party only

Expert witness made available to testify on his/her findings

For more information visit:
woodworkinstitute.com/services/specialty-services

BIDDER PRE-QUALIFICATION

To protect you and your customer from the unknown, include in your specifications the following language: "To be eligible to bid or negotiate this job, the architectural woodwork subcontractor must be a Woodwork Institute (WI) Accredited Millwork Company (AMC) in good standing." For more information visit:
woodworkinstitute.com/architectural-resources/quality-assurance

SITE COMPLIANCE INSPECTION SERVICE (SCIS)

Available on a fee basis

Provided to a contractual party to a project in which no certification program has been specified yet compliance to Section 2 of NAAWS is desired.

Inspection report made available to all parties

For more information visit:
woodworkinstitute.com/services/specialty-services

AFFILIATES

ACCREDITED MILLWORK COMPANY – accredited and licensed architectural woodwork fabricators and installers.

CERTIFIED MILLWORK PROFESSIONALS – individuals who have proven their knowledge of fabrication and installation as per our standards.

MILLWORK INDUSTRY PARTNERS - product or service providers to the architectural woodwork industry.

For more information about our affiliates visit:
woodworkinstitute.com/membership-listing-2

ACKNOWLEDGED PRODUCT LISTING

Acknowledges that a product (hardware, finishing system, wall paneling systems, etc.) meets the minimum requirements of NAAWS.

For more information visit:
woodworkinstitute.com/acknowledged-product-listing

CONTACT THE WOODWORK INSTITUTE

For more information on our programs and services, or to be connected to your dedicated Architectural Services Representative, please visit the Woodwork Institute's website at woodworkinstitute.com or call the administrative office at (916) 372-9943.

CG TC

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INTENT & LIMITATIONS, SPONSORS STATEMENT & ACKNOWLEDGEMENT

INTENT & LIMITATIONS

Like all architectural components of the construction process, woodwork design and configuration possibilities are limited only by the creativity of the design professional. We have included architectural wood products, which through evolution, have become fixtures of our daily lives, and have developed a measurable guideline to ensure these products meet these standards.

While these *North American Architectural Woodwork Standards* (NAAWS) are to be applied to the production and installation of all architectural wood products, the performance of wood products once installed outside of a climate controlled (interior) environment (as identified in Section 13 of these standards) cannot be measured by these standards. Wood products installed in non-climate-controlled environments will have varying degrees of performance and should be governed by contractual agreements between the manufacturers and the buyers.

It is the intent of these standards to assist the design professional to specify a variety of architectural woodwork products which meet the functional and aesthetic requirements of their clients. Encompassing all products in these standards is not possible; but by understanding and applying these standards and implementing the services provided by the Sponsor Associations, the design professional will best serve their clients' needs and can be confident their quality criteria will be achieved.

When design professionals reference the NAAWS for their projects, they also assume the obligation of enforcing that the quality standards are met.

SPONSORS STATEMENT

The Architectural Woodwork Manufacturers Association of Canada (AWMAC), and the Woodwork Institute have jointly collaborated on the development of the *North American Architectural Woodwork Standards* (NAAWS).

Publication of NAAWS is being accompanied by a French-Canadian translation that will be available from AWMAC and a Spanish translation that will be available from Woodwork Institute as an informational service to the global community. Translations are an unofficial, non-normative translation of the official North American Architectural Woodwork Standards (NAAWS) Edition. In case of dispute or interpretation misunderstanding, it is the original English version of the NAAWS that must be considered as the reference for any issue related to standards.

While a print on demand copy of the standards is available for a nominal cost, the primary means of distribution is via a PDF download. Please be aware, print versions lack any tables of content, index or interactive functionality.

Please help in continuing to improve NAAWS with your suggestions. Access to a NAAWS Suggestion Form is available throughout the manual through the "Suggestion" link on the left margin or at: naaws.com

SPECIAL ACKNOWLEDGEMENT

The NAAWS Committee wishes to acknowledge and thank the Decorative Hardwoods Association for the data sourced from its standards specifications (ANSI/HPVA HP-1-2020), including "sheet products" identified in Section 4 of the NAAWS. For more information about the Decorative Hardwoods Association and HPVA resources, see: decorativehardwoods.org

COMPLIANCE INSPECTION / CERTIFICATION

NAAWS INSPECTION / CERTIFICATION AUTHORIZATION

NAAWS is a substantive standard and when required by specification, may not be waived. For the purpose of maintaining the reliability and integrity of work purporting to conform to NAAWS, only the NAAWS Sponsor Associations, consisting of AWMAC and Woodwork Institute, and their assignees, are authorized to inspect and certify conformance of architectural woodwork to the NAAWS.

Consequently, architectural woodwork that has been purportedly inspected or certified to conform to NAAWS by persons or entities other than the NAAWS Sponsor Associations and/or their assignees is not recognized and not in conformance with NAAWS.

NAAWS COMPLIANCE INSPECTION / CERTIFICATION

AWMAC and the Woodwork Institute are authorized to verify conformance of architectural woodwork to NAAWS. Additionally, AWMAC and the Woodwork Institute may, in their respective discretion, certify qualified individuals within their respective jurisdictions (for AWMAC, persons domiciled in Canada; for Woodwork Institute, persons domiciled in the United States), and all other jurisdictions worldwide other than the jurisdiction of the other, to verify conformance of architectural woodwork to NAAWS. Said third parties shall have met the criteria and requirements for certifying architectural woodwork as set forth and administered by AWMAC and/or the Woodwork Institute respectively.

DISCLAIMERS & WARRANTS

DISCLAIMERS & WARRANTS

THE SPONSOR ASSOCIATIONS shall not be responsible to anyone for the use of or reliance upon these standards. The Sponsor Associations shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon these standards.

These *North American Architectural Woodwork Standards* (NAAWS) provide the minimum criteria for the design, fabrication, finishing, and installation of architectural woodwork. Provisions for ADA, mechanical and electrical safety have not been included. References to life-safety requirements are included for information only. Governmental agencies or other national standards-setting organizations provide the standards for life-safety requirements.

While the NAAWS does establish assembly and installation standards for all wood products, the joint flushness and gap tolerance performance for wood products once installed outside of climate controlled (interior) environments (as identified in Section 02 of these standards) cannot be governed by these Standards.

EXCEPTION, when the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

EXTERIOR ENVIRONMENTS and woodwork products for such are not covered by these standards.

INTERIOR, NON-CLIMATE CONTROLLED ENVIRONMENTS are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

ILLUSTRATIONS are intended to assist in understanding the standards and may not include all requirements for a specific product or unit, nor do they show the only method of fabrication. Such partial drawings shall not be used to justify improper or incomplete design and/or construction.

APPENDIX is provided as additional resource and is only part of the standards when referenced.

RESOURCE GUIDE is provided as additional resource and is not part of the standards.

CITATIONS and **QUOTES** from other industry Standards are included within NAAWS; however, are neither developed nor published by the Sponsor Associations. Their reference to and usage of is not a validation of these citations and quotations outside the context of the NAAWS. Only when these citations and partial quotations are applied in concert with all other related provisions of this NAAWS are these citations and partial quotations recognized for application to architectural woodwork.

INTERPRETATION OF THE NAAWS STANDARDS or RESOLUTION OF CONFLICTING STANDARDS WITHIN NAAWS shall be brought to the attention of the NAAWS Committee only by its authorized inspection / certification Sponsor Associations by way of the NAAWS Interpretation and Conflicting Standards Resolution form which may be found at naaws.com. If the issue to be addressed is perceived as a conflict in NAAWS, until such time as a determination is made, the least restrictive standard requirement within NAAWS shall prevail.

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LIMITED USE LICENSE AGREEMENT & SUGGESTION FORM

LIMITED USE LICENSE AGREEMENT

BY USING NAAWS, RECIPIENT ACCEPTS THE TERMS AND CONDITIONS BELOW:

- **Legal Agreement.** This Limited Use License Agreement (the "Limited Use Agreement") constitutes a legal agreement between the addressee and his or her organization (collectively, "Recipient"), the Woodwork Institute and the Architectural Woodwork Manufacturers Association of Canada ("Owners").
- **Controlling Terms.** This Limited Use Agreement sets forth herein the only terms and conditions governing the use of the enclosed product.
- **License Grant.** Subject to the terms and conditions of this Limited Use Agreement, Owners hereby grant to Recipient a non-transferable, non-exclusive license to use NAAWS and its updates (the "Materials") for architectural woodwork and case work design, construction, installation and specification purposes only.
- **Use Only by Recipient.** Recipient will not transfer the Materials to any person or entity except its employees, nor authorize any third party to use or sell Materials or derivatives thereof.
- **Compliance with Laws, Precautions**. Recipient shall use Materials in strict accordance with all applicable local, state and federal laws, regulations and guidelines. Recipient understands that the Materials are merely standards, and that they are to be used with caution and prudence, and in consultation with expert advisors.
- **Liability.** Recipient assumes all liability for damages that may arise from the use of the Materials. Owners will not be liable to Recipient for any loss, claim or demand made by the Recipient, or made against the Recipient by any other party, due to or arising from the use of the Materials by the Recipient, except to the extent permitted by law when caused by the gross negligence or willful misconduct of Owners.
- **Disclaimer of Warranties.** The Owners disclaim any other representations and warranties, expressed or implied, including without limitation any warranty of non-infringement, title, merchantability, or fitness for a particular purpose.
- **Limitation of Liability.** In no event shall Recipient be entitled to recover from Owners any special, indirect, incidental, consequential, or punitive damages in connection with this agreement or the license granted hereunder.
- **Entire Agreement and Assignability.** This Limited Use Agreement sets forth the complete and entire agreement of the parties with respect to the subject matter hereof and supersedes and terminates all prior agreements and understandings between the parties. No subsequent amendment or addition to this Limited Use Agreement shall be binding upon the parties unless reduced to writing and signed by the respective authorized officers of the parties. This Limited Use Agreement shall not be assigned or otherwise transferred by Recipient.
- **Publication.** Any publication or presentation of NAAWS will duly acknowledge Owners as their source.

SUGGESTION FORM

The Sponsor Associations encourage your suggestions for changes, revisions, and/or improvements to these standards. Please bring such to the attention of the NAAWS (North American Architectural Woodwork Standards) Committee by submission of a NAAWS Improvement Suggestion Form which can be accessed through the "Suggestion" link found on the left-hand margin of each manual page or on the NAAWS website naaws.com Simply complete the form and submit it electronically.

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COMPONENT & REFERENCE STANDARDS

COMPONENT & REFERENCE STANDARDS

Most components used to build the products covered within these standards are regulated by separate, individual standards. Some of these standards are accredited by American National Standards Institute (ANSI) which accredits the procedures used in standards development. Some standards are not necessarily accredited by ANSI; however, are equally creditable and industry accepted.

Within NAAWS, these standards are typically used as a minimum starting point and built upon with additional restrictions or requirements as may be appropriate.

The following is a listing of those used throughout this NAAWS document, with latest edition of such governing:

ABRASION RESISTANCE:
ASTM C501 - astm.org
ISO-4586 - iso.org

AGRIFIBER:
Shall meet or exceed the performance properties of ANSI A208.1 or 2 - compositepanel.org

BUILDING CODE:
International Building Code (IBC) - iccsafe.org
California Building Code (CBC) - bsc.ca.gov
National Building Code (Canada) - nrc-cnrc.gc.ca/eng/index.html

CASEWORK:
ANSI/KCMA 161.1 - kcma.org
ISEFA 8 - sefalabs.com
UL 210 - ul.com
NFPA 70 - nfpa.org
LM 80 - energy.gov

CHEMICAL RESISTANCE:
ISO-4586 - iso.org or SEFA 8 - sefalabs.com

COMBINATION CORE:
Shall meet or exceed the performance characteristics of ANSI A208.1 / 2 - compositepanel.org

DOOR, WOOD:
ANSI/WDMA I.S. 1A, 6A and TM 15 - wdma.site-ym.com

ENDANGERED WOOD SPECIES:
Convention on International Trade in Endangered Species (CITES) - cites.org

EPOXY RESIN *(Countertops):*
ASTM D1763 - 00 - astm.org

FIRE RETARDANCE & FLAME SPREAD:
Underwriters' Laboratories, Test # 723 - ul.com
ASTM-E-84 Tunnel Test - astm.org
NFPA 80, National Fire Protection Association - nfpa.org

GLASS:
ASTM C1036 - astm.org
Consumer Product Safety Commission's Safety Standard for Architectural Glazing Materials - cpsc.gov

HARDWARE, CABINET:
ANSI/BHMA A156.9 Cabinet Hardware
ANSI/BHMA A156.11 Cabinet Locks
ANSI/BHMA A156.18 Materials and Finishes
ANSI/BHMA A156.26 Continuous Hinges - buildershardware.com

HARDBOARD:
ANSI A135.4 - compositepanel.org

HARDWOOD LUMBER:
NHLA Grading Rules - nhla.com

HARDWOOD PLYWOOD (veneer face grade & thickness, squareness, straightness, characteristics, defects)**:**
ANSI/HPVA HP-1 - decorativehardwoods.org

HIGH-DENSITY OVERLAY (HDO):
Voluntary Product Standard PS 1 - nist.gov

HIGH-PRESSURE LAMINATE (HPL):
ISO (International Organization for Standards) - iso.org
ISO 4586.

HISTORIC RESTORATION:
United States Department of the Interior - doi.gov
National Park Service - nps.gov
Historic Sites and Monuments Board of Canada - parkscanada.gc.ca

LABORATORY CASEWORK:
Scientific Equipment and Furniture Association (SEFA) - sefalabs.com

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COMPONENT & REFERENCE STANDARDS (continued)

COMPONENT & REFERENCE STANDARDS (continued)

MEDIUM-DENSITY FIBERBOARD (MDF):
Composite Panel Association (CPA) ANSI A208.2 - compositepanel.org

MEDIUM-DENSITY OVERLAY (MDO):
Voluntary Product Standard PS 1 - nist.gov

MOISTURE CONTENT:
US Forest Products Laboratory - fpl.fs.fed.us/index.php

ORIENTED STRAND BOARD (OSB):
Voluntary Product Standard PS 2 - nist.gov

ORNAMENTAL WOODWORK:
US Department of the Interior - doi.gov
Historic Sites and Monuments Board of Canada - parkscanada.gc.ca

PARTICLEBOARD:
ANSI A208.1 - compositepanel.org

PRESERVATIVE TREATMENT:
Window and Door Manufacturers Association (WDMA) WDMA I.S. 4-15A - wdma.com

SOFTWOOD LUMBER:
Voluntary Product Standard PS 20 - nist.gov

SOFTWOOD PLYWOOD:
Voluntary Product Standard PS 1 - nist.gov

SOLID SURFACE:
ICPA'S (International Cast Polymer Association) ANSI/ICPA SS-1 - icpa-hq.org

STAIN RESISTANCE:
ASTM D3023 and C1378 - astm.org

THERMALLY FUSED LAMINATE (TFL):
ISO-4586 - iso.org

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CONTRIBUTING ASSOCIATIONS

THE FOLLOWING ASSOCIATIONS ARE GRATEFULLY ACKNOWLEDGED:

American Institute of Architects (AIA)
American National Standards Institute (ANSI)
American Society of Interior Designers (ASID)
American Society for Testing and Materials (ASTM)
Builders Hardware Manufacturers Association (BHMA)
Composite Panel Association (CPA)
Construction Specifications Canada (CSC)
Construction Specifications Institute (CSI)
Decorative Hardwoods Association (HPVA)
The Engineered Wood Association (APA)
Interior Design of Canada (IDC)
International Organization for Standards (ISO)
International Solid Surface Fabricators Association (ISSFA)
International Wood Products Association (IWPA)
Laminating Materials Association (LMA)
National Electrical Manufacturers Association (NEMA)
National Fire Protection Association (NFPA)
National Hardwood Lumber Association (NHLA)
Royal Architectural Institute of Canada (RAIC)
Scientific Equipment & Furniture Association (SEFA)
Stair Manufacturer Association (SMA)
Western Wood Products Association (WWPA)
Window and Door Manufacturers Association (WDMA)
Wood Molding and Millwork Producers Association (WMMPA)

END OF INTRODUCTION

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

PREFACE

GENERAL

- NAAWS Review
- Variations in Natural Wood Products
- Dimensional Change
- Moisture & Architectural Woodwork
- System of Measure
- Warranty Language

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS

PURPOSE - Provide design professionals with logical and simple means to comprehensively specify elements of architectural woodwork for use in climate-controlled environments.

Provide compliance criteria to ensure that manufacturers / installers bidding on a project compete on an equal basis and are obligated to perform work of equal quality.

Provide industry information, terminology, and test criteria to properly determine compliance.

OVERVIEW - These standards are based on two Grades of quality that may be mixed within a single project. Limitless design possibilities and a wide variety of lumber and veneer species, along with most panel products, factory finishes, and profiles are available in both Grades.

- **CUSTOM GRADE** is typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's material quality, workmanship, and/or installation.
- **PREMIUM GRADE** is selectively used in the most visible and high-profile areas of a project, such as reception counters, boardrooms, and executive areas, providing the highest level of material quality, workmanship, and/or installation.

These standards cannot address every contingency; however, this document is the most comprehensive single architectural woodworking standard available.

When these standards are referenced, the client is protected, and the manufacturer / installer has a clear direction for what is required.

ECONOMY GRADE has been removed from these standards, as no longer being relevant to quality architectural woodwork.

NON-RESTRICTIVE - These standards merely establish the minimum rules by which all parties shall conform. Issues not clearly defined in the contract documents or in these standards will be resolved by selection, fabrication, finishing, and/or installation at the option of the manufacturer or installer.

FIRST-CLASS WORKMANSHIP - It is intended that architectural woodwork specified to meet these standards will conform to "First-Class Workmanship" as defined within the Glossary and these standards.

DEFAULT STIPULATION - When these standards are referenced as a part of the contract documents and no Grade is specified, Custom Grade will be the default stipulation. In the absence of material specifications, it will be the manufacturer's option to select materials suitable for opaque finish.

EXCEPTION - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

These standards are intended for typical commercial, institutional and/or residential applications and environments and might not perform as expected in abusive or other environments where special design considerations should be taken.

DISCLAIMERS - The sponsors of these standards shall not be responsible to anyone for the use of or reliance upon these standards. They shall not incur any obligation nor liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon these standards.

These standards provide the minimum criteria for the concept, design, fabrication, finishing, and installation of architectural woodwork.

Provisions for mechanical and electrical safety have not been included. References to life-safety requirements are included for information only.

Governmental agencies or other national standards-setting organizations provide the standards for life-safety requirements.

ADA or other accessibility requirements are not addressed in these standards as they are the responsibility of the architect and/or the design professional.

Woodwork must be inspected upon arrival, and all claims or complaints must be filed before painters' finish is applied. Doors must be properly sealed on all surfaces, including top and bottom edges, to prevent absorption of moisture. The manufacturer will not be responsible for defects resulting from neglect of these precautions.

ILLUSTRATIONS - The illustrations are intended to assist in understanding these standards and might not include all requirements for a specific product or unit, nor do they show the only method of fabrication. Such partial drawings shall not be used to justify improper or incomplete design and/or construction.

VARIATIONS IN NATURAL WOOD

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS (continued)

APPENDIX - Like Section 02 Fundamental Requirements, the Appendix is a depository of additional compliance requirements applicable to these standards as may be referenced.

TESTING - All methods of casework and drawer joinery provided for within NAAWS 4.0 have been tested and proven compliant to the unique NAAWS integrity requirements outlined in the **APPENDIX**. These tests are unique to NAAWS and were created specifically for the needs of architectural woodwork casework, and drawers. The test procedures and their success establish the minimum acceptable level of integrity and performance for casework / drawer joinery and in wall blocking requirements incorporated within NAAWS 4.0.

These testing requirements meet or exceed the highest and most demanding performance levels of ANSI/AWI 0641-2019.

CITATIONS and **QUOTES** - Other industry standards, neither developed nor published by the Sponsor Associations, are used within these standards. The reference to and usage of is not a validation of these citations and quotations outside the context of these standards. Only when these citations and partial quotations are applied in concert with all other related provisions of these standards are these citations and partial quotations recognized for application to architectural woodwork.

RESOLUTION OF CONFLICTING STANDARDS shall be brought to the attention of the NAAWS Committee by way of the NAAWS Interpretation and Conflicting Standards Resolution form which may be found on naaws.com. If the issue to be addressed is perceived as conflict in NAAWS, until such time as a determination is made, the least restrictive standard within NAAWS shall prevail.

IMPROVEMENT - The Sponsor Associations encourage your suggestions for changes, revisions, and/or improvements to these standards. Please bring such to the attention of the NAAWS (North American Architectural Woodwork Standards) Committee by submission of a NAAWS Improvement Suggestion Form referenced accessible through the “Suggestion” link found on the left-hand margin of each manual page or on the NAAWS website naaws.com. Simply complete the form and submit it electronically.

TOLERANCES - The tolerances found within Section 15 of these standards fall into two categories, those for:

- Factory fabricated joinery, assembly and construction - found in the Product portion of Sections 05 - 12.
- Field installation joinery and assembly - found in Section 14.

Most fabrication and installation assemblies include solid wood to solid wood joints, solid wood to wood veneer joints, solid wood to wood based products (HPL, TFL,CGS (Compact Laminate) and panel products), solid wood to non-wood based products (which can be drywall, glass, metal, stone, acrylics, and other surfaces), and non-wood to non-wood joints.

Tolerances found in these standards include:

- Flatness of wood-based panel products
- Solid wood to solid wood joints and assemblies
- Solid wood to wood veneer joints and assemblies
- Wood veneer to wood veneer joints and assemblies
- Solid wood to wood-based product joints and assemblies
- Solid surface to solid surface joints and assemblies

Because of the differences of expansion and contraction of non-wood products compared to solid wood and wood-based products, these standards do not apply tolerances regarding flatness or joinery to these non-wood-based products.

VARIATIONS IN NATURAL WOOD PRODUCTS

Wood is a natural material with variations in color, texture, and figure. These variations are influenced by the natural growing process and are uncontrollable by the manufacturer.

The color of wood within a tree varies between the “sapwood” (the outer layers of the tree that continue to transport sap), which is usually lighter in color, and the “heartwood” (the inner layers in which the cells have become filled with natural deposits).

Various species, veneer cuts, and/or lumber milling options produce different grain patterns (figures) which influence the selection process. There will be variations of grain patterns within any selected species in both lumber and veneer and each other.

The manufacturer cannot select solid lumber cuttings within a species by grain and color in the same way veneers might be selected. Color, texture, and grain variations may occur in architectural woodworking.

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DIMENSIONAL CHANGE & MOISTURE

DIMENSIONAL CHANGE IN ARCHITECTURAL WOODWORK

This advisory concerns prevention of dimensional problems in architectural woodwork products as the result of uncontrolled relative humidity. It is further intended as a reminder of the natural dimensional properties of wood and wood-based products such as plywood, particleboard, HPL and of the routine and necessary care and responsibilities which must be assumed by those involved.

For centuries, wood has served as a successful material for architectural woodwork, and as history has shown wood products perform with complete satisfaction when correctly designed and used. Problems directly or indirectly attributed to dimensional change of the wood are usually, in fact, the result of faulty design, or improper humidity conditions during site storage, installation, or use.

Wood is a hygroscopic material, and under normal use and conditions all wood products contain some moisture. Wood readily exchanges this molecular moisture with the water vapor in the surrounding atmosphere according to the existing relative humidity. In high humidity, wood picks up moisture and swells. In low humidity, wood releases moisture and shrinks. As normal minor fluctuations in humidity occur, the resulting dimensional response in properly designed construction will be insignificant. To reduce humidity related problems, the appropriate recommendations from Section 13 should be considered. Uncontrolled extremes can likely cause problems.

Oxidation is a reaction of acids in wood (e.g., tannic acid), with iron, oxygen, and moisture, whether this be relative humidity or direct moisture. Control of moisture is a simple way to protect wood products from stains as a result of oxidation.

Together with proper design, fabrication, and installation, humidity control is obviously the important factor in preventing dimensional change problems.

Architectural woodwork products should be manufactured as designed from wood that has been dried to an appropriate average moisture content and maintained at this condition up to the time of delivery.

SUBSEQUENT DIMENSIONAL CHANGE in wood is and always has been an inherent natural property of wood. These changes are not the responsibility of the manufacturer or products made from it. Specifically:

- Responsibility for dimensional change problems in wood products resulting from design rests with the designer / architect / specifier.
- Responsibility for dimensional change problems in wood products resulting from improper relative humidity exposure during site storage and installation rests with the general contractor.
- Responsibility for dimensional change problems in wood products resulting from humidity extremes after occupancy rests with engineering and maintenance.

MOISTURE AND ARCHITECTURAL WOODWORK

The moisture content of wood is crucial. If wood is not properly dried and/or seasoned, the best of workmanship cannot prevent moisture-related defects such as surface checks, cracking, bowing, twisting, and glue-line failure that might occur during production and afterward. In severe cases, a product can even be destroyed; unfortunately, most moisture defects are irreversible.

Wood is a hygroscopic material, expanding when it takes on moisture, shrinking when it loses moisture. How much moisture will be absorbed or how fast lumber will dry depends upon the present moisture content of the wood, the wood species, the relative humidity, and the temperature of the surrounding air. The drying process of lumber has to be slow enough to avoid stress between the surface and the core because too much stress results in surface checks, cracks, split ends, and other drying effects.

If wet and dry pieces of wood are placed in an area, they will absorb or lose moisture until all pieces have the same final moisture content (Equilibrium Moisture Content or EMC). For instance, if you make furniture, cabinets, picture frames, or clocks for inside a home, an office, or other heated live-in area, all wooden parts will eventually dry to approximately 6-12% wood moisture (extreme climate zones might have slightly higher or lower values).

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MOISTURE AND ARCHITECTURAL WOODWORK
(continued)

For lasting quality and beauty, use only wood with a moisture content between 6-12%. Moisture-related defects might occur if only one piece has a higher or lower moisture content than 6-12%. Without control of the moisture content, occurrences of moisture related defects increase dramatically.

Many manufacturers reduce the occurrences of moisture problems by buying only kiln-dried wood. Kiln-dried wood should have a moisture content between 6-12%. Even though the wood might be dried properly when it leaves the dry kiln, it can change in moisture content during manufacturing, transportation, or storage. Manufacturers might inadvertently further complicate the problem by assembling a project with materials that have dissimilar moisture contents.

TO REDUCE THE RISK OF MOISTURE DAMAGE, the U.S. Department of Agriculture, Forest Service, Forest Products Laboratory recommends in their General Technical Report 113 that:

- Large assemblies, such as ornamental beams, cornices, newel posts, stair stringers, and handrails, should be built up from comparatively small pieces.
- Wide door and window casing and base molding should be hollow backed.
- Backband trim, if mitered at the corners, should be glued and splined before erection.
- Large solid pieces, such as wood stile and rail paneling, should be designed and installed so that the panels are free to move across the grain. Narrow widths are preferable.

SUBSEQUENT MOISTURE DAMAGE of wood products are not the responsibility of the manufacturer of the products. Specifically:

- Responsibility for moisture damage in wood products resulting from design rests with the designer / architect / specifier.
- Responsibility for moisture damage in wood products resulting from improper relative humidity exposure during site storage and installation rests with the general contractor.
- Responsibility for moisture damage in wood products resulting from humidity extremes after occupancy rests with engineering and maintenance.

SYSTEMS OF MEASUREMENT

These standards are written with the U.S. Customary System of Measurement followed by the metric system in brackets.

The system of measurement used in the original design of a project's architectural drawings will dictate which system of measurement within these standards is used for verification of compliance.

The metric number is typically a "soft" conversion of the U.S. Customary System of measurement. In order to make the metric number more conceptually coherent and consistent, most conversions for less than 3" (76 mm) in dimension are "soft" converted to the nearest 0.1 mm; for measurements above 3" (76 mm), the "soft" value is converted to the nearest 1 mm.

Exceptions to this convention will occur as, for example, 1220 mm is commonly used for 48", as opposed to 1219 mm and 2440 mm for 96", as opposed to 2438 mm.

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WARRANTY / GUARANTEE

WARRANTY / GUARANTEE LANGUAGE

There have been repeated requests for “industry standard” warranty or guarantee language, both on the part of design professionals and woodwork manufacturers. It is not the purpose or intent of this publication to give legal advice with regard to warranties. Such language varies from governing body to governing body.

CAUTION: You might use the following language as a starting point; however, the sponsors of these standards assume no liability whatsoever from its use. It is advised that warranty language be reviewed by competent counsel for the state or province in which it is intended.

Architectural woodwork is guaranteed to be of good material and workmanship and free from defects that render it unserviceable for the use for which it is intended. Natural variations in the color or texture of the wood are not to be considered defects. The quality of architectural woodwork is safeguarded while it is in the manufacturer’s possession. To be protected by this guarantee, products must not be stored in damp warehouses or placed in moist or freshly plastered buildings. The woodwork must not be subjected to abnormal heat or dryness. Permanent-type heat and air conditioning must be in operation a sufficient length of time to “cure” the building before any woodwork or doors are delivered to the site. (Temporary-type heat sources might either add excessive moisture or create excessive dryness, depending upon the type of fuel. Thus, temporary heating can be a source of woodwork problems and should be avoided).

Adhere to the requirements in Section 13 Care and Storage for range and maintenance of relative humidity. Acclimatize delivered woodwork to the job site for a minimum of 72 hours before installation.

The manufacturer agrees, within a period of (insert year) year(s) after delivery date, to repair or replace (in the white, unfinished, if so, furnished originally) without charge any woodwork that is defective within the meaning of this guarantee. The manufacturer does not agree to be responsible for any work that was not originally performed by them. The manufacturer (insert does or does not) agree to pay charges for finishing or installing replaced woodwork. This guarantee is not effective if goods are repaired or replaced without first obtaining the manufacturer’s written consent.

CG TC

END OF PREFACE

NAAWS

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

DESIGN PROFESSIONAL GUIDE

GENERAL

- ☐ Compliance Inspection / Certification
- ☐ Sponsor Association Offerings
- ☐ Specification Guidelines
- ☐ Drawing Guidelines
- ☐ Responsibilities
- ☐ Advisories
- ☐ Recommendations
- ☐ Specification Considerations

COMPLIANCE INSPECTION / CERTIFICATION

NAAWS INSPECTION / CERTIFICATION AUTHORIZATION

NAAWS is a substantive standard and when required by specification, may not be waived. For the purpose of maintaining the reliability and integrity of work purporting to conform to NAAWS, only the NAAWS Sponsor Associations, consisting of AWMAC and Woodwork Institute, and their assignees, are authorized to inspect and certify conformance of architectural woodwork to the NAAWS.

Consequently, architectural woodwork that has been purportedly inspected or certified to conform to NAAWS by persons or entities other than the NAAWS Sponsor Associations and/or their assignees is not recognized and not in conformance with NAAWS.

NAAWS COMPLIANCE INSPECTION / CERTIFICATION

AWMAC and the Woodwork Institute are authorized to verify conformance of architectural woodwork to NAAWS. Additionally, AWMAC and the Woodwork Institute may, in their respective discretion, certify qualified individuals within their respective jurisdictions (for AWMAC, persons domiciled in Canada; for Woodwork Institute, persons domiciled in the United States), and all other jurisdictions worldwide other than the jurisdiction of the other, to verify conformance of architectural woodwork to NAAWS. Said third parties shall have met the criteria and requirements for certifying architectural woodwork as set forth and administered by AWMAC and/or the Woodwork Institute respectively.

SPONSOR ASSOCIATION OFFERINGS

NAAWS INSPECTION / CERTIFICATION AUTHORIZED SPONSOR ASSOCIATIONS offer the following tools to assist Design Professionals:

Within CANADA

Architectural Woodwork Manufacturers Association of Canada Offers:

LUNCH AND LEARN PRESENTATIONS - AWMAC's FREE lunch-and-learn presentations are tailor-made for architectural and design firms and organizations that specify architectural woodwork for any millwork project. For more information, visit awmac.com/gis/lunch-learns.

RECOGNIZED MANUFACTURERS AND INSTALLERS - AWMAC Manufacturer and Installer Members are educated industry leaders who have successfully completed AWMAC's Manufacturer Standards Questionnaire (MSQ) or Installer Standards Questionnaire (ISQ). Learn more about AWMAC members at **awmac.com/member-directory.**

ACCREDITED INSPECTORS - To verify the conformance of architectural woodwork to NAAWS in Canada, AWMAC educates, trains, and certifies qualified individuals as AWMAC Certified Inspectors.

EDUCATION - In addition to promoting the use of the North American Architectural Woodwork Standards (NAAWS) in schools, AWMAC offers educational programs to secondary and post-secondary students and educational institutions such as our Student Standards Questionnaire (SSQ), Apprenticeship and Student Cabinetmaking Contest, and Tool Bag Program. Learn more about these initiatives at **awmac.com/education.**

CONTACT AWMAC

AWMAC National | awmac.com
AWMAC British Columbia Chapter | bc.awmac.com
AWMAC Northern Alberta Chapter | nab.awmac.com
AWMAC Southern Alberta Chapter | sab.awmac.com
AWMAC Saskatchewan Chapter | sk.awmac.com
AWMAC Manitoba Chapter | mb.awmac.com
AWMAC Ontario Chapter | on.awmac.com
AWMAC Quebec Chapter | qc.awmac.com
AWMAC Atlantic Chapter | atl.awmac.com

Within UNITED STATES

Woodwork Institute Offers:

FREE AIA SEMINARS - American Institute of Architects (AIA) Continuing Education System (CES) program compliant. Current offerings and request access can be found at: woodworkinstitute.com/architectural-resources/aia-seminars

FREE CONSULTATION and/or **SPECIFICATION REVIEW** - Our Architectural Services Representatives are available to provide these services upon request. A listing of Representatives, their territories and their contact information can be found at: woodworkinstitute.com/about-us-2/about-us

ACCREDITED FABRICATORS and **INSTALLERS** - Our AMC's (Accredited Millwork Company) represent the best fabricators and installers in our industry, a listing of AMC's and their contact information can be found at: woodworkinstitute.com/membership-listing-2

GUIDE SPECIFICATIONS - NAAWS based offerings, in interactive digital format with optional quality control options can be found and downloaded at: woodworkinstitute.com/architectural-resources/specification-language

ACKNOWLEDGED PRODUCTS LISTING - If it's listed, you are assured it meets NAAWS minimum requirements. Product listings can be found at: woodworkinstitute.com/acknowledged-product-listing

QUALITY CONTROL OPTIONS

CERTIFIED COMPLIANCE PROGRAM (CCP)
MONITORED COMPLIANCE PROGRAM (MCP)
CERTIFIED SEISMIC INSTALLATION PROGRAM (CSIP)
EXPERT WITNESS SERVICE
INDEPENDENT INSPECTION SERVICE
SITE COMPLIANCE INSPECTION SERVICE
Full details are available at: woodworkinstitute.com

CONTACT THE WOODWORK INSTITUTE

For more information on our programs and services, or to be connected to your dedicated Architectural Services Representative, please visit the Woodwork Institute's website at woodworkinstitute.com or call the administrative office at (916) 372-9943.

INTERNATIONALLY North American Architectural Woodwork Standards (NAAWS) Offers:

- **CABINET DESIGN SERIES (CDS)** - Eliminate the need to include casework elevations in your architectural drawings, check out the CDS system in NAAWS "Appendix" and access the cad files at: naaws.com

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ARCHITECTURAL WOODWORK SPECIFICATION GUIDELINES

Specifications, along with the architectural drawings, are the road map for a project's success. Use of these standards will greatly reduce the text of your specifications and their development time. They eliminate the need to worry about every fabrication and material detail:

- **Budget constraints** should be communicated up front so that all parties can work together toward a successful resolution.
- **Requirements for each GRADE** are specifically defined within these standards; however, **special requirements** or **unusual applications** shall be communicated.
- **Compliance programs**, which both Sponsor Associations offer, are cost-effective and help enforce your contract documents. They ensure the performance and compliance of your architectural woodwork project's contract documents. With some, written status reports are issued during the project's progression, affording you timely notification of noncompliant findings.
- **Avoid conflict** in your specifications that might allow for interpretation other than what was envisioned:
  - Requiring compliance to Example "A" **AND** Example "B" means that the end result will be in full compliance with both.
  - Requiring compliance to Example "A" **OR** Example "B" means that compliance to either is acceptable.
- **Enforce your contract documents and their intent;** however, be open-minded to proposed changes and cost savings. Materials and their availability are in constant flux; therefore, listen and be open to change when it does not affect your design intent.
- **Pre-qualify your bidders to ensure their performance ability**. Seek out and take advantage of our industry's knowledge and experience.
- **Guide specifications** for some and/or all of the Product Sections are offered by the Sponsor Associations on an individual association basis.

ARCHITECTURAL WOODWORK MANUFACTURERS ASSOCIATION OF CANADA (AWMAC) offers Construction Specifications Canada (CSC) / Devis de Construction Canada (DCC) Master Formatted, guide specifications in digital, interactive, Word file formats.

Included in the guide specifications is wording for AWMAC's Guarantee and Inspection Service (GIS).

The Master Format sections covered by the guide specifications are:

Architectural Wood Casework – Section 06 41 00
This guide specification covers the materials and methods you would want to specify for Architectural Wood Casework.

Wood Paneling – Section 06 42 00
This guide specification covers the materials and methods you would want to specify for Wall / Ceiling Surfacing and Partitions.

Wood Trim – Section 06 46 00
This guide specification covers the materials and methods you would want to specify for Millwork.

Wood Doors – Section 08 14 00
This guide specification covers the materials and methods you would want to specify for wood or laminated plastic doors.

It is strongly recommended that you read the appropriate Sections of AWMAC's STANDARDS (NAAWS) before using any guide spec. Many of the items you would ordinarily specify are governed by your choice of Grade.

WOODWORK INSTITUTE offers CSI (Construction Specifications Institute) Master Formatted, guide specifications in digital, interactive, Word and plain text formats. Word file formats include .rtf (rich text format), .doc (Word 2003) and .docx (Word 2007). Specifically, Woodwork Institute offers guide specifications, including CCP, MCP and CSIP quality control options, for:

- Standing and Running Trim
- Wall Paneling
- Passage Doors
- Casework
- Countertops

Downloads are available at:
woodworkinstitute.com/architectural-resources/specification-language

DRAWING GUIDELINES

ARCHITECTURAL WOODWORK DRAWING GUIDELINES

For design professionals, the proper use of these standards will greatly reduce drafting time. It is not necessary to produce standard joinery details on your drawings. Requirements for each **GRADE** are defined throughout these standards; however:

SPECIAL REQUIREMENTS or **UNUSUAL APPLICATIONS** need to be noted and detailed.

STANDING AND RUNNING TRIM

- Elevations should indicate the placement of standing and running trim, including cross section details along with overall dimensions should be shown for all trim types. If a finish schedule is used in lieu of elevations, it should be comprehensive enough to clearly indicate all the above.

ARCHITECTURAL WALL AND CEILING SURFACING

- Elevations should indicate the placement of architectural wall surfacing, including each panel size, along with edge, corner, reveal, ceiling, and base treatments.
- Door and/or other woodwork matching should be so indicated. Reveals, dimensions and locations should be as specified; however, a minimum of 1/4" (6.4 mm) wide reveal is recommended. If a finish schedule is used in lieu of elevations, it should clearly indicate all of the above.

PASSAGE DOORS

- Include a comprehensive door and hardware schedule indicating the location, type, size, and handling of each door, along with applicable requirements for:
  - Pair and/or transom matching.
  - Room and/or panel matching.
  - Transom panel or Dutch door edge and/or shelf treatment.
  - Special core blocking.
  - Glass and louver cutouts.
  - Undercut tolerances.
  - Flame spread, acoustical, x-ray, and/or other ratings / requirements.
  - Hardware.
- Include elevations of typical door types to indicate glass and louver cutout sizes and locations.

CASEWORK

- Indicate **CONSTRUCTION TYPE** desired:
  - **FRAMELESS**
  - **FACE FRAME** (**NOTE,** HPL / TFL faced or CGS (Compact Laminate) casework are **NOT RECOMMENDED** nor supported by these standards).
  - These standards define and support the following**:**
    - Wood Faced - **FACE FRAME**
    - Wood Faced - **FRAMELESS**
    - HPL or TFL Faced - **FRAMELESS**
    - CGS (Compact Laminate) - **FRAMELESS**
- Elevations are not necessary if **CASEWORK DESIGN SERIES (CDS)** numbers, which can be found in the **APPENDIX,** are utilized; however, a floor plan indicating each design number selection and relative dimensions is required.
- When casework elevations are shown, they should indicate:
  - The basic overall dimensions.
  - Dimensions of items required to be of predetermined or controlled size.
  - Dimensions required for installation of items of equipment.
  - Whether sliding or hinged doors are desired, including swing if hinged.
  - Thickness of cabinet doors if other than nominal 3/4" (19.0 mm) is required.
  - If and where locks are required.
  - Required details not shown in these standards or those that involve installation of unusual equipment.
  - Shelf location and whether fixed or adjustable.
  - Material and load capacity required.
  - Type of countertop.

COUNTERTOPS

- When countertop elevations are shown, they should indicate:
  - Indicate the material requirement (Solid Wood, Veneered Wood, HPL, CGS Compact Laminate, Solid Surface, Epoxy Resin or Engineered / Natural Stone).
  - Top thickness.
  - Front edge height and profile.
  - Splash height and configuration.

SUGGESTION
RESOURCE GUIDE
CG
TC
A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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RESPONSIBILITIES & ADVISORIES

RESPONSIBILITIES

The Design Professional is responsible to clearly indicate or delineate all material, fabrication, installation, and applicable building code / regulation requirements, and:

- To evaluate the fastening methods required and modify as appropriate to ensure adequate in wall blocking and fasteners are used for the project conditions.
- To communicate or facilitate communication of design and field changes to all parties so that if dimensions are changed, each subcontractor can be held responsible for their work.
- To employ any special code or regulation requirements within their designs and schedule, Examples include:
  - ADA
  - Acoustics
  - Flame Spread
  - Seismic
  - Door performance

CONTRACT DOCUMENTS

- Design professional is responsible for contract documents which clearly detail products which will comply with local or national applicable codes and rules.
- Project specifications shall include requirements for:
  - Neutral or positive pressure compliance. If positive pressure, specify the category of door: “A” or “B” assembly.
  - Whether the smoke and draft label (S label) is validated or not.
  - Accessibility requirements.
  - Glass or glazing.
  - Pre-fitting and/or machining for hardware.
  - Pre-hanging and/or machining for weather stripping.
  - Priming, sealing and/or transparent finishing.
  - Flashing and/or metal edge guards.
  - Louvers and/or vision frames:
    - Due to various labeling requirements and warranty concerns, consult with your material supplier to determine minimum requirements.
    - Generally, fusible link louvers installed in 45-, 60-, and 90-minute fire rated doors must comply with individual fire door authorities.
    - Wood louvers are not permitted by NFPA 80 in fire rated doors.
  - Metal or wood vision panels shall be spaced a minimum distance from the edge of the door and/or other cutouts for louvers, locks, closers, or other hardware.
    - Due to various labeling requirements and warranty concerns, consult with your manufacturer to determine minimum requirements.

ADVISORIES

The following advisories are intended to assist Design Professionals in their individual project specifications by providing reminders of important woodwork norms.

RESPONSIBILITIES

- It is the responsibility of the:
  - **CONTRACTOR** to coordinate the manufacturer’s shop drawings with work of all other trades and to ensure that hold-to / guaranteed dimensions are enforced.
  - **DESIGN PROFESSIONAL** or **CONTRACTOR**, depending on contract relationships, to communicate design and field changes to all parties so that if dimensions are changed, each subcontractor can be held responsible for their work.

DIMENSIONAL CHANGE

- Wood is a hygroscopic material, and under normal use and conditions all wood products contain some moisture. Wood readily exchanges this molecular moisture with the water vapor in the surrounding atmosphere according to the existing relative humidity. In high humidity, wood picks up moisture and swells. In low humidity, wood releases moisture and shrinks.
- Lumber and sheet products, whether stand alone or laminated together, require routine and necessary care and responsibilities which must be assumed by those involved.
- As normal minor fluctuations in humidity occur, the resulting dimensional response in properly designed construction will be insignificant; however, uncontrolled relative humidity will likely cause problems.
- Architectural woodwork which is laminated together can fail due to variable rates of expansion and contraction when humidity controls are not in place. Delamination failures occur in both high and low humidity conditions and after major fluctuations.

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ADVISORIES (continued)

ADVISORIES (continued)

DIMENSIONAL CHANGE (continued)

- To reduce humidity related problems, the appropriate recommendations from Section 13 should be considered.
- Subsequent changes are not necessarily the responsibility of the manufacturer. Specifically, responsibility for dimensional change problems in wood products resulting from:
  - **DESIGN** rests with the designer / architect / specifier.
  - **IMPROPER RELATIVE HUMIDITY** exposure during site storage and installation rests with the general contractor.
  - **HUMIDITY EXTREMES** after occupancy rests with engineering and maintenance.

PHOTODEGRADATION

- Is the effect on the appearance of exposed wood faces caused by exposure to both sun and artificial light sources.
- If an entire face is exposed to a light source, it will photo-degrade somewhat uniformly and hardly be noticeable, whereas partially exposed surfaces or surfaces with shadow lines might show nonuniform photodegradation.
- Some woods, such as American Cherry, Fir and Walnut, are more susceptible than others, and extra care should be taken to protect against the effects of nonuniform photodegradation.

OXIDATION

- Is the effect on the appearance of exposed wood faces caused by exposure to atmosphere. This is analogous to browning reactions in freshly cut fruit; for instance, apples. Hardwoods can develop deep yellow to reddish brown discolorations on the surface of the wood when exposed to air immediately after sawing or peeling.
- These discolorations are especially noticeable on: Cherry, Birch, Red Alder, Sycamore, Oak, Maple, Sweet Gum
- Some species, such as Alder, Oak, Birch, and Maple, develop these discolorations during air-seasoning. A related gray stain on several varieties of Southern Oaks also appears to be oxidative in nature. Proper selection, sanding, and finishing can minimize the effects of oxidation. Care should be taken when using filler, as it might not change the same as the wood.

CHEMICAL or STAIN RESISTANCE must be specified.

- Chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping, and other factors. If such is a concern, it is recommended that:
  - Consideration be giving to any chemical or staining agents that might be used on or near the surfaces.
  - Actual samples are tested in a similar environment with those agents.
  - NAAWS has adapted SEFA's (Scientific Equipment and Fixture Association) chemical listing, methods of testing, and minimum acceptable results (see **APPENDIX**) as the minimum acceptable chemical-resistance requirement for finishes used at exposed and semi-exposed surfaces, when such is required by specification.

ABRASION RESISTANCE must be specified.

- Consider the abrasive elements that might be used on or near the surfaces. Common guidelines can be found at:
  - ASTM C501 (latest edition) as published by ASTM International, astm.org
  - ISO-4586 (latest edition) as published by the International Organization for Standardization, iso.org

FIRE RATED CORE USE

- Due to adverse reaction of some veneers laminated to fire rated (FR), ultra-low emitting formaldehyde (ULEF or NAUF), medium density fiberboard MDF - causing discoloration of the wood veneer even months after installation, major core material suppliers have issued disclaimers in the use of FR cores.
- It is strongly suggested that use of FR ULEF MDF and particleboard cores should be done after testing compatibility of adhesives, wood veneer and cores.
- Any resulting discoloration with the use of these cores may be exempt in their warranties, their use should only be considered after consultation with the board supplier.

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ADVISORIES (continued)

ADVISORIES (continued)

STRUCTURAL MEMBERS

- Such as grounds, in wall blocking, backing, furring, brackets, or other anchorage which becomes an integral part of the building's walls, floors, or ceilings, required for the installation of architectural woodwork are not furnished or installed by the architectural woodwork manufacturer or installer.

HPL CONCERNS

- **High gloss** will highlight core and surface imperfections.
- **Resurfacing** of HPL or TFL surfaces are not recommended unless done with a peel and stick adhesive especially formulated for resurfacing existing HPL or TFL surfaces.
- Except for these specialty products the application of HPL over the top of existing HPL is not permitted:
  - Experience shows that the adhesion of the new HPL to the existing surface is very low, often resulting in delamination and failure of the glue line. The application of HPL over existing TFL is strongly discouraged.
  - Some fabricators report success by aggressively sanding the melamine surface, followed by applying enough contact adhesive and adequate pressure. Delamination is a defect. The risk of delamination is high. Specify or use this procedure with care.

STAIRWORK & RAILS

- Stairs, rails, and handrail / guardrails are subject to building code requirements. Code restrictions apply to rise, run, handrail, and guardrail heights, structural strength and other issues.
- It is the responsibility of the design professional to comply with applicable building code(s) and regulations, and consultation with an experienced stair builder is strongly recommended.

CASEWORK

- **Testing -** All methods of casework and drawer joinery provided for within NAAWS 4.0 have been tested and proven compliant to the unique NAAWS requirements outlined in the **APPENDIX**. These tests are unique to NAAWS and were created specifically for the needs of architectural woodwork casework, and drawers. The test procedures and their success establish the minimum acceptable level of integrity and performance for casework / drawer joinery and in wall blocking requirements incorporated within NAAWS 4.0.

  These testing requirements meet or exceed the highest and most demanding performance levels of ANSI/AWI 0641-2019.
- **Corners** created by tall, wall, or base casework will create non usable space.
- **Finished Ends** shall be integral, not applied secondarily, except:
  - **Applied end panels** are permitted at CGS (Compact Laminate) casework and at teaching wall assemblies.
- **Base / Toe** shall be integral (constructed as an integral part of the cabinet body) or separate (constructed as a separate member) at manufacturer's choice.
- **Storage, Janitor Closet**, and/or **Utility Room Cabinets** shall be built in conformance to Custom Grade, regardless of the overall project's Grade requirement, unless specified otherwise.
- **Surfaces** behind presentation panels (such as white board or tack board) are treated as **Semi Exposed, except at**:
  - Premium Grade it is treated as **Exposed**.
- **Toe Base Height Variance** due to floor variations is not considered a defect; however:
  - Casework is required to be installed level; shimming of the toe base, not to exceed 1/2" (12.7 mm), is acceptable.
  - Floor variations exceeding 1/2" (12.7 mm) shall be corrected before cabinets are installed; however, correction of such is not the responsibility of the cabinet installer.

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ADVISORIES (continued)

CASEWORK (continued)

- **Laboratory Casework**
  - NAAWS provides minimum requirements for Laboratory Casework intended to assist design professionals in specifying custom designed wood, HPL or CGS (Compact Laminate) faced laboratory casework and matching furniture / fixture accessories with the same confidence that is provided by NAAWS for their other casework needs.
  - Requires explicit specification requirement for such within the contract documents.
  - Requiring compliance to NAAWS and its optional laboratory casework requirements shall be in concert with that of the Scientific Equipment and Furniture Association (SEFA), sefalabs.com Recommended Practices.
  - NAAWS does not address, nor make any recommendations as to, metal casework or fabrications, cylinder restraint assemblies, pipe drop enclosures, drying racks, hoods or containment units, slotted channel framing, etc.
- **Seismic Casework Installation** requires explicit specification requirement for such within contract documents, and:
  - It is the user's responsibility to confirm compatibility, acceptability and scope of these seismic engineered installation standards.
  - The Sponsor Associations shall not be responsible to anyone for the use of or reliance upon these standards, nor shall they incur any obligation nor liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon these standards.

RECOMMENDATIONS

SHOP DRAWINGS

- Digital or hard copy are required to be submitted for initial design professional review, if hard copy, two copies are required, and:
  - If the review is labeled "Approved", "Approved as Noted", "Reviewed" or "Reviewed as Noted", the design professional keeps one copy, and a marked set is returned to the manufacturer with a request for the required number of final copies.
  - If the review is labeled "Not Approved", "Reviewed as Noted", or "Revise and Resubmit" the design professional returns one set requesting correction and re-submittal. The other set is kept by the design professional to check against the re-submittal.

BUILDING RELATIVE HUMIDITY

- Maintenance of relative humidity every hour of every day, within the ranges shown in Section 13 is important. Uncontrolled extremes such as those listed below will likely cause problems:
  - Relative humidity, above or below the ranges shown.
  - Sudden changes in the allowable relative humidity, especially when it is repetitive.

LUMBER and SHEET PRODUCTS

- **Review** the GENERAL portion of Sections 03 and 04 for an overview of the characteristics and the minimum acceptable requirements of lumber and/or sheet products that might be used is strongly recommended.

FABRICATION

- Methods of fabrication can affect the final appearance, especially regarding the direction of the grain and the visibility of the glue joints. As a design professional, you may wish to specify the method; however, it is recommended that an architectural woodwork firm be consulted before making a particular selection. Mock-ups may be required to visualize the end product.

FORMALDEHYDE EMISSION REGULATIONS

- Should be carefully researched before shipping product into an unfamiliar area.

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RECOMMENDATIONS (continued)

RECOMMENDATIONS (continued)

CHECKING or WARPAGE

Can be avoided or greatly reduced in solid stock or wood veneered panels by proper environmental maintenance, such as being:

- Protected from extremes and/or major fluctuations in relative humidity and temperature.
- Finished on both surfaces to retard moisture movement in and out of the panel.
- Placed in locations that avoid directly facing air vents and/or radiant heat sources.

SHEET PRODUCTS

- **COMPOSITE CORES** (e.g., particleboard, medium-density fiberboard, agrifiber, or combination core products) are recommended in lieu of veneer core, because these cores produce a smoother exposed face, vary less in thickness, and are less likely to warp.
- **PAINT GRADE SURFACE** use of Medium Density Overlay (MDO), Medium Density Fiberboard (MDF) or Hardboard is recommended.
- **PRESELECTED FLITCHES,** when design professional has determined in advance of bid, which characteristics and/or defects are acceptable or are to be eliminated for the total face appearance, the yield and leaf width / length are directly related to this determination and therefore there may be waste / yield implications.
- **VENEER CORE** should not be used for cabinet doors because they are likely to warp.
- **ROTARY CUT SOFTWOOD** sheets with clear faces, free of patches, are not typically available.
- **Solid surface** thicknesses are nominal and may be a fabrication concern where thickness is critical. Material applications should be coordinated within the material suppliers' guidelines. Use of the same batch of materials is important at adjacent sheets as it tends to lessen color variations.
- **CGS** (Compact Laminate) performs well in high moisture, chemical resistant and heavy use applications.

PRIMING and FINISHING

- **FIELD FINISHING** should be avoided because a factory-controlled finishing environment offers a superior finished product; however, is permitted provided:
  - There is no violation of applicable codes and regulations.
  - The following statement is included in Division 09 of the contract specifications:

    "Before finishing, all exposed portions of woodwork shall have handling marks or effects of exposure to moisture removed with a thorough, final sanding over all surfaces of the exposed portions, using appropriate grit sandpaper, and shall be cleaned before applying sealer or finish."
- **CONCEALED SURFACES** of all architectural woodwork that might be exposed to moisture, such as those adjacent to exterior concrete walls, should be primed / sealed.
- **AVOID:**
  - Brush-applied finishes for architectural woodwork; they are not covered by these standards.
  - Bleached Veneers because of potential finishing problems.
- **FIRE-RETARDANT** or **RESISTANT APPLIED FINISHES** are subject to applicable codes and regulations, where permitted, the use of fire-rated cores in lieu of fire-retardant finishes is recommended.
- **PRE-FINISHED** wood panels or materials may have aesthetic and performance characteristics that meet or exceed these standards without using a listed or recommended finish system.

SINKS AT HPL COUNTERTOPS

Use of under-mount sinks is not recommended because of the potential for moisture problems, even with proper preparation and installation:

- Either self-rimming sinks or sinks with surface-mounted metal retention rings are recommended.

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SPECIFICATION CONSIDERATIONS

SPECIFICATION CONSIDERATIONS

QUALITY CONTROL

Within CANADA

- **AWMAC's GUARANTEE AND INSPECTION SERVICE (GIS)** awmac.com/gis
- **AWMAC's EXPERT OPINION SERVICE** awmac.com/gis/expert-opinions
- **AWMAC's CONSULTATION SERVICE** awmac.com/gis/consultations

Within UNITED STATES

- **WOODWORK INSTITUTE'S AMC BIDDER PRE-QUALIFICATION** woodworkinstitute.com/architectural-resources/quality-assurance
- **WOODWORK INSTITUTE'S CERTIFIED COMPLIANCE PROGRAM (CCP)** woodworkinstitute.com/services/certified-compliance-program
- **WOODWORK INSTITUTE'S MONITORED COMPLIANCE PROGRAM (MCP)** woodworkinstitute.com/services/monitored-compliance-program
- **WOODWORK INSTITUTE'S CERTIFIED SEISMIC INSTALLATION PROGRAM (CSIP)** woodworkinstitute.com/services/certified-seismic-installation-program

SPECIAL CODE or REGULATION COMPLIANCE

- If design accommodations are required, it is the responsibility of the design professional to employ such within their designs and schedules.
- **ADA** or barrier-free compliance design and requirements.
- **NON-COMPLIANT ENVIRONMENTAL CONDITIONS,** such as**:**
  - HVAC not maintained during hours of non-occupancy or on weekends.
  - Windows and doors intended to be open during occupancy.
- **WINDOW PERFORMANCE** testing, labeling and hardware.
- **FLAME SPREAD** and/or smoke development rating requirements.

SPECIAL TREATMENT

- Fire retardant treatment
- Chemical resistance
- Preservative treatment
- Moisture resistance
- Shielding from adjacent heating or cooling sources.

SOLID WOOD

- Species of wood.
- Method of cutting (plain, quarter or rift).
- Grain direction, if other than vertical.
- Special figure, which is not a function of a species grade, must be specified.
- Prohibition of finger joints, which are otherwise permitted at edges.

SPECIAL WOOD CHARACTERISTICS

- Such as sapwood, heartwood, ribbon stripe, quarter sawn, rift sawn, or vertical grain must be specifically specified, and:
  - **Natural** as a type selection of a species allows an unlimited amount of heartwood or sapwood within a face and is the default selection.
  - **Select Red** or **White** means all heartwood or sapwood, respectively for Birch and Maple.
  - **Select Brown** means all heartwood for Ash.

WOOD VENEER

- **SPECIES** of veneer.
- **METHOD OF SLICING** (plain, quarter, rotary, or rift).
- **MATCHING OF VENEER LEAVES** (book, slip, or random) and veneer leaves within a panel face (running, balance, or center-balanced).
- **SEQUENCE OF ADJACENT PANELS** (non-sequenced, sequenced, or blueprint panels and components) and end-matching.
- **GRAIN DIRECTION**.
- **FOR SELECTED FLITCHES**, the sources, gross footage of flitches, and cost per square foot.
- **SPECIAL FIGURE**, which is not a function of a species grade, must be specified.

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SPECIFICATION CONSIDERATIONS (continued)

SPECIALITY SHEET PRODUCTS

- Such as plywood with textured faces, pre-finished plywood, overlaid plywood, composition sheets, flame spread rated plywood, moisture resistant plywood, lead lined sheets, projectile resistant armor (bullet resistant), reconstituted veneers, bamboo sheets, acrylic sheets, or PVC sheets which are the products of an individual material supplier, are covered by their material supplier's specification - not by these standards.

HPL, TFL, CGS (Compact Laminate), SOLID SURFACE, EPOXY AND ENGINEERED STONE

- Material supplier.
- Thickness.
- Pattern or Color.
- Sheen.
- **PATTERN DIRECTION,** unless specified, will be manufacturers choice.
- **VEINED / SWIRLED** solid surface and other surfacing elements may have random patterns that cannot be matched at seams. Pattern breaks, pattern changes and color variations may occur, and will not be considered a defect in materials or workmanship. Extra care is required when specifying veined materials, due to extra cost, waste, and labor requirements. Material Supplier's recommendations and documentation will govern over maximum sizes, joint and seam locations and sizes; allowable mismatch, and installation requirements.

FINISHING

- Uniform color; special finishing techniques might be required (see Section 05).
- Use of **FILLER, WASH COAT**, or **STAIN.**
- **NAAWS FINISHING SYSTEM** for transparent or opaque application:
  - **SYSTEM - 1**, Lacquer, Nitrocellulose
  - **SYSTEM - 2**, Lacquer, Pre-Catalyzed
  - **SYSTEM - 3**, Lacquer, Post-Catalyzed
  - **SYSTEM - 4**, Latex Acrylic, Water-Based
  - **SYSTEM - 5**, Varnish, Conversion
  - **SYSTEM - 6**, Oil, Synthetic Penetrating (available in transparent only)
  - **SYSTEM - 7**, Vinyl, Catalyzed
  - **SYSTEM - 8**, Acrylic Cross Linking, Water-Based
  - **SYSTEM - 9**, UV Curable, Acrylated Epoxy, Polyester or Urethane
  - **SYSTEM - 10**, UV Curable, Water-Based
  - **SYSTEM - 11**, Polyurethane, Catalyzed
  - **SYSTEM - 12**, Polyurethane, Water-Based
  - **SYSTEM - 13**, Polyester, Catalyzed

GLASS

- Type
- Thickness

CLOSET and UTILITY SHELVING

- Shelf size
- Thickness
- Support system

WOOD PASSAGE DOORS

- Hardware such as kick plates, door closers, hinges, panic hardware, locks, etc.
- Stile and rail doors:
  - Stile or rail widths and/or construction.
  - Ornamental detail or joinery.
  - Panel layout and grain direction.

SPECIFICATION CONSIDERATIONS (continued)

SPECIFICATION CONSIDERATIONS (continued)

CASEWORK

- Construction type.
- Door and drawer front Interface style.
- Door and drawer front edge profile.
- Toe base finish.
- Grain or pattern direction, if other than vertical.
- Inside clearance, if critical.
- Wood casework:
  - Species of veneer.
  - Method of slicing (plain, quarter, rift, or rotary).
  - Matching of veneer leaves (book, slip, or random).
  - Matching of veneer leaves within the face of a cabinet unit.
  - Matching between doors, drawers, and adjacent panels (non-sequenced, sequenced, or blueprint).
  - End matching.
- Hardware.
- **SEISMIC INSTALLATION** (Requires explicit specification requirement for such within contract documents).
- **LABORATORY CASEWORK:** (Requires explicit specification requirement for such within contract documents):
  - Pipe chase allowance and/or removable backs behind base cabinets.
  - Removable top at countertop splash.
  - Moisture resistant base.
  - Chemical resistant finish or surfaces.

COUNTERTOPS

- Material:
  - HPL
  - CGS Compact Laminate
  - Solid Surface
  - Epoxy Resin
  - Engineered / Natural Stone
- Top thickness.
- Front edge height and profile.
- Edgebanding Type.
- Splash height and configuration.
- Countertop or splash edge profiles.
- For laboratory use, any requirements for:
  - Chemical resistance.
  - Finish.
  - Abrasion-resistance.
  - Removable splash ledger.

END OF DESIGN PROFESSIONAL GUIDE

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

USER'S GUIDE

GENERAL

- Introduction
- Sections
- Formatting

INTRODUCTION

Sponsored by the Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute (hereinafter called the Sponsor Associations), these joint standards represent the best of what these organizations have to offer in defining the minimum requirements of material and workmanship for the fabrication and installation of architectural woodwork in a climate controlled interior environment. The joint standards are based on two definitive levels of materials and workmanship: Custom and Premium Grade.

The North American Architectural Woodwork Standards (NAAWS) is both a voluntary and a definitive document, intended to communicate the requirements for satisfactory performance when referenced as part of contract documents.

NAAWS statements felt to be extremely important are highlighted to the right side by the following yellow triangular encased exclamation point:

SECTIONS IN THIS DOCUMENT are interrelated and are intended to be used together, not in part. For example, if a project specification requires compliance with Section 10, then compliance with Sections 1-5 and 13-15 along with the Appendix and Glossary as applicable are also required.

NAAWS is primarily designed for free digital distribution and use on all types of computers, tablets and smart phones in interactive PDF format. Page flow is intended as a singular column with all header / footer information and page numbers in the same location on each page. In the interactive PDF Version, all ORANGE colored URL's are hot-linked and each page uses the following navigation buttons that will take you:

- To the **CONTENT GUIDE.**
- Back one page.
- To previously viewed page.
- Forward one page.
- To the first page of each section / portion.

Additionally, each page has a horizontal link bar below the header to provides instant access to each of the documents individual sections, from the Introduction to the Glossary.

I P DP UG 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 A G

Just above the footer, there is an additional horizontal link bar that provides alphabetical access to the Glossary.

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

RESOURCE GUIDE

SUGGESTION

And finally, on the left hand side of each page there are two vertical link bars that provide access to the NAAWS Suggestion Form and the Resource Guide.

PRINT ON DEMAND (POD) versions of the standards will be available for purchase at a nominal charge; however it is a direct copy of the digital edition without any removal of the navigation buttons or links.

CONTENT GUIDE, located within the Introduction, provides interactive links through a table formatted grid to help you navigate throughout and within each section / portion of the standard.

INSIDE FRONT COVER provides information about the front cover picture and translation offerings / stipulations.

SECTIONS 01 - 15, the primary **COMPLIANCE STANDARDS** of NAAWS, are typically organized into two portions:

- **GENERAL**, including:
  - **Scope**, with listing of Inclusions and Exclusions.
  - **SURFACE DEFINITIONS**
  - **DEFAULT STIPULATIONS**
  - **GENERAL REQUIREMENTS**
- **PRODUCT**, Including:
  - **MATERIAL REQUIREMENTS**
  - **ASSEMBLY REQUIREMENTS**

INTRODUCTION (continued)

APPENDIX and **GLOSSARY** (as applicable) are also considered **COMPLIANCE STANDARDS** of NAAWS.

NON-STANDARDS PORTIONS of NAAWS, include the:

- **INTRODUCTION**
- **PREFACE**
- **DESIGN PROFESSIONAL GUIDE**
- **USER'S GUIDE**
- **RESOURCE GUIDE**

"UNLESS SPECIFIED OTHERWISE" is a significant aspect of these standards.

- When this standard is referenced in contract documents, it shall establish the minimum contractual compliance requirements for materials, fabrication, installation, and workmanship - in the absence of any specific contractual requirement to the contrary.
- If there is a conflict between the contract documents and these standards, the contract documents shall prevail.

SECTIONS

- **INTRODUCTION** - Provides Introductory and Sponsor statements, Disclaimers, an interactive Content Guide and a brief introduction of the Sponsor Associations.
- **PREFACE** - Provides information in areas of importance that should be reviewed in advance of using the standards.
- **DESIGN PROFESSIONAL GUIDE -** Provides listings of Sponsor Associations Offerings, Specification Guidelines, Drawing Guidelines, Design Professional Responsibilities, Advisories, Recommendations and Specification Considerations.
- **USER'S GUIDE -** Provides a tool to enhance your understanding of the philosophy behind the layout of these standards and its use.
- **SECTION 01 - SUBMITTALS -** Addresses minimum submittal requirements, including shop drawings, samples, etc.
- **SECTION 02 - FUNDAMENTAL REQUIREMENTS -** Is a depository of the minimum compliance requirements common to work covered by **SECTIONS 05** through **12** and **SECTION 14** of these standards unless a project's contract documents require otherwise.
- **SECTION 03 - LUMBER -** Addresses the minimum acceptable performance and appearance characteristics of lumber to be used within the standards' product Sections 06-12. This section does not attempt to establish raw material grades. It defines the minimum characteristics for lumber when used in a product governed by Sections 06-12 based on the Grade specified.
- **SECTION 04 - SHEET PRODUCTS -** Addresses the minimum acceptable performance and appearance characteristics of panel materials to be used within the standards' product Sections 06-12. This section does not attempt to establish raw material grades. It defines the minimum characteristics for panels when used in a product governed by Sections 06-12 based on the Grade specified.
- **SECTION 05 - FINISHING -** Addresses the minimum acceptable performance and appearance characteristics for factory and field finishing used within the standards' product Sections 06-12 based on the Grade specified.
- **SECTION 06 - MILLWORK -** Addresses the minimum acceptable architectural woodwork fabrication requirements for standing and running trim, door frames, window frames, sashes, blinds and shutters, screens, ornamental and miscellaneous architectural woodwork based on the Grade specified.
- **SECTION 07 - STAIRWORK & RAILS -** Addresses the minimum acceptable architectural woodwork fabrication requirements for wood stairs, integral trim, handrails and guardrails based on the Grade specified.
- **SECTION 08 - WALL / CEILING SURFACING & PARTITIONS -** Addresses the minimum acceptable architectural woodwork fabrication requirements for wood veneer, solid wood, stile and rail wood, HPL, TFL, solid surface and Compact wall / ceiling and partition surfacing based on the Grade specified.
- **SECTION 09 - PASSAGE DOORS -** Addresses the minimum acceptable architectural woodwork fabrication requirements for passage doors of flush and stile & rail construction with wood and HPL faces based on the Grade specified.
- **SECTION 10 - CASEWORK -** Addresses the minimum acceptable architectural woodwork fabrication requirements for wood, HPL, TFL and CGS (Compact Laminate) faced cabinet based on the Grade specified.

SECTIONS (continued)

SECTIONS (continued)

- **SECTION 11 - COUNTERTOPS AND HORIZONTAL SURFACES -** Addresses the minimum acceptable architectural woodwork fabrication requirements for tops, wall caps, splashes and sills of HPL, wood, solid surface, CGS Compact Laminate, epoxy resin and natural / engineered stone based on the Grade specified.
- **SECTION 12 - HISTORIC RESTORATION WORK -** Addresses the minimum acceptable architectural woodwork fabrication requirements for historic restoration work, including stripping, repairs and finishing.
- **SECTION 13 - CARE & STORAGE -** Addresses minimum care and storage (environmental condition) requirements to be maintained before, during, and after the delivery, storage, and installation of product.
- **SECTION 14 - INSTALLATION -** Addresses the minimum acceptable architectural woodwork installation requirements for Sections 05 - 12, including those for seismic casework.
- **SECTION 15 - TOLERANCES -** Addresses the minimum acceptable aesthetic tolerances for all fabricated and installed architectural woodwork.
- **APPENDIX -** Provides additional resources to the manufacturer, design professional, educator, user, or certifying organization and is only part of these standards when referenced.
- **GLOSSARY -** Provides definitions and in most cases illustrations or pictures of terms used throughout these standards.
- **RESOURCE GUIDE** - Provides additional Non-Compliance Information.

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FORMATTING

FORMATTING

Each document page, except the title page and all Section / document cover pages, includes a:

- **HEADER** providing the Title / Section #, whether the page includes compliance requirements, the pages beginning topic, and a link bar to each additional Section of the standards such as:

I P DP UG 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 A G

- **FOOTER** providing the page number, document name / edition, effective date, copyright notice, update / errata notice, and alphabetic Glossary link bar as follows:

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

Numerical sections are divided into **GENERAL** and **PRODUCT** sub-sections with text laid out in a numerical, outline presentation, wherein each requirement becomes a specific, uniquely referenced item. Additional qualifications to an item are indented to the right, immediately below, or listed subsequently:

- The **GENERAL** portion is divided into **Scope**, **Surface Definitions, Default Stipulations,** and **General Requirements** sub-sections and presented in a single column; non-table format similar to:

01.4 GENERAL REQUIREMENTS

1 The following requirements will govern unless a project's contract documents require otherwise.

2 These requirements are intended to provide a well-defined degree of control over a project's quality of submittals.

2 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

4 **GRADES AND SHOP DRAWING REQUIREMENTS ARE THE SAME FOR ALL ARCHITECTURAL WOODWORK PROJECTS REGARDLESS OF GRADE SPECIFIED.**

5 **RANGE OF COLOR** will be expected on finished wood products due to variance in wood color within the same species and even within the same sample.

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

FORMATTING (continued)

- The **PRODUCT** portion is divided into **Material Requirements** and **Assembly Requirements** sub-sections and presented in a single column; table format similar to:

01.5	LISTING REQUIREMENTS	
1	**MATERIAL LIST** will include as applicable items to be used for exposed, exposed interior, semi-exposed, and/or concealed surfaces, including:	
1	**1**	For **OPAQUE** finish, the lumber and/or veneer species.
1	**2**	For **TRANSPARENT** finish:
1 2	**1**	**LUMBER** species and cut; however, cut is not relevant for items exposed on several sides such as turnings, railings, and some moldings.

- Table headers and/or footers are used on a page-to-page basis to indicate where there is additional coverage of a topic on a previous or a subsequent page as shown below:

01.5	LISTING REQUIREMENTS	
	Continued from previous page	
5	**SECTION 9 - DOORS** will additionally include:	
5	**1**	Orientation of veneer grain and/or directional pattern, and:
5 1	**1**	Flush door construction, door core, rails, and cross band type and thickness.

4	**SECTION 8 - WALL / CEILING SURFACING & PARTITIONS** will additionally include:	
4	**1**	Cut, match, and balance of veneer leaves within the panel, and:
4 1	**1**	Match and balance of panels to adjacent panels, within an elevation, within a room, and to adjacent doors or casework
4 1	**2**	Panel core type, backing or balance sheet, and edgebanding, including thickness and material description.
4 1	**3**	Related material specifications, such as reveals, metal panels or accents, plastic resin materials, and adhesive types.
4 1	**4**	Orientation of veneer grain and/or directional pattern.
	Continued on next page	

We recommend that when referencing a line item to another that the entire number sequence is used starting with the Table heading, which in this case is "01.5". To this we would add ".4.1.4" totaling "01.5.4.1.4" to indicate the last row in the sample above.

Please also note that there is a thick grey line between the bottom green row that says, "Continued on next page" and row 01.5.4.1.4, this is to indicate the end of Item 01.5.4.

For further clarification or explanation, call your local Sponsor Association.

END OF USER'S GUIDE

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

SUBMITTALS

SECTION-01

INCLUDING: **Shop Drawings, Profile and Veneer Flitch Samples, Finish Samples, Hardware Samples**

01.1 SCOPE

1 All submittals, documents and samples.

01.2 SURFACE DEFINITIONS

1 n/a

01.3 DEFAULT STIPULATION

1 n/a

01.4 GENERAL REQUIREMENTS

1 The following requirements will govern unless a project's contract documents require otherwise.

2 These requirements are intended to provide a well-defined degree of control over a project's quality of submittals.

2 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

4 **GRADES AND SHOP DRAWING REQUIREMENTS ARE THE SAME FOR ALL ARCHITECTURAL WOODWORK PROJECTS REGARDLESS OF GRADE SPECIFIED.**

5 **RANGE OF COLOR** will be expected on finished wood products due to variance in wood color within the same species and even within the same sample.

6 **SUBMITTALS** submitted to the contractor, design professional, and/or owner for review prior to fabrication are the property of the manufacturer, and the manufacturer is not responsible for errors caused by their unauthorized use by others, and:

6.1 The manufacturer is encouraged to make technical suggestions and raise questions based upon working experience; however, changes incorporated within shop drawings, in themselves, are not a request for approval and must be specifically identified in separate written documentation within the submittal package, requesting approval of the suggested changes. Means and methods such as joinery details are not considered material changes.

7 **RESPONSIBILITY FOR:**

7.1 **CODE / REGULATION** research, and compliance direction is that of the design professional, not of the manufacturer and/or installer.

7.2 **COORDINATION** of manufacturer's shop drawing with work of all other trades (and assurance that hold-to / guaranteed dimensions are enforced) is that of the general contractor, not of the manufacturer and/or installer.

7.3 **COMMUNICATION** of design and field changes to all parties (so that if dimensions are changed, each subcontractor can be held responsible for their work), is that of the design professional or contractor, depending on prime contract relationship.

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01.4 GENERAL REQUIREMENTS (continued)

8. **SUBMITTALS**, as required, will be submitted to the contractor, design professional, and/or owner for review prior to fabrication, note project phasing if applicable, and be specifically created illustrating the project requirements; however:

8.1 **ALLOW REUSE** of portions of the Contract Documents in the creation of shop drawings, if permitted by the design professional prior to the original shop drawing submittal (copies with notations are not acceptable) and will follow the following requirements.

9 Shop drawings, listings and schedules will be submitted electronically in portable document format (PDF) or on paper. PDF and/or paper and will be dated, numbered and drafted / written in a minimum sheet size for:

9.1 Shop drawings, of 11" x 17" (279 mm x 432 mm).

9.2 Listings, schedules and passage doors drawings, of 8.5" x 11" (216 mm x 279 mm).

10 **COVER** or **TITLE SHEET** is required and will include project name and address, and as applicable the design professional firm, contractor firm, manufacturer firm, installer firm, and finisher firm along with contact information, including phone, fax and email for each, and include:

10.1 **GRADE REQUIREMENT** if same throughout, or if multiple grades apply Cover or Title Sheet will indicate the applicable Grades and scope, and the drawings will individually indicate which Grade.

10.2 **TABLE OF CONTENTS** listing all items in the woodworker's submittal package including number and title of each page, names of all material, hardware, etc., lists, description of finish samples supplied and include:

10.2.1 **SUBSTITUTION** and/or **CHANGE REQUESTS**, which will be itemized separately from the shop drawings and be submitted as soon as possible, no later than the time of shop drawing submittal, and will include the reason for the request, comparison of the requested product or design to that specified or shown including technical data from the product manufacturers and/or detailed drawings as applicable, a statement of the cost and other trades and schedule impacts.

10.2.2 **VARIANT ITEMS** listing with reference to the contract document and the standards citation, if applicable.

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01.5 LISTING REQUIREMENTS

1				**MATERIAL LIST** will include as applicable items to be used for exposed, exposed interior, semi-exposed, and/or concealed surfaces, including:
1	1			For **OPAQUE** finish, the lumber and/or veneer species.
1	2			For **TRANSPARENT** finish:
1	2	1		**LUMBER** species and cut; however, cut is not relevant for items exposed on several sides such as turnings, railings, and some moldings.
1	2	2		**VENEER** species, cut, leaf match / balance, panel match, and room match, and if specified, flitch number and supplier.
1	3			**RECLAIMED** or **RECYCLED** wood requirements and source.
1	4			**NON-TRADITIONAL** material requirements and source.
1	5			**PANEL CORE** type and thickness with any special compliance requirements, such as moisture resistant, fire retardant, NAUF (No Added Urea Formaldehyde), ULEF (Ultra Low Emitting Formaldehyde), or CARB (California Air Resources Board).
1	6			**HPL**, including applicable grade, thickness and any fire-retardant requirements.
1	7			**CGS** (Compact Laminate).
1	8			**SOLID SURFACE**, **NATURAL** or **ENGINEERED STONE**, or **EPOXY RESIN**.
1	9			**SPECIALITY WORK**, such as metal, glass, fabric, etc.
1	10			**ADHESIVE** types being used, including where they are being used with indication of the adhesive type used at detail drawings.
1	11			**HARDWARE** (except fasteners) with material suppliers specification sheet.
1	12			**FINISHING** requirements, including NAAWS System number, sheen.
2				**SECTION 6 - MILLWORK** will additionally include:
2	1			Applicable wood treatments, adhesive, and:
2	1	1		Trim schedule for each room or area, including as applicable: detail section reference and blocking requirements.
2	1	2		Column, pilaster, cornice, finial, and/or pediment schedule for each location, including opening number, location, elevation reference, and section reference.
2	1	3		Frame and screen schedule for each room or area, including as applicable: opening number and location, elevation and/or section references, opening size, handing and pre-machining requirements, hardware types and locations, and screen specifications.
3				**SECTION 7 - STAIRWORK & RAILS** will additionally include specifications.

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01.5 LISTING REQUIREMENTS

Continued from previous page

4	**SECTION 8 - WALL / CEILING SURFACING & PARTITIONS will additionally include:**		
4	**1**		Cut, match, and balance of veneer leaves within the panel, and:
4	1	**1**	Match and balance of panels to adjacent panels, within an elevation, within a room, and to adjacent doors or casework.
4	1	**2**	Panel core type, backing or balance sheet, and edgebanding, including thickness and material description.
4	1	**3**	Related material specifications, such as reveals, metal panels or accents, plastic resin materials, and adhesive types.
4	1	**4**	Orientation of veneer grain and/or directional pattern.
5	**SECTION 9 - PASSAGE DOORS will additionally include:**		
5	**1**		Orientation of veneer grain and/or directional pattern, and:
5	1	**1**	Flush door construction, door core, rails, and cross band type and thickness.
5	1	**2**	Solid or veneer edgebanding, including adhesive type and any fire rated components.
5	1	**3**	Match and/or balance of door veneer leaves, including within door face and to adjacent paneling.
5	1	**4**	Stile and rail construction, including solid or veneered with core type and thickness.
5	1	**5**	Frame schedule, including as applicable opening number and location; elevation and/or section references; handing and pre-machining requirements; hardware types and locations; glass lite openings with size, type and location; and louver openings with size, type and location.
6	**SECTION 10 - CASEWORK will additionally include:**		
6	**1**		Exposed, exposed interior, semi-exposed and interior face of cabinet door surface material (if HPL, its thickness).
6	**2**		Concealed surface materials; panel core type and thickness.
6	**3**		Edgebanding material and thickness.
6	**4**		Drawer box material and construction.
6	**5**		Cabinet hardware including:
6	5	**1**	Drawer slides or guides.
6	5	**2**	Hinges.
6	5	**3**	Adjustable shelf pins, brackets, and/or standards.
6	5	**4**	Miscellaneous finish hardware including finish.
6	**6**		Glass type(s) and thickness.
6	**7**		Special metal work and/or specialty items.
6	**8**		Adhesive type(s).
6	**9**		Other materials such as plastic resin or acrylic.
6	**10**		Orientation of veneer grain and/or directional pattern.

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01.5 LISTING REQUIREMENTS

Continued from previous page

7	**SECTION 11 - COUNTERTOPS & HORIZONTAL SURFACES** will additionally include:		
7	**1**	Panel core type and thickness.	
7	**2**	Exposed material(s) description and thickness.	
7	**3**	Backing sheet material(s) and thickness at countertop and/or splash.	
7	**4**	Adhesive type.	
7	**5**	Sealer used at sink cutouts and/or splashes.	
7	**6**	Orientation of veneer grain and/or directional pattern.	
8	**SECTION 12 - HISTORIC RESTORATION WORK** will additionally include:		
8	**1**	Items to be repaired, including description, location, original material, and material to be used in repair.	
8	**2**	Items to be replaced, including description, location, material to be used, and basis for design.	
8	**3**	Specific restoration requirements for:	
8	3	**1**	Removal.
8	3	**2**	Storage.
8	3	**3**	Repair or patching.
8	3	**4**	Replacement criteria.
8	3	**5**	Stripping.
8	3	**6**	Refinishing.
8	3	**7**	Installation.
8	3	**8**	Adhesive type(s).
8	3	**9**	Material requirements, see applicable Section(s), if not otherwise specified.

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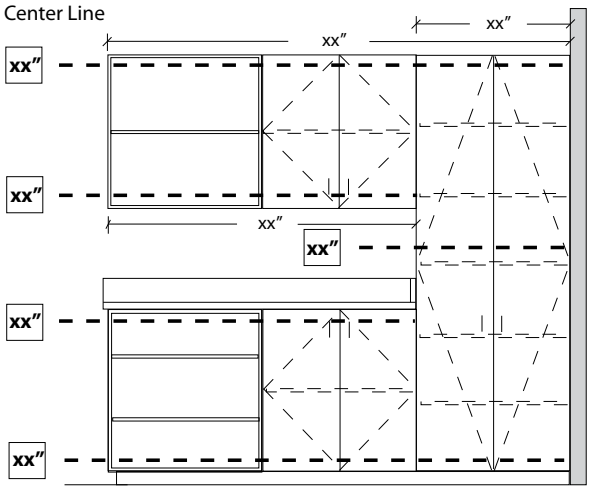
01.6 DRAWING REQUIREMENTS

1				**DRAWINGS**, digital or paper, will show each item of woodwork in plan, elevation and section as needed to clearly indicate what is provided, its location, and its method(s) of construction and attachment, including:
1	1			Provide a reference plan drawn in minimum 1/4" = 1'-0" or 1:50 metric scale showing location(s) of all work to be provided.
1	2			Plan and elevation views drawn in minimum 3/8" = 1'-0" or 1:25 metric scale.
1	3			Detailed section views drawn in minimum 1-1/2" = 1'-0" or 1:10 metric scale or as required within each product section, with sufficient detail to clearly indicate unique features in construction drawn in minimum 3" = 1'-0" or 1:5 metric scale.
1	4			Internal blocking, where required, for woodwork installation, showing center line height or horizontal location and materials, for:
1	4	1		Side or back wall runs of all countertops not otherwise supported by casework or support brackets.
1	4	2		Wall or ceiling applied surfacing and/or standing and running trim.
1	4	3		Wall mounted shelf standards.
1	4	4		Door and window frames.
1	4	5		Wood or wood product blocking is required where nails are permitted for woodwork attachment.
1	4	6		Casework by a standard convention such as: 
2				**MOCK-UPS** will be provided as required by contract documents.

Continued on next page

01.6 DRAWING REQUIREMENTS

Continued from previous page

3	**SECTION 6 - MILLWORK** will additionally include as applicable**:**		
3	**1**		Column, pilaster, cornice, finial, and/or pediment construction details minimum 1-1/2" = 1'-0" or 1:10 metric scale, except be sufficient in detail to clearly indicate unique features in construction at minimum 3" = 1'-0" or 1:5 metric scale.
3	**2**		Frame and screen members. Also, elevations, constructions details and frames in section detail with elevations as necessary for coordination with other trades.
3	**3**		**DETAILED SECTIONS** of corners, inside and outside, joints within the woodwork item and between the woodwork item and other trim, woodwork interface to elements provided by other trades, attachment, and relationships to adjacent trim members or features.
4	**SECTION 7 - STAIRWORK & RAILS** will additionally include as applicable**:**		
4	**1**		Professional engineer seal (if required of the manufacturer in the contract documents), plan and elevation views drawn at minimum 3/4" = 1'-0" or 1:20 metric scale for each rise and run of stair, and section of balustrade, and:
4	1	**1**	**DETAILED SECTIONS** of joinery, attachment, relationships to adjacent features, handrail brackets and other hardware.
4	1	**2**	**FIELD JOINT** locations of multi-length pieces of stringers, riser and treads if such pieces cannot be made out of one piece of material in length.
5	**SECTION 8 - WALL / CEILING SURFACING & PARTITIONS** will additionally include as applicable**:**		
5	**1**		Trim members, shown in profile; plan and elevation views for each panel location; and:
5	1	**1**	**DETAILED SECTIONS**, including vertical and horizontal sections; corner joints, both inside and outside; panel to panel, base, floor, crown or ceiling joint; attachment methods; and hardware.
6	**SECTION 9 - PASSAGE DOORS** will additionally include as applicable**:**		
6	**1**		Trim members, shown in profile; manufacturer's specifications or cut sheet showing construction; and:
6	1	**1**	**DETAILED SECTIONS** of construction Type, 3, 5, or 7-ply for slab doors, solid or veneered for stile and rail; panel core type and thickness; diagram of hardware blocking locations at slab door; stile and rail construction, including that of stiles, rails, raised panels, and moldings; stile and rail joints; louvers and/or lites; flame spread rating.

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01.6 DRAWING REQUIREMENTS

Continued from previous page

7	**SECTION 10 - CASEWORK** will additionally include as applicable:		
7	**1**		Reference plan, so work areas can be located in building; trim and/or scribe shown in profile; and casework, shown in plan, elevation, and section view, minimum 3/8" = 1'-0" or 1:25 metric scale, including:
7	1	**1**	Dimensions necessary to construct cabinets and provision for field dimensions.
7	1	**2**	Section of each cabinet type or configuration and details of all joinery and connections, including dimensions and attachment method of face-frame members. Details need not be drawn if properly referenced to a supplementary provided document.
7	1	**3**	Type and thickness of cabinet doors and drawer members, including heights and depths.
7	1	**4**	Shelf core, thickness and load rating.
7	1	**5**	Additional laboratory casework requirements or details.
7	1	**6**	Specification and location of special metal work and/or specialty items.
7	1	**7**	Countertops, per the specific requirements for countertops listed below.
7	1	**8**	Section details showing method of cabinet attachment to walls, floors, ceilings and any special seismic requirements.
7	1	**9**	Blocking or strapping requirements and their locations (blocking to be furnished by others) shown on cabinet elevations with dimensions off finished floor.
8	**SECTION 11 - COUNTERTOPS & HORIZONTAL SURFACES** will additionally include as applicable:		
8	**1**		Each countertop, including indication of field joints / seams, if applicable.
8	**2**		Type, quantity and layout of joint fasteners.
8	**3**		Sink size, type, mounting and location if provided to manufacturer prior to shop drawing submittal.
8	**4**		Support brackets with notation, if furnished by others.
8	**5**		In elevation view, any interface to casework and support brackets.
8	**6**		In section detail, minimum 3" = 1'-0" or 1:5 metric scale, showing: front and/or end overhang, front and/or end edge types, splash type and height, drip groove, end splash return.
8	**7**		Attachment to casework, including fastener type, quantity and layout.

Continued on next page

01.6 DRAWING REQUIREMENTS

Continued from previous page

9	**SECTION 12 - HISTORIC RESTORATION WORK** will additionally include as applicable:			
9	**1**	Previous Sections general and specific Drawing requirements will prevail for applicable product types.		
9	**2**	**DRAWINGS** will include, as applicable:		
9	2	**1**	Plan, elevation, and section views, as applicable, of applicable Section(s) above.	
9	2	**2**	Reference plan showing location of each item to be repaired or replaced.	
9	2	**3**	Relationship of items to be repaired or replaced to building and architectural features.	
9	2	**4**	Section details of:	
9	2	4	**1**	Trim members in full scale.
9	2	4	**2**	Fabrication.
9	2	4	**3**	Joinery.
9	2	4	**4**	Attachment.

SUGGESTION

RESOURCE GUIDE

CG TC

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01.7 SAMPLE REQUIREMENTS

1	**SAMPLES**, if required, for:		
1	1		**HARDWARE** will include one sample of each decorative and functional hardware item and be returned after approval.
1	2		**HPL, CGS** (Compact Laminate)**, SOLID SURFACE, NATURAL / ENGINEERED STONE, EPOXY RESIN** will include 3 each of supplier's standard sample size.
2	**SECTION 5 - FINISHING** requires**:**		
2	1		Minimum of 12" x 12" (305 mm x 305 mm) for panel products and if on lumber a minimum of 3-1/2" (89 mm) x 12" (305 mm) in length, on material representative of that to be used for the project protected from light, bear a label identifying the date, job name, the design professional, the contractor, the manufacturer, the finisher and the finish system name and number and steps used, and at:
2	1	1	**OPAQUE FINISH**, require a minimum of three (3) samples for each color selection.
2	1	2	**TRANSPARENT FINISH**, due to variance in wood color within the same species and even within the same log, a range of color will be expected on finished wood products, a minimum of three (3) samples each, indicating the color and grain to be expected for each finish selection.
3	**SECTION 12 - HISTORIC RESTORATION WORK** requires**:**		
3	1		**DESIGN PROFESSIONAL'S** written acceptance of all representative visual qualities before proceeding with work, including any altered or modified methods and techniques used, as required, to achieve intended results; acceptable samples, suitably marked, during the restoration process as a standard for work to be performed; and at:
3	1	1	**NEW WORK**, prepare and have approved samples representative of all new molding and/or decorative profiles; panel, frame, stile and rail door, railing, and/or otherwise unique architectural woodwork assemblies; typical trim joinery and casework construction; and fasteners.
3	1	2	**RESTORATION WORK**, perform sample restoration work of the following general processes on existing materials in an area directed by the design professional, of sufficient scope to demonstrate the effectiveness of proposed materials and techniques of each process such as removal of existing finishes; patching, plugging, and/or cut-ins; or refinishing.
3	2		Written **RESTORATION** and **CONSERVATION PROGRAM** be developed with a qualified wood conservator and submitted for each phase of the restoration process, outlining:
3	2	1	Where existing wood materials will need to be removed, repaired, and retained, including the means and methods to catalog the wood members, remove, crate and protect, store, and reinstall.
3	2	2	A plan for protection of surrounding materials, including interface with other trades.
3	2	3	A plan to retain toxic and/or offensive off-gassing and provide adequate ventilation.
3	2	4	A plan to date-stamp all new work in letters minimum 1/4" (6.4 mm) high noting the month, year, and the installer's or manufacturer's name in an area not exposed to view as a record of when the work was installed.

END OF SECTION 01

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

FUNDAMENTAL REQUIREMENTS

S E C T I O N - 02

GENERAL

- 02.1 Scope
- 02.2 N/A
- 02.3 N/A
- 02.4 General Requirements

PRODUCT

- 02.5 Specific Requirements

INCLUDING: **Fundamental General and Product Requirements**

02.1 SCOPE

1 Primary governance over Sections 05 - 14 as may be applicable.

02.2 SURFACE DEFINITIONS

1 n/a

02.3 DEFAULT STIPULATION

1 n/a

02.4 FUNDAMENTAL GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **SUBMITTAL REQUIREMENTS** are established within Section 01.

3 **NAAWS INSPECTION / CERTIFICATION AUTHORIZATION** - NAAWS is a substantive standard and when required by specification, may not be waived. For the purpose of maintaining the reliability and integrity of work purporting to conform to NAAWS, only the NAAWS Sponsor Associations, consisting of AWMAC and Woodwork Institute, and their assignees, are authorized to inspect and certify conformance of architectural woodwork to the NAAWS.

Consequently, architectural woodwork that has been purportedly inspected or certified to conform to NAAWS by persons or entities other than the NAAWS Sponsor Associations and/or their assignees is not recognized and not in conformance to NAAWS.

4 **NAAWS COMPLIANCE INSPECTION / CERTIFICATION -** AWMAC and the Woodwork Institute are authorized to verify conformance of architectural woodwork to NAAWS. Additionally, AWMAC and the Woodwork Institute may, in their respective discretion, certify qualified individuals within their respective jurisdictions (for AWMAC, persons domiciled in Canada; for Woodwork Institute, persons domiciled in the United States), and all other jurisdictions worldwide other than the jurisdiction of the other, to verify conformance of architectural woodwork to NAAWS. Said third parties shall have met the criteria and requirements for certifying architectural woodwork as set forth and administered by AWMAC and/or the Woodwork Institute respectively.

5 **LUMBER & SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 3 and 4, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Section 5, unless otherwise modified herein, and:

6.1 **PRIMING** is not the responsibility of the manufacturer and/or installer, unless the material is furnished pre-finished.

6.2 **FACTORY FINISHING** when specified, requires concealed surfaces be factory sealed.

02.4 FUNDAMENTAL GENERAL REQUIREMENTS (continued)

7 **CARE & STORAGE REQUIREMENTS** are established within Section 13.

8 **INSTALLATION REQUIREMENTS** are established within Section 14.

9 **TOLERANCES** are established within Section 15.

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **CUSTOM GRADE** is the primary quality characterized herein and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation. **PREMIUM GRADE** however, may be specified for use in those areas of a project where the highest level of quality, materials, workmanship, and installation is required, or be mixed with within a single project creating limitless design possibilities with a wide variety of lumber / veneer species, TFL, HPL, factory finishes, and profiles.

12 **PREMIUM GRADE** requirements are provided as an exception and highlighted in separate table rows colored in gold.

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02.5 FUNDAMENTAL PRODUCT REQUIREMENTS

1	**THESE REQUIREMENTS** govern over all work covered by Sections 05 through 14 of these standards unless a project's contract documents require otherwise.				
2	**EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.				
3	**INTERIOR, NON-CLIMATE-CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.				
4	**IF REQUIRED**, the following must be so specified: **Special Building Code or Regulations** **Special ADA** requirements **Seismic Fabrication** and/or **Installation** **Flame Spread Rating** **Fire Retardant Coatings** **Rated Fire Door Assemblies**				
5	**AESTHETIC REQUIREMENTS** only apply to surfaces visible after fabrication and installation, and when judged from a normal viewing stance and facility lighting, are considered compliant if inconspicuous when viewed from 48" (1220 mm), and:				
5	**P**	**Premium Grade**	When viewed from 24" (610 mm).		
5	**1**	**EXPOSED, EXPOSED EXTERIOR, EXPOSED INTERIOR** and **SEMI-EXPOSED SURFACES** are all visible surfaces.			
5	**2**	**CONCEALED SURFACES** are non-visible surfaces and are not covered by the aesthetic requirements.			
6	**SHEET PRODUCTS** (Section 04) requires:				
6	**1**	**PANEL GRAIN** or **PATTERN DIRECTION** to be manufacturer's choice unless otherwise specified in the contract documents or required within Product Sections 06 - 12.			
6	**2**	**WOOD VENEER** to be, at:			
6	2	**1**	**OPAQUE FINISH**, a closed grain species of manufacturer's choice, of Grade - **"C"**, except at:		
6	2	1	**P**	**Premium Grade**	It will be Grade **- "B"**.
6	2	**2**	**TRANSPARENT FINISH** the species specified, and if not specified, be of manufacturer's choice, plain sliced, book matched, a minimum of 0.020" (0.5 mm) nominal thickness that precludes show through of core, of Grade - **"A"**, except at:		
6	2	2	**P**	**Premium Grade**	It will be Grade **- "AA"**.
6	**3**	**FIGURE,** which is not a function of a species grade, be specified in the contract document, and if required:			
6	3	**1**	**CATHEDRAL** type figure, be achieved by a single component in "AA" Face Grade or the split heart method in Face Grades "A - D" with each half subject to the minimum component width requirements for Face Grade "B."		

Continued on next page

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

02.5 FUNDAMENTAL PRODUCT REQUIREMENTS

Continued from previous page

6		**SHEET PRODUCTS** (Section 04) requires:	
6	4	**HPL BACKED WOOD VENEERS** to be specified or otherwise approved.	
6	5	**BALANCED PANELS** to be free from warp that affect serviceability for the intended purpose.	
6	6	**BLUEPRINT MATCHING,** when specified**, requires** wall / ceiling panels, passage doors and casework to be single sourced.	
7		**LUMBER** (Section 03) permits or requires:	
7	1	**BOARD LENGTHS,** required to be longer than those lengths listed in Section 03, be glued and joined for length or furnished in multiple pieces.	
7	2	**PLAIN SAWN** be furnished, unless otherwise specified.	
7	3	**PERMITS HEARTWOOD** or **SAPWOOD** in Ash, Birch, Maple, Cherry, Elm, and Red Oak; however, if only heartwood or sapwood is desired, it will be so specified.	
7	4	**RADIUS MOLDINGS** be laminated or formed, pre shaped, or machined to the radius and fabricated in the longest practical lengths to minimize installer joints.	
7	5	**SMOOTHNESS** be in conformance to Section 15 **KCPI** and **SANDING** tests.	
8		**NATURAL** and **MANUFACTURED DEFECTS** are permitted in accordance with Sections 3 and 4 or if covered by adjoining members or otherwise concealed when installed, and:	
8	1	Exposed and semi exposed surfaces will be defect free of items such as scuff marks or dance scratches unless stated otherwise in these standards	
9		**COLOR & GRAIN MATCH FOR TRANSPARENT FINISH** of veneer to veneer, solid wood to solid wood, and veneer to solid wood requires one species for the entire project, adhesive used for laminating will be selected for color to avoid a prominent glue line, lumber (including block segments or veneer of laminated material) and sheet products are to be compatible in color and grain, except at:	
9	P	**Premium Grade**	Sheet products will be well matched for color and grain; with sheet products compatible in color with solid stock, and adjacent sheet products well matched for color and grain.
10		**RECLAIMED** or **RECYCLED WOOD** or **NON-TRADITIONAL MATERIALS** are not subject to the product compliance requirements of NAAWS and will be as agreed to between owner / design professional and the woodwork manufacturer / installer.	

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02.5 FUNDAMENTAL PRODUCT REQUIREMENTS

Continued from previous page

11		**INSET SOLID WOOD EDGING**, when used, will have a similar moisture content as panel core and to minimize telegraphing be calibrated with panel core thickness prior to being securely glued or laminated to faces.
12		**SPECIFIC PROFILE** and/or **JOINERY**, if required, will be so specified or drawn.
13		**WHERE MULTIPLE OPTIONS** are permitted, it will be of manufacturer's choice unless specified otherwise.
14		**WARP** which can be eliminated (held flat and straight) with normal attachment is permitted.
15		**GLUING** or **LAMINATION** will be in accordance with the Adhesive Guidelines within the **APPENDIX**, and delamination or separation will not occur, and adhesive bleed through or residue is not permitted on exposed surfaces.
16		**SCRIBE** or **CAULKING** of architectural woodwork to other architectural woodwork is required.
17		**CUTOUTS**, including those for electrical and plumbing, will be neatly cut and properly sized by the installer provided needed templates are furnished prior to installation, and unless otherwise required by the material supplier, in:
17	1	**HPL**, **TFL** or **CGS (Compact Laminate**) will have a minimum 1/8" (3.2 mm) radius at inside corners.
17	2	**SOLID SURFACE, EPOXY,** and **NATURAL / ENGINEERED STONE** will have a minimum 1/4" (6.4 mm) radius at inside corners.
18		**HPL** or **TFL** sheet products will be free of exposed fasteners at exposed exterior surfaces.
19		**HARDWARE** will be installed per material suppliers' instructions and adjusted for smooth operation, using all furnished fasteners and fasteners' provisions and when fastener provisions are countersunk, fasteners will be countersunk.
20		**GLASS** will conform to applicable codes and regulations; these standards will not supersede such regulations, and:
20	1	Clear will be minimum 1/8" (3.2 mm) thickness for glazing elements, and minimum 1/4" (6.4 mm) thickness for shelves.
20	2	Obscure type, will be roll figured sheet glass, 1/8" (3.2 mm) in thickness, of standard pattern set with the smooth side facing the exterior or corridor, unless otherwise specified.
20	3	Wire type, whether polished or obscure, will be 1/4" (6.4 mm) in thickness.
20	4	Beveled type, will be set with the bevel to the exposed face.
20	5	Leaded or zinc came installation, will have the individual light carefully fitted together with came intersections neatly soldered and the whole assembly watertight. Reinforcing bars will be provided where necessary.
20	6	Insulating units will have the panes hermetically sealed and separated by a dehydrated air space.

Continued on next page

02.5 FUNDAMENTAL PRODUCT REQUIREMENTS

Continued from previous page

21			**FACTORY & FIELD** workmanship, such as gaps, flushness, flatness, etc. will be judged by the allowable tolerances for the applicable grade established within Section 15 (Tolerances), which includes test Tolerances for:
21	1	A	Chip Out
21	2	B	Overlap
21	3	C	Over Machined
21	4	D	Show-Through / Telegraphing
21	5	E	Squareness of Panel
21	6	F	Flatness of Panel / Door
21	7	G	Flushness, Fabrication
21	8	H	Flushness, Installation
21	9	I	Flushness at Butted Edges
21	10	J-1	Flushness at Adjoining Fixed Panels
21	11	J-2	Flushness at Adjoining Casework Doors, Drawers and False Fronts
21	12	K	Reveals at Adjoining Panels / Doors
21	13	L	Gaps at Butted Surface Edges in Same Core Member
21	14	M	Gaps at Mitered or Butted Surfaces
21	15	N	Gaps at Mitered or Butted Edges
21	16	O	Gaps at Parallel Members
21	17	P	Gaps at Installation
21	18	Q	Gaps / Reveals at Cabinet Door / Drawers
21	19	R	Edge Alignment at Cabinet Door / Drawers
22			**FIRST CLASS WORKMANSHIP COMPLIANCE IS ALWAYS REQUIRED WITHIN THESE STANDARDS.**

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END OF SECTION 02

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

LUMBER

SECTION-03

INCLUDING: **Hardwood** and **Softwood Lumber**

03.1 SCOPE

1 All lumber used for the fabrication or production of architectural woodwork is covered by these standards.

03.2 SURFACE DEFINITIONS

1 **EXPOSED, EXPOSED-EXTERIOR, EXPOSED-INTERIOR** and/or **SEMI-EXPOSED** lumber surfaces include all surfaces visible after fabrication or installation.

03.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED** all visible lumber surfaces after fabrication and installation will be Custom Grade aesthetic requirements.

03.4 GENERAL REQUIREMENTS

1 The following requirements are intended to provide a well-defined degree of control over a project's quality of materials and workmanship and will govern unless a project's contract documents require otherwise.

2 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

3 **GRADE CLASSIFICATIONS** of **CUSTOM,** and **PREMIUM** are used within these standards only in reference to the acceptable quality of workmanship, material, and/or installation in a completed architectural woodwork product covered in sections 06 - 12, and:

3.1 The use of these classifications is only for the purpose of identifying lumber that can be used in finished products meeting those Grades.

3.2 These classifications are not intended to be used as Grades of raw material or to judge a stand-alone board or member.

4 **LUMBER ASSOCIATION REQUIREMENTS** will not be used, since even their highest Grades permit defects unacceptable in architectural woodwork and are not based upon the use of the whole piece, but rather on a percentage of the piece, and:

4.1 The appearance of a piece in the end product is of importance, not whether it is cut from a larger board that contained defects that can be eliminated.

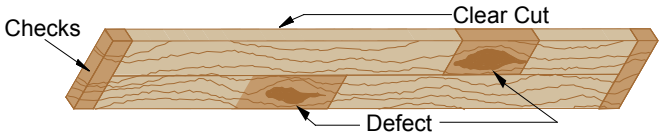

Figure: 03-001

5 **LUMBER REQUIREMENTS**

5.1 Apply only to surfaces visible after manufacture and installation.

5.2 Establish criteria as to which, if any, natural or seasoning characteristics are acceptable.

5.3 Limit the extent of characteristics that will be permitted based on an exposed area's size and proximity of characteristics to one another.

5.4 Do not apply to special varieties of species that display unusual characteristics desirable for aesthetic and design reasons.

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03.4 GENERAL REQUIREMENTS (continued)

6 **CONTRACT DOCUMENTS** will govern if in conflict with these standards.

7 **TRANSPARENT FINISHES** in lumber may not be accepted in the same manner as veneer; special finishing techniques might be required (see Section 05).

8 **RECONSTITUTED LUMBER** is typically manufactured from sliced wood veneer, which in some cases are dyed, then glued up and sawn in such a manner as to imitate dimensional lumber species. Use of these engineered products are permitted only if specified and/or approved by the owner and/or design professional.

9 **SPECIAL** and **UNUSUAL CHARACTERISTICS**, for example **HICKORY, PECAN, BUTTERNUT, KNOTTY PINE, WORMY CHESTNUT, PECKY CYPRESS, and WATTLED WALNUT** are not covered by these standards, and:

9.1 If their use is contemplated, individual ranges of characteristics and availability should be investigated and specified accordingly.

10 **MAHOGANY** is a generic term and should not be specified without further definition, such as American or African Mahogany and varies in color from a light pink to a light red, reddish brown to a golden brown or yellowish tan, and:

10.1 Figure or grain includes plain sliced, plain to broken stripe, mottled, fiddleback, swirl and crotches.

10.2 It can turn darker or lighter in color after machining.

10.3 **PHILIPPINE MAHOGANY** will permit the use of Lauan, Tanguile, and other natural Philippine species, and:

10.3.1 **LAUAN, TANGUILE**, and other species are native to the Philippine Islands and are sometimes referred to as Philippine Mahogany; however, they are not a true Mahogany.

11 **CHERRY, WALNUT**, and certain other hardwood species are required to be specified by origin, such as American Cherry, American Walnut, or English Brown Oak, because they can be significantly different in color and texture.

12 **INDUSTRY PRACTICES:**

12.1 Lumber is furnished plain sawn unless otherwise specified.

12.2 Lumber is dimensioned in the following conventional order: thickness, followed by width (across the grain direction), followed by length (with the grain direction); see drawing.

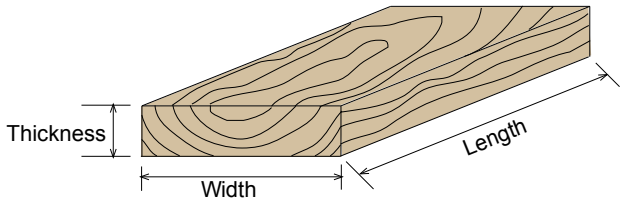

Figure 03-002

12.3 **GLUING** for thickness and/or width is permitted as governed by these standards; see drawing

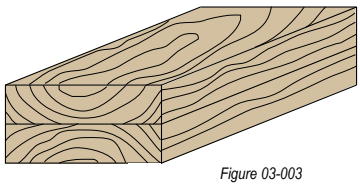

Figure 03-003

Figure 03-004

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03.4 GENERAL REQUIREMENTS (continued)

13 **AESTHETIC** Grade requirements apply only to exposed and semi-exposed surfaces visible after installation.

14 **VISIBLE SURFACES** will be sound lumber, free of decay, shake, pith, wane and warp.

15 **BOARD**, refers to a piece of lumber before gluing for width or thickness.

16 **MEMBER**, refers to a piece of lumber after gluing for width or thickness.

17 **SPECIAL CHARACTERISTICS**, such as sapwood, heartwood, ribbon stripe, quarter sawn, rift sawn, and vertical grain are not required unless specified.

18 **MOISTURE CONTENT** of lumber will follow Section 13 Care and Storage.

19 **GLUING** for thickness and/or width is permitted as governed by this Section and requires a **RIGID GLUE** line in accordance with the **ADHESIVE GUIDELINES** within the **APPENDIX** and **DELAMINATION** or **SEPARATION** will not occur.

20 **SPECIES NOT** specifically **COVERED** by these standards will be as agreed to between design professional and manufacturer / installer as to length requirements and size / exposed area of permitted natural characteristics.

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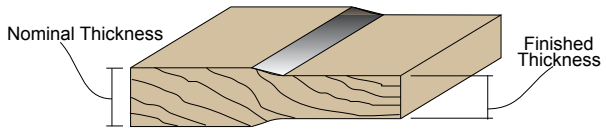
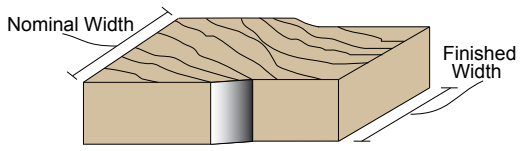
Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

03.5 MATERIAL REQUIREMENTS

1		Minimum **FINISHED THICKNESS** of S4S and profiled members:		
1	1	Nominal 4/4 or 1" (25.4 mm)	=	11/16" (17.5 mm).
1	2	Nominal 5/4 or 1-1/4" (31.8 mm)	=	15/16" (23.8 mm).
1	3	Nominal 6/4 or 1-1/2" (38.1 mm)	=	1-3/16" (30.2 mm).
1	4	Nominal 8/4 or 2" (50.8 mm)	=	1-1/2" (38.1 mm).
1	5	Nominal 10/4 or 2-1/2" (63.5 mm)	=	2" (50.8 mm).
1	6	Nominal 12/4 or 3" (76 mm))	=	2-1/2" (63.5 mm).
1	7	Nominal 16/4 or 4" (102 mm)	=	3-1/2" (89 mm).
1	8			
2		Minimum **FINISHED WIDTH** of S4S and profiled members:		
2	1	Nominal 1" (25.4 mm)	=	11/16" (17.5 mm).
2	2	Nominal 2" (50.8 mm)	=	1-1/2" (38.1 mm).
2	3	Nominal 3" (76 mm)	=	2-1/2" (63.5 mm).
2	4	Nominal 4" (102 mm)	=	3-1/2" (89 mm).
2	5	Nominal 5" (127 mm)	=	4-1/4" (108 mm).
2	6	Nominal 6" (152 mm)	=	5-1/4" (133 mm).
2	7	Nominal 8" (203 mm)	=	7" (178 mm).
2	8	Nominal 10" (254 mm)	=	9" (229 mm).
2	9	Nominal 12" (305 mm)	=	11" (279 mm).
2	10	Nominal 12+" (305+ mm)	=	1" (25.4 mm) less than nominal size.
2	11			
3		When **MACHINE SANDED** (portable or fixed), a reduction of 1/32" (0.8 mm) off the above thicknesses or widths is permitted.		

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03.6 HARDWOOD REQUIREMENTS

1 **APPLYING** to only the following species:

ALDER	**MAPLE, HARD & SOFT**
ASH	**OAK, RED**
BIRCH	**OAK, WHITE**
CHERRY, American	**POPLAR**
LAUAN	**TEAK**
MAHOGANY, American or African	**WALNUT, American**

1 **1** For **SPECIES NOT LISTED**, length requirements and size / exposed area of permitted natural characteristics will be as agreed to between owner / design professional and manufacturer / installer.

2 **GLUING** for **THICKNESS** is permitted when finished dimensions exceed 1-1/16" (27.0 mm).

3 **GLUING for WIDTH** is permitted when:

3 **1** Finished dimensions exceed 6" (152 mm), or:

3 1 **1** 4-1/4" (108 mm) at Rift sawn White / Red Oak; quarter sawn White / Red Oak, Maple, and Walnut; and select White / Red Birch, White Ash, Alder and Cherry.

3 **2** Direction of the end grain of boards glued for width will be alternated, see example:

3 2 **1**

4 Lumber of the **SAME SPECIES** but of **DIFFERENT ORIGINS** will not be mixed on a project (example: American and European Cherry).

5 If only the generic term **MAHOGANY** is specified, it will mean African or American Mahogany.

6 Specifications calling for **PHILIPPINE MAHOGANY** will permit the use of Lauan, Tanguile, and other natural Philippine species of wood.

7 **OAK, RIFT GRAIN**, will permit twenty-five percent (25%) of the exposed surface area of each board to contain medullary ray flake.

8 **NATURAL ASH, BIRCH**, and **MAPLE** will permit both sapwood and heartwood in any board.

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03.6 HARDWOOD REQUIREMENTS

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9	**MAXIMUM LENGTH** required for finish thickness up to 1-1/2" (38.1 mm):		
9	1	Boards required to be longer than those listed may be glued and joined for length or furnished in multiple pieces.	
9	2	**ALDER:**	
9	2	1	<2" (50.8 mm) in finish width = 9'-10" (2997 mm).
9	2	2	2" (50.8 mm) to <3" (76 mm) in finish width = 8'-10" (2692 mm).
9	2	3	3" (76 mm) to <4" (102 mm) in finish width = 7'-6" (2286 mm).
9	2	4	4" (102 mm) to <5" (127 mm) in finish width = 6'-10" (2083 mm).
9	2	5	5" (127 mm) or wider is not usually available.
9	3	**ASH, NATURAL:**	
9	3	1	<3" (76 mm) in finish width = 15'-6" (4724 mm).
9	3	2	3" (76 mm) to <4" (102 mm) in finish width = 14'-6" (4420 mm).
9	3	3	4" (102 mm) to <5" (127 mm) in finish width = 13'-6" (4115 mm).
9	3	4	5" (127 mm) to <6" (152 mm) in finish width = 12'-6" (3810 mm).
9	3	5	6" (152 mm) to <7" (178 mm) in finish width = 10'-6" (3200 mm).
9	3	6	7" (178 mm) <9" (229 mm) in finish width = 8'-10" (2692 mm).
9	4	**ASH, SELECT BROWN** or **WHITE:**	
9	4	1	<4" (102 mm) in finish width = 11'-6" (3505 mm).
9	4	2	4" (102 mm) to <6" (152 mm) in finish width = 10'-6" (3200 mm).
9	4	3	6" (152 mm) to <7" (178 mm) in finish width = 8'-6" (2591 mm).
9	4	4	7" (178 mm) to <9" (229 mm) in finish width = 7'-10" (2388 mm).
9	5	**BIRCH, NATURAL:**	
9	5	1	<4" (02 mm) in finish width = 10'-6" (3200 mm).
9	5	2	4" (02 mm) to <6" (152 mm) in finish width = 9'-6" (2896 mm).
9	5	3	6" (152 mm) to <7" (178 mm) in finish width = 8'-6" (2591 mm).
9	5	4	7" (178 mm) to <9" (229 mm) in finish width = 7'-6" (2286 mm).
9	6	**BIRCH, SELECT RED** or **WHITE:**	
9	6	1	<4" (102 mm) in finish width = 9'-6" (2896 mm).
9	6	2	4" (102 mm) to <6" (152 mm) in finish width = 8'-6" (2591 mm).
9	6	3	6" (152 mm) or finish wider is not usually available.

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03.6 HARDWOOD REQUIREMENTS

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9			**MAXIMUM LENGTH** required for finish thickness up to 1-1/2" (38.1 mm) (continued)
9	**7**		**CHERRY, AMERICAN:**
9	7	**1**	<4" (102 mm) in finish width = 9'-10" (2997 mm).
9	7	**2**	4" (102 mm) to <6" (152 mm) in finish width = 8'-10" (2692 mm).
9	7	**3**	6" (152 mm) to <7" (178 mm) in finish width = 7'-10" (2388 mm).
9	7	**4**	7" (178 mm) or finish wider is not usually available.
9	**8**		**LAUAN; MAHOGANY, AMERICAN or AFRICAN:**
9	8	**1**	<9" (229 mm) in finish width = 15'-10" (4826 mm).
9	**9**		**MAPLE, NATURAL:**
9	9	**1**	<3" (76 mm) in finish width = 14'-10" (4521 mm).
9	9	**2**	3" (76 mm) to <4" (102 mm) in finish width = 13-10" (4216 mm).
9	9	**3**	4" (102 mm) to <5" (127 mm) in finish width = 12'-10" (3912 mm).
9	9	**4**	7" (178 mm) to <7" (178 mm) in finish width = 10'-10" (3302 mm).
9	9	**5**	7" (178 mm) to <9" (229 mm) in finish width = 8'-10" (2692 mm).
9	**10**		**MAPLE, WHITE:**
9	10	**1**	<2" (50.8 mm) in finish width = 14'-10" (4521 mm).
9	10	**2**	2" (50.8 mm) to <4" (102 mm) in finish width = 11'-10" (3607 mm).
9	10	**3**	4" (102 mm) to <5" (127 mm) in finish width = 10'-10" (3302 mm).
9	10	**4**	5" (127 mm) to <7" (178 mm) in finish width = 8'-10" (2692 mm).
9	10	**5**	7" (178 mm) or wider is not usually available.
9	**11**		**OAK, RED** or **WHITE** (except Rift or Quarter Sawn):
9	11	**1**	<2" (50.8 mm) in finish width = 14'-10" (4521 mm).
9	11	**2**	2" (50.8 mm) to <4" (102 mm) in finish width = 13'-10" (4216 mm).
9	11	**3**	4" (102 mm) to <6" (152 mm) in finish width = 11'-10" (3607 mm).
9	11	**4**	6" (152 mm) to <7" (178 mm) in finish width = 9'-10" (2997 mm).
9	11	**5**	7" (178 mm) <9" (229 mm) in finish width = 8'-10" (2692 mm).

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03.6 HARDWOOD REQUIREMENTS

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9			**MAXIMUM LENGTH** required for finish thickness up to 1-1/2" (38.1 mm) (continued)
9	12		**OAK, RED** or **WHITE, RIFT** or **QUARTER SAWN:**
9	12	1	<3" (76 mm) in width = 13'-10" (4216 mm).
9	12	2	3" (76 mm) to <4" (102 mm) in finish width = 11'-10" (3607 mm).
9	12	3	4" (102 mm) to <6" (152 mm) in finish width = 9'-10" (2997 mm).
9	12	4	6" (152 mm) to <7" (178 mm) in finish width = 7'-10" (2388 mm).
9	12	5	7" (178 mm) or wider is not usually available.
9	13		**POPLAR:**
9	13	1	<6" (152 mm) in finish width = 15'-10" 4826 mm).
9	13	2	6" (152 mm) to <7" (178 mm) in finish width = 13'-10" (4216 mm).
9	13	3	7" (178 mm) to <9" (229 mm) in finish width = 12'-10" (3912 mm).
9	14		**TEAK:**
9	14	1	<2" (50.8 mm) in finish width = 9'-6" (2896 mm).
9	14	2	2" (50.8 mm) to <4" (102 mm) in finish width = 8'-6" (2591 mm).
9	14	3	4" (102 mm) to <7" (178 mm) in finish width = 7'-6" (2286 mm).
9	14	4	7" (178 mm) or wider is not usually available.
9	15		**WALNUT, AMERICAN:**
9	15	1	<2" (50.8 mm) in finish width = 9'-6" (2896 mm).
9	15	2	2" (50.8 mm) to <4" (102 mm) in finish width = 8'-6" (2591 mm).
9	15	3	4" (102 mm) to <5" (127 mm) in finish width = 7'-6" (2286 mm).
9	15	4	5" (127 mm) to <6" (152 mm) in finish width = 5'-6" (1676 mm).
9	15	5	6" (152 mm) or wider is not usually available.

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03.6 HARDWOOD REQUIREMENTS

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10	**OPAQUE FINISH** allows:				
10	1	**NOT MATCHING** for **COLOR** when glued for thickness or width.			
10	2	**NATURAL CHARACTERISTICS** if they are inconspicuous after two coats of finish.			
10	3	**FILLING** of checks, splits, or other open characteristics which is the responsibility of the architectural woodwork manufacturer.			
10	4	**QUANTITY, SPACING** and **DISTRIBUTION** of **NATURAL CHARACTERISTIC** in any one board's exposed face of **NONE** in any face smaller than 300 square inches (193,548 square mm), with **ONE** permitted for each additional 150 square inches (96,774 square mm), subject to a maximum of **FOUR** in any board, and **NO** knots, pitch streaks, or pitch pockets within 24" (610 mm) of one another, except at:			
10	4	**P**	**Premium Grade**	**NONE** in any face smaller than 400 square inches, with **ONE** permitted for each additional 200 square inches (129,032 square mm), subject to a maximum of **THREE** in any board, and **NO** knots, pitch streaks, or pitch pockets within 36" (9144 mm) of one another.	
10	5	The following **NATURAL CHARACTERISTICS:**			
10	5	1	**BARK POCKET**, none.		
10	5	2	**BIRDSEYE**, sound - unlimited.		
10	5	3	**BIRDSEYE**, checked and filled - unlimited.		
10	5	4	**BURL**, sound < 1" (25.4 mm) in diameter, except at:		
10	5	4	**P**	**Premium Grade**	< 3/4" (19.0 mm) in diameter.
10	5	5	**CHECK**, filled < 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:		
10	5	5	**P**	**Premium Grade**	< 1/32" (0.8 mm) wide x 4" (102 mm) long.
10	5	6	**HONEYCOMB**, none.		
10	5	7	**KNOT**, sound and tight < 5/8" (15.9 mm) in diameter, except at:		
10	5	7	**P**	**Premium Grade**	< 3/8" (9.5 mm) in diameter.
10	5	8	**KNOT**, checked and filled < 1/2" (12.7 mm) in diameter, except at:		
10	5	8	**P**	**Premium Grade**	< 1/4" (6.4 mm) in diameter.
10	5	9	**KNOT**, open and filled < 1/4" (6.4 mm) in diameter, except at:		
10	5	9	**P**	**Premium Grade**	< 1/8" (3.2 mm) in diameter.

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03.6 HARDWOOD REQUIREMENTS

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10	**OPAQUE FINISH** allows (continued)				
10	**5**	The following **NATURAL CHARACTERISTICS** (continued)			
10	5	**10**		**MINERAL STAIN**, unlimited	
10	5	**11**		**PATCH,** ≤ 1-1/2" (38.1 mm) wide x 3-1/2" (89 mm) long.	
10	5	**12**		**PITCH POCKET** or **STREAK**, filled < 1/16" (1.6 mm) wide x 6" (152 mm) long or 1/8" (3.2 mm) wide x 4" (102 mm) long, except at:	
10	5	12	**P**	**Premium Grade**	< 1/16" (21.6 mm) wide x 3" (76 mm) long or 1/8" (3.2 mm) wide x 2" (50.8 mm) long.
10	5	**13**		**SAPWOOD**, unlimited.	
10	5	**14**		**SHAKE**, filled ≤ 1/8" (3.2 mm) wide x 3" (76 mm) long, except at:	
10	5	14	**P**	**Premium Grade**	≤ 1/16" (1.6 mm) wide x 2" (50.8 mm) long.
10	5	**15**		**SPLIT**, filled ≤ 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:	
10	5	15	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
10	5	**16**		**STICKER BOARD DISCOLORATION**, unlimited.	
10	5	**17**		**WORMHOLE**, filled ≤ 1/16" (1.6 mm) in diameter, except at:	
10	5	17	**P**	**Premium Grade**	No worm holes permitted.

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03.6 HARDWOOD REQUIREMENTS

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11	**TRANSPARENT FINISH** allows:				
11	**1**	**MATCHING**, when glued for thickness or width or when veneered construction is utilized, will be Compatible for color and grain, except at:			
11	1	**P**	**Premium Grade**	Well matched for color and grain.	
11	**2**	**FILLING** of checks, splits, or other open characteristics is the responsibility of the finisher.			
11	**3**	**QUANTITY, SPACING** and **DISTRIBUTION** of **NATURAL CHARACTERISTIC** in any one board's exposed face of **THREE** with **NO** knots, pitch streaks, or pitch pockets within 36" (914 mm) of one another, except at:			
11	3	**P**	**Premium Grade**	**TWO** with **NO** knots, pitch streaks, or pitch pockets within 48" (1220 mm) of one another.	
11	3	**1**	For: **ALDER** **ASH,** Natural **BIRCH,** Natural **LAUAN** **MAHOGANY, American or African** **MAPLE**, Hard or Soft, Natural **POPLAR** **RED & WHITE OAK** **TEAK** None in any face smaller than 400 square inches (258,064 square mm), with **ONE** permitted for each additional 150 square inches (96,774 square mm), except at:		
11	3	1	**P**	**Premium Grade**	None in any face smaller than 600 square inches (387,096 square mm), with **ONE** permitted for each additional 200 square inches (129,032 square mm).
11	3	**2**	For: **ASH**, Select Brown **BIRCH**, Select Red & White **MAPLE**, Select White None in any face smaller than 350 square inches (225,806 square mm), with **ONE** permitted for each additional 150 square inches (96,774 square mm), except at:		
11	3	2	**P**	**Premium Grade**	None in any face smaller than 500 square inches (322,580 square mm), with **ONE** permitted for each additional 200 square inches (129,032 square mm).
11	3	**3**	For: **CHERRY**, American **RED & WHITE OAK,** Rift / Quarter Sawn **WALNUT**, American None in any face smaller than 200 square inches (129,032 square mm), with **ONE** permitted for each additional 100 square inches (64,516 square mm), except at:		
11	3	3	**P**	**Premium Grade**	None in any face smaller than 300 square inches (193,548 square mm), with **ONE** permitted for each additional 150 square inches (96,774 square mm).

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03.6 HARDWOOD REQUIREMENTS

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11	**TRANSPARENT FINISH** allows (continued)				
11	**4**	The following **NATURAL CHARACTERISTICS**:			
11	4	**1**			**BARK POCKET**, none.
11	4	**2**			**BIRDSEYE**, sound - unlimited.
11	4	**3**			**BIRDSEYE**, checked ≤ 10% of face, except at:
11	4	3	**P**	**Premium Grade**	None.
11	4	**4**			**BURL**, sound ≤ 1" (25.4 mm) in diameter, except at:
11	4	4	**P**	**Premium Grade**	≤ 1/2" (12.7 mm) in diameter.
11	4	**5**			**CHECK,** ≤ 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:
11	4	5	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
11	4	**6**			**HEARTWOOD**, in Select White Ash, Birch, and Maple - none.
11	4	**7**			**HONEYCOMB**, none.
11	4	**8**			**KNOT**, sound and tight ≤ 1/4" (6.4 mm) in diameter, except at:
11	4	8	**P**	**Premium Grade**	≤ 1/8" (3.2 mm) in diameter.
11	4	**9**			**KNOT**, checked ≤ 1/4" (6.4 mm) in diameter, except at:
11	4	9	**P**	**Premium Grade**	None.
11	4	**10**			**KNOT**, open - none.
11	4	**11**			**MINERAL STAIN,** ≤ 10% of face, except at:
11	4	11	**P**	**Premium Grade**	None.
11	4	**12**			**PATCH,** ≤ 1-1/2" (38.1 mm) wide x 3-1/2" (89 mm) long, and inconspicuous from 36" (914 mm), except at:
11	4	12	**P**	**Premium Grade**	None.
11	4	**13**			**PITCH POCKET** or **STREAK** - none
11	4	**14**			**SAPWOOD**, in unselected species - unlimited.
11	4	**15**			**SAPWOOD**, in select Red Birch and Brown Ash - none.
11	4	**16**			**SAPWOOD** in Cherry, and Walnut ≤ 10% of face, except at:
11	4	16	**P**	**Premium Grade**	≤ 5% of face.
11	4	**17**			**SHAKE,** none.
11	4	**18**			**SPLIT,** ≤ 1/16" (2 mm) wide x 6" (152 mm) long, except at:
11	4	18	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
11	4	**19**			**STICKER BOARD DISCOLORATION,** none.
11	4	**20**			**WORM HOLE**, filled ≤ 1/16" (1.6 mm) in diameter, except at:
11	4	20	**P**	**Premium Grade**	None.

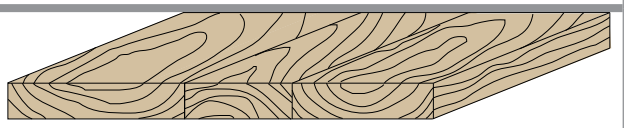
SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

03.7 SOFTWOOD REQUIREMENTS

1	**APPLYING** only to the following species: **CEDAR, WESTERN RED** **PINE, SUGAR** **PINE, PONDEROSA** **HEMLOCK** **FIR, DOUGLAS** **REDWOOD**			
1	1	For **SPECIES NOT LISTED**, length requirements and size / exposed area of permitted natural characteristics will be as agreed to between owner / design professional and manufacturer / installer.		
2	**GLUING** for **WIDTH** is permitted when finished dimensions exceed 7" (178 mm) and direction of the end grain of boards glued for width will be alternated. 			
3	**GLUING** for **THICKNESS** is permitted when finished dimensions exceed 1-1/2" (38.1 mm).			
4	**VERTICAL GRAIN** will have a minimum of 5 growth rings per inch at exposed surfaces of each individual board.			
5	**MAXIMUM LENGTH** required for thickness up to 1-1/2" (38.1 mm):			
5	1	**DOUGLAS FIR, HEMLOCK, & WESTERN RED CEDAR:**		
5	1	1	4" to 8" (102 mm to 203 mm) in width = 15'-8" (4775 mm).	
5	1	2	10" (254 mm) in width = 13'-8" (4166 mm).	
5	1	3	12" (305 mm) is not usually available.	
5	2	**PONDEROSA** or **SUGAR PINE** 4" to 12" (102 mm to 305 mm) in width = 15'-8" (4775 mm).		
5	3	**REDWOOD** 4" to 12" (102 mm to 305 mm) in width = 19'-8" (5994 mm).		
5	4	**BOARDS** required to be **WIDER** than those listed above may be glued for width.		
5	5	**BOARDS** required to be **LONGER** than those listed as available above may be glued and joined or furnished in two pieces for length at the option of the manufacturer.		
6	**OPAQUE FINISH** allows:			
6	1	**NATURAL CHARACTERISTICS** only if they are inconspicuous after two coats of finish are applied.		
6	2	**FILLING** of checks, splits, or other open characteristics which is the responsibility of the architectural woodwork manufacturer.		
6	3	**QUANTITY, SPACING** and **DISTRIBUTION** of **NATURAL CHARACTERISTIC** in any one board's exposed face of **NONE** in any face smaller than 400 square inches (258,064 square mm), with **ONE** permitted for each additional 150 square inches (96,774 square mm) subject to **FOUR** in any board and **NO** knots, pitch streaks, or pitch pockets within 24" (610 mm) of one another, except at:		
6	3	**P**	**Premium Grade**	**NONE** in any face smaller than 600 square inches (387,096 square mm), with **ONE** permitted for each additional 200 square inches (129,032 square mm) subject to **THREE** in any board and **NO** knots, pitch streaks, or pitch pockets within 36" (914 mm) of one another.

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03.7 SOFTWOOD REQUIREMENTS

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6	**OPAQUE FINISH** allows (continued)				
6	**4**	The following **NATURAL CHARACTERISTIC:**			
6	4	**1**	**BARK POCKET**, none.		
6	4	**2**	**BIRDSEYE**, sound - unlimited.		
6	4	**3**	**BIRDSEYE,** checked and filled - unlimited.		
6	4	**4**	**BURL**, sound ≤ 1" (25.4 mm) in diameter, except at:		
6	4	4	**P**	**Premium Grade**	≤ 3/4" (19 mm) in diameter.
6	4	**5**	**CHECK**, filled ≤ 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:		
6	4	5	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
6	4	**6**	**HONEYCOMB**, none.		
6	4	**7**	**KNOT**, sound, tight, ≤ 5/8" (15.9 mm) in diameter, except at:		
6	4	7	**P**	**Premium Grade**	≤ 3/8" (9.5 mm) in diameter.
6	4	**8**	**KNOT**, checked and filled ≤ 1/2" (12.7 mm) in diameter, except at:		
6	4	8	**P**	**Premium Grade**	≤ 1/4" (6.4 mm) in diameter.
6	4	**9**	**KNOT**, open and filled < 1/4" (6.4 mm) in diameter, except at:		
6	4	9	**P**	**Premium Grade**	< 1/8" (3.2 mm) in diameter.
6	4	**10**	**MINERAL STAIN,** unlimited.		
6	4	**11**	**PATCH,** ≤ 1-1/2" (38.1 mm) wide x 3-1/2" (89 mm) long.		
6	4	**12**	**PITCH POCKET** or **STREAK,** < 1/16" (1.6 mm) wide x 6" (152 mm) long or 1/8" (3.2 mm) wide x 4" (102 mm) long, except at:		
6	4	12	**P**	**Premium Grade**	< 1/16" (1.6 mm) wide x 3" (76.2 mm) long or 1/8" (3.2 mm) wide x 2" (50.8 mm) long.
6	4	**13**	**SAPWOOD**, unlimited.		
6	4	**14**	**SHAKE**, filled ≤ 1/8" (3.2 mm) wide x 3" (76.2 mm) long, except at:		
6	4	14	**P**	**Premium Grade**	≤ 1/16" (1.6 mm) wide x 2" (50.8 mm) long.
6	4	**15**	**SPLIT**, filled ≤ 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:		
6	4	15	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
6	4	**16**	**STICKER BOARD DISCOLORATION**, unlimited.		
6	4	**17**	**WORM HOLES,** filled ≤ 1/16" (1.6 mm) in diameter, except at:		
6	4	17	**P**	**Premium Grade**	None.

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03.7 SOFTWOOD REQUIREMENTS

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7	**TRANSPARENT FINISH** allows:				
7	1	**MATCHING**, when glued for thickness or width or when veneered construction is utilized, will be Compatible for color and grain, except at:			
7	1	**P**	**Premium Grade**	It will be matched for color and grain.	
7	2	**FILLING** of checks, splits, or other open characteristics which is the responsibility of the finisher.			
7	3	**QUANTITY, SPACING** and **DISTRIBUTION** of **NATURAL CHARACTERISTIC** in any one board's exposed face of none in any face smaller than 600 sq. in. (387,096 sq. mm), with **ONE** permitted for each additional 300 sq. in. (193,548 sq. mm) subject to a maximum of **THREE**, with **NO** knots, pitch streaks, or pitch pockets within 36" (914 mm) of one another, and:			
7	3	**P**	**Premium Grade**	None in any face smaller than 900 sq. in. (580,644 sq. mm), with **ONE** permitted for each additional 400 sq. in. (258,064 sq. mm) subject to **TWO**, with NO knots, pitch streaks, or pitch pockets within 48" (1220 mm) of one another.	
7	4	The following **NATURAL CHARACTERISTICS**:			
7	4	1	**BARK POCKET**, none.		
7	4	2	**BIRDSEYE**, sound, unlimited.		
7	4	3	**BIRDSEYE**, checked ≤ 10% of face, except at:		
7	4	3	**P**	**Premium Grade**	None.
7	4	4	**BURL**, sound ≤ 5/8" (16 mm) in diameter, except at:		
7	4	4	**P**	**Premium Grade**	≤ 1/2" (12.7 mm) in diameter.
7	4	5	**CHECK** ≤ 1/16" (1.6 mm) wide x 6" (152 mm) long, except at:		
7	4	5	**P**	**Premium Grade**	≤ 1/32" (0.8 mm) wide x 4" (102 mm) long.
7	4	6	**HONEYCOMB**, none.		
7	4	7	**KNOT**, sound and tight ≤ 1/2" (12.7 mm) in diameter, except at:		
7	4	7	**P**	**Premium Grade**	≤ 1/4" (6.4 mm) in diameter.
7	4	8	**KNOT**, checked ≤ 1/4" (6.4 mm) in diameter, except at:		
7	4	8	**P**	**Premium Grade**	None.
7	4	9	**KNOT**, open - none.		
7	4	10	**MINERAL STAIN,** ≤ 10% of face, except at:		
7	4	10	**P**	**Premium Grade**	None.
7	4	11	**PATCH,** ≤ 1-1/2" (38.1 mm) wide x 3-1/2" (89 mm) long, and inconspicuous from 36", except at:		
7	4	11	**P**	**Premium Grade**	None.

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03.7 SOFTWOOD REQUIREMENTS

Continued from previous page

7	**TRANSPARENT FINISH** allows (continued)				
7	4	The following **NATURAL CHARACTERISTICS** (continued)			
7	4	12	**PITCH POCKET** or **STREAK** ≤ 1/16" (1.6 mm) wide x 3" (76 mm) long or 1/8 (3.2 mm) wide x 2" (50.8 mm) long, except at:		
7	4	12	**P**	**Premium Grade**	None.
7	4	13	**SAPWOOD**, in unselected species - unlimited.		
7	4	14	**SAPWOOD**, in all heart Redwood - none.		
7	4	15	**SHAKE,** ≤ 1/16" (1.6 mm) wide x 2" (50.8 mm) long, except at:		
7	4	15	**P**	**Premium Grade**	None.
7	4	16	**SPLIT,** ≤ 1/32" (0.8 mm) wide x 4" (102 mm) long, except at:		
7	4	16	**P**	**Premium Grade**	None.
7	4	17	**STICKER BOARD DISCOLORATION,** none.		
7	4	18	**WORM HOLES,** ≤ 1/16" (1.6 mm) in diameter, except at:		
7	4	18	**P**	**Premium Grade**	None.

END OF SECTION 03

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

SHEET PRODUCTS

SECTION - 04

INCLUDING: Hardwood and Softwood Veneer, HPL, CPL, CGS (Compact Laminate), TFL, Balance & Backer Sheets, Medium and High-Density Overlays, Hardboard, Particleboard, MDF, Solid Surface, Epoxy Resin, and Natural / Engineered Stone

04.1 SCOPE

1 Sheet products used for the fabrication or production of architectural woodwork covered by these standards.

04.2 SURFACE DEFINITIONS

1 **EXPOSED, EXPOSED-EXTERIOR, EXPOSED-INTERIOR** and/or **SEMI-EXPOSED** sheet product surfaces include all surfaces visible after fabrication or installation.

04.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED** all visible lumber surfaces after fabrication and installation will be Custom Grade aesthetic requirements.

04.4 GENERAL REQUIREMENTS

1 The following requirements are intended to provide a well-defined degree of control over a project's quality of materials and workmanship and will govern unless a project's contract documents require otherwise.

2 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

3 **GRADE CLASSIFICATIONS** of **CUSTOM** and **PREMIUM** are used within these standards only in reference to the acceptable quality of workmanship, material, and/or installation in a completed architectural woodwork product. This material section deals with sheet products, which are a component of finished products covered in Product Sections 06 - 12.

3.1 The use of these Grade classifications herein is only for the purpose of identifying sheet products that can be used in finished products meeting those Grades. These Grade classifications are not intended to be used as Grades of raw material or to judge a stand-alone sheet.

4 **PANEL ASSOCIATION GRADES**, by themselves, should not be used for architectural woodwork, because even their highest grades might permit unacceptable defects, and the appearance of a piece in the end product is of primary importance, not whether it is cut from a larger sheet that contained characteristics which can be eliminated.

5 **SHEET PRODUCT REQUIREMENTS** apply only to surfaces visible after manufacture and installation, establish criteria as to which, if any, natural characteristics are acceptable, limit the extent of characteristics that will be permitted based on an exposed area's size and the proximity of characteristics to one another, and do not apply to special varieties of species that display unusual characteristics desirable for aesthetic and design reasons.

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Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

04.5 MATERIAL REQUIREMENTS

1				**AESTHETIC** grade rules apply only to exposed and semi-exposed surfaces visible after installation.
2				**PANEL GRAIN DIRECTION** is indicated by its size listing; for example, 48" x 96" (1220 mm x 2440 mm) means the grain direction runs with the 96" (2440 mm) direction, whereas a 96" x 48" (2440 mm x 1220 mm) panel's grain direction runs with the 48" (1220 mm) dimension.
3				**SPECIES** not covered by these standards will be as agreed to between owner / design professional and manufacturer / installer as to length requirements and size / exposed area of permitted natural characteristics.
4				Additional **REQUIREMENTS,** if so specified:
4	1			**FIRE RETARDANT CORE** will be color tinted or otherwise documented.
4	2			**MOISTURE RESISTANT CORE** will be color tinted or otherwise documented.
4	3			**WATERPROOF ADHESIVE.**
5				**PANEL LAYUP** will be for interior use, unless specified otherwise; will be constructed with an odd number of plies; and:
5	1			Requires **BALANCED CONSTRUCTION** of faces, thickness, and moisture content to produce a warp-free panel suitable for its intended use.
5	2			Requires a **RIGID GLUE** line in accordance with the **ADHESIVE GUIDELINES** within the **APPENDIX**, and **DELAMINATION** or **SEPARATION** will not occur.
5	3			Requires **CORES** of veneer, lumber, particleboard, MDF, or a combination thereof, however, veneer core is not permitted at cabinet door or drawer front components and wall / ceiling panels, and:
5	3	1		At **VENEER CORE**, the individual ply thickness may vary from 1/100" (0.3 mm) to 1/4" (6.4 mm), and at:
5	3	1	1	**EUROPEAN MULTI-PLY**, will consist of equally thick sheets of cross banded, void free hardwood veneer with a minimum of 11 plies (layers) for ¾" (19 mm) and 13 plies for 1" (25.4 mm). 12/01/2021
5	4			Prohibits **SURFACE DISTORTIONS** or **DEFECTS**, such as bubbling, blistering, cracking, crazing or ridges in the exposed face veneer.
5	5			Prohibits **TELEGRAPHING** that exceeds 0.004" (0.10 mm) in any 3" (76 mm) span, except as indicated in Section 9 for wood doors, and **VENEER WITH BACKER SHEET** will be balanced with appropriate balance material if required.
5	6			**DISCOLORATION** of veneers caused by use of **FR ULEF/NAUF** particleboard and MDF cores is not the responsibility of the millworker or board suppliers.
5	7			**LAMINATION OVER EXISTING HPL** or **TFL** is not permitted, unless such product and adhesive is specifically formulated by its material supplier for such application.
6				**THICKNESS TOLERANCE** will be equal to:
6	1			+0/-1/32" (0/-0.8 mm) for nominal thickness less than 1/4" (6.4 mm).
6	2			+0/-3/64" (0/-1.2 mm) for nominal thickness of 1/4" (6.4 mm) or greater.

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04.5 MATERIAL REQUIREMENTS

Continued from previous page

7		**SQUARENESS TOLERANCE** will be equal to:
7	1	3/32" (2.4 mm) for panels 48" x 48" (1220 mm x 1220 mm) or greater.
7	2	1/16" (1.6 mm) for panels smaller than 48" x 48" (1220 mm x 1220 mm).
8		**STRAIGHTNESS TOLERANCE** will be equal to:
8	1	1/16" (1.6 mm) for edges less than 96" (2440 mm) in length.
8	2	3/32" (2.4 mm) for edges 96" (2440 mm) or greater.
9		**CATHEDRAL** type figure will be achieved by:
9	1	A single component in "AA" Face Grade.
9	2	The split heart method in Face Grades "A - D", and each half of a split heart will be subject to the minimum component width requirements for Face Grade "B."

04.6 HARDWOOD VENEER REQUIREMENTS

1	**APPLIES** to the following common species:				
	ALDER, Western Red	**BIRCH**		**MAHOGANY**, American or African	**OAK,** Red & White
	ANIGRE	**CHERRY**		**MAPLE**	**SAPELE**
	ASH	**HICKORY**		**PECAN**	**WALNUT**
	BEECH	**LAUAN**		**POPLAR**	
2	**CORE** will be manufacturer's choice.				
3	**VENEER** will be of sufficient thickness so as not to permit show through of cross banding after sanding or finishing, and:				
3 1	**DISCOLORATION** of veneers caused by specified use of FR ULEF/NAUF particleboard and MDF cores is not the responsibility of the millworker or board suppliers.				
4	**EDGES** of multi-leaf faces will appear parallel.				
5	**BACKING SPECIES** will be manufacturer's choice.				
6	**FIGURE** is not a function of a species grade, and special requirements will have been so specified.				
7	**NATURAL** allows unlimited heartwood and/or sapwood within a face.				
8	**RIFT GRAIN OAK** will allow up to twenty-five percent (25%) of the exposed surface area to contain medullary ray flake.				
9	**VENEER FACE GRADES** range from **AA** through **C**, based on appearance features with fewer natural characteristics permitted in higher grades:				
9 1	**SPECIES**, other than those listed above may be covered by these standards, provided the specifier and manufacturer agree to a species grouping as a basis for the evaluation and grade of the unlisted species.				
9 2	**SPECIALTY GRADE** veneers such as Wormy Chestnut, Birds Eye Maple, and English Brown Oak have unusual decorative features and are considered a specialty Grade. Veneers in which the features of greatest significance are unusual characteristics that are not covered within grades AA-C will be as agreed upon between specifier and manufacturer.				
9 3	**VARIANCE** from these standards might invalidate certain criteria and tests, such as strong color contrasts will occur when rotary natural Birch leaves are slip matched.				
10	**VENEER FACE GRADE REQUIREMENTS** for:				
10 1	**OPAQUE FINISH** requires close grain hardwood (excluding Alder, Western Red), Grade - **C**, except at:				
10 1 P	**Premium Grade**	Requires Grade - **B.**			
10 2	**TRANSPARENT FINISH** (including Alder, Western Red), Grade - **A**, except at:				
10 2 P	**Premium Grade**	Requires Grade - **AA**. (excluding Alder, Western Red)			
10 3	At **PRESELECTED FLITCHES,** the following characteristics are applicable only when design professional has determined, in advance of bid, which characteristics and/or defects are acceptable or are to be eliminated for the total face appearance.				
11	**SUMMARY TABLE of ALLOWABLE WOOD VENEER FACE GRADE CHARACTERISTICS** based on data generated and published by the Decorative Hardwoods Association, ANSI/HPVA HP-1 - 2020, available at decorativehardwoods.org. The NAAWS Committee acknowledges and thanks DHA for its important contributions to the architectural woodwork industry, and:				
11 1	**TERMINOLOGY DEFINITIONS** can be found in the Glossary and/or Resource Guide.				
11 2	The table is not intended to create a face grade, **It is** intended only to establish the **ACCEPTABLE REQUIREMENTS** and/or **CHARACTERISTICS** of exposed surfaces after the woodwork is completed or installed**.**				

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04.6 HARDWOOD VENEER REQUIREMENTS

Continued from previous page

11 Summary Table (continued)

Table: 04-001 - **ALLOWABLE WOOD VENEER FACE GRADE CHARACTERISTICS**

Grade Designation	ASH, BEECH (American or European), BIRCH, MAPLE, and POPLAR				MAHOGANY (American or African), ANIGRE, MAKORE, and SAPELLI				RED OAK and WHITE OAK				PECAN and HICKORY [b, c, d]			
	AA	A	B	C	AA	A	B	C	AA	A	B	C	AA	A	B	C
Veneer Cut - Plain Sliced, Quarter, or Rotary Cut	Yes				Yes				Yes				Yes			
Sapwood - Allowance	46			Yes	No			Yes	No	49	50	Yes	Yes			
Heartwood - Allowance	47			Yes	Yes				Yes				Yes			
Color Streak or Spot - Allowance	Slight	48	Yes		Slight		59	Yes	Yes				Yes			
Color Variation - Allowance	47	47	Yes		Slight		58	Yes	Slight		Yes		Yes			
Color Contrast at Joints, Sharp - Allowance	01			Yes	01			Yes	01			Yes	01			Yes
Type of Matching allowed: Book Matched	Yes	Yes	30	n/a	Yes	Yes	30	n/a	Yes	Yes	30	n/a	Yes	Yes	30	n/a
Slip Matched	30	30	30		30	30	30		30	30	30		30	30	30	
Pleasing Matched	n/a	n/a	Yes		n/a	n/a	Yes		n/a	n/a	Yes		n/a	n/a	Yes	
Nominal Minimum Width of Face Components [a]																
Plain Sliced	06	05	03	02	06	05	03	02	06	05	03	02	06	05	03	02
Quarter Sliced	03	03	03		03	03	03		03	03	03		03	03	03	
Rotary Sliced	06	05	04		06	05	04		06	05	04		06	05	04	
Burls & Pin Knots, Small, Conspicuous - Frequency	14	12	10	02	14	12	10	02	13	11	09	02	07	08	02	
Combined Average Number	17	19	20		17	19	20		17	20	11		22	23		
Burls, Conspicuous, Maximum Size	26	27	28	02	26	27	28	02	26	23	28	02	26	27	28	02
Pin Knots, Conspicuous - Frequency	No	15	13	02	No	15	13	02	No	12	10	02	10	08	02	
Average Number		16	18			16	18			19	20		17	23		
Maximum, Overall Size / Dark Part Size		29	29			29	29			29	29		29	29		
3 Knots, Sound and Repaired, Scattered - Frequency	No		15	13	No		15	13	No		15	13	No		15	12
Combined Average Number			16	18			16	18			16	18			16	19
Maximum Size of Sound			27	28			27	28			23	28			13	28
Maximum Size of Repaired			25	28			25	28			25	28			25	28
Average Number of Repaired			15	15			15	15			15	15			15	15
Mineral Streak - Allowance	52	Slight		Yes	No	Slight	59	Yes	No	52	34	Yes	Slight		Yes	
Bark Pocket - Allowance	No		31	32	No		31	32	No		31	32	No		32	33
Worm Track - Allowance	Slight		53	Yes	No		Slight	Few	No		Sl	Fe	No	Sl	Few	Yes
Vine Mark - Allowance	Slight			Yes	Slight		Yes		No	Slight	Yes		Slight	59	Yes	
Cross Bar - Allowance	Slight		Yes		59		Yes		No	Slight			Slight	59	Yes	
Rough Cut / Ruptured Grain - Allowance	No		Slight	35	No		Slight		No		Slight		No		Slight	35
Splits, Tapering, Hairline, Blended and Repaired	36	37	38	39	36	37	38	39	36	37	38	39	36	37	38	39
Repair - Allowance	40	41	42	Yes	40	41	42	Yes	40	41	42	Yes	40	41	42	Yes
Unfilled Worm Hole - Allowance	No				No			24	No				No			
Quartered - Restrictions	43				43				51				43			
Rift and Comb Grain - Restrictions									44 & 45							
Cherry Gum Spots and Streaks - Allowance													54		55	
Bird Peck - Allowance													N0	Slight	Yes	Yes

NUMBER CODES ON FOLLOWING PAGE

Open splits, joints, bark pockets, and doze are not permitted in above grades.

[a] Outside components will be different size to allow for edge trim loss and certain types of matching.

[b] For Pecan, Hickory, Walnut and Cherry, conspicuous pin knots mean sound knots 1/4" (6.4 mm) or less in diameter with dark centers larger than 1/16" (1.6 mm). Blending pin knots are sound knots1/4" (6.4 mm) or less in diameter with dark centers 1/16" (1.6 mm) or less and are permitted in all Grades.

[c] For Pecan and Hickory, to achieve a more rustic appearance, bird peck shall be specified.

[d] For Pecan and Hickory, knife marks may occur in these denser species

Continued on next page

04.6 HARDWOOD VENEER REQUIREMENTS

Continued from previous page

11 Summary Table (continued)

Table: 04-001 - **ALLOWABLE WOOD VENEER FACE GRADE CHARACTERISTICS** (continued)

Grade Designation	WALNUT and CHERRY [e, f] AA	A	B	C	ALDER (Western Red) A
Veneer Cut - Plain Sliced, Quarter, or Rotary Cut	Y				
Sapwood - Allowance 12/01/2021	No	Yes [e]	Yes [e]	Yes	Yes
Heartwood - Allowance	Yes				Yes
Color Streak or Spot - Allowance	Slight		Yes		Slight
Color Variation - Allowance	Slight		Yes		Slight
Color Contrast at Joints, Sharp - Allowance	01			Yes	n/a
Type of Matching allowed: Book Matched	Yes	Yes	30	n/a	Yes [g]
Slip Matched	30	30	30		n/a
Pleasing Matched	n/a	n/a	Yes		30
Nominal Minimum Width of Face Components [a]					03
Plain Sliced	06	05	03	02	n/a
Quarter Sliced	03	03	03		n/a
Rotary Sliced	06	05	04		n/a
Burls & Pin Knots, Small, Conspicuous - Frequency	12	09	08	02	
Combined Average Number	18	11	23		
Burls, Conspicuous - Maximum Size	26	27	28	02	28
11 3 Pin Knots, Conspicuous - Frequency	14	10	07		
Average Number	17	20	22	02	Yes
Maximum, Overall Size / Dark Part Size	29	29	29		
Knots, Sound and Repaired, Scattered - Frequency			15	13	
Combined Average Number			16	18	
Maximum Size of Sound	No		27	28	56 & 57
Maximum Size of Repaired			25	28	
Average Number of Repaired			15	15	
Mineral Streak - Allowance	Slight		Yes		
Bark Pocket - Allowance	No		31	32	No
Worm Track - Allowance	No		Sl	Few	
Vine Mark - Allowance	Slight	Oc	Yes		
Cross Bar - Allowance	Slight	Oc	Yes		
Rough Cut / Ruptured Grain - Allowance	No		Slight		No
Splits, Tapering, Hairline, Blended and Repaired	36	37	38	39	37 on panel ends
Repair - Allowance	40	41	42	Yes	42
Unfilled Worm Hole - Allowance	No				
Quartered - Restrictions	43				

[a] Outside components will be different size to allow for edge trim loss and certain types of matching.
[e] For Walnut and Cherry, sapwood is permitted in Grades A and B; however, the percentage shall be agreed upon between buyer and seller.
[f] For Walnut and Cherry, open splits, joints, bark pockets,and doze is not permitted.
[g] The general color of individual components shall not be significantly lighter or darker than that of other components in the face.

Number Codes

01 - Yes, if Slip, Plank, or Random matched
02 - No Limit
03 - 3" (76 mm)
04 - 4" (102 mm)
05 - 5" (127 mm)
06 - 6" (152 mm
07 - 1 per 1 sq. ft (11 per 1 m^2)
08 - 2 per 1 sq. ft (22 per 1 m^2)
09 - 1 per 1-1/3 sq. ft (8 per 1 m^2)
10 - 1 per 2 sq. ft (6 per 1 m^2)
11 - 1 per 2-2/3 sq. ft (4 per 1 m^2)
12 - 1 per 3 sq. ft (4 per 1 m^2)
13 - 1 per 4 sq. ft (3 per 1 m^2)
14 - 1 per 5 sq. ft (2 per 1 m^2)
15 - 1 per 8 sq. ft (4 per 3 m^2)
16 - 4 per 32 sq. ft
17 - 6 per 32 sq. ft
18 - 8 per 32 sq. ft
19 - 10 per 32 sq. ft
20 - 16 per 32 sq. ft
21 - 24 per 32 sq. ft
22 - 32 per 32 sq. ft
23 - 64 per 32 sq. ft
24 - 1/16" (1.6 mm) max. dia.
25 - 1/8" (3.2 mm)
26 - 1/4" (6.4 mm)
27 - 3/8" (9.5 mm)
28 - 1/2" (12.7 mm)
29 - 1/4" (6.4 mm) / 1/8" (3.2 mm)
30 - If specified
31 - Few to 1/8" x 1" (3.2 mm x 25.4 mm)
32 - Few to 1/4" x 2" (6.4 mm x 50.8 mm)
33 - Few to 3/8" x 4" (9.5 mm x 102 mm)
34 - Few to 12" (304 mm)
35 - Two 8" (203 mm) diameter areas or equivalent
36 - Two 1/32" x 3" (0.8 mm x 76 mm) on panel ends only
37 - Two 1/16" x 6" (1.6 mm x 152 mm)
38 - Four 1/8" x 8" (3.2 mm x 203 mm)
39 - Four 3/16" x 8" (4.8 mm x 203 mm)
40 - Very small blending
41 - Small blending
42 - Blending
43 - 1" in 12" (25.4 mm in 305 mm) maximum grain slope; 2-1/2" in 12" (63.5 mm in 305 mm) maximum grain sweep
44 - Rift permits 1" in 12" (25.4 mm in 305 mm) max. grain slope, 2-1/2" in 12" (63.5 mm in 305 mm) max. grain sweep, fleck not to exceed 3/8" (9.5 mm) in width.
45 - Comb permits 1/2" in 12" (12.7 mm in 305 mm) max. grain slope, 1/2" in 12" (12.7 mm in 305 mm) maximin grain sweep, fleck not to exceed 3/32" (2.4 mm) in width.
46 - Yes when specified Sapwood or Natural, and No when specified Heartwood
47 - No when specified Sapwood, and Yes when specified Heartwood and Natural
48 - Slight when specified Sapwood and Yes when specified Heartwood and Natural
49 - Yes for Rotary cut White Oak, limited to 5% at Red Oak unless otherwise specified.
50 - Yes for White Oak and Red Oak, limited to 10% in rift, comb, and plain-sliced or 20% in rotary cut.
51 - Unlimited Fleck, unless otherwise specified.
52 - No, Slight at Maple
53 - Slight, Yes at Ash
54 - Occasional spots
55 - Spots & Streaks
56 - Sound, with or without dark center - 1/2" (12.7 mm)
57 - Repaired, Two 1/4" (6.4 mm)
58 - Moderate
59 - Occasional
60 - Slight, Blending

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

04.7 SOFTWOOD VENEER REQUIREMENTS

1			Applies only to the following species: **DOUGLAS FIR, REDWOOD, WESTERN RED CEDAR,** and **WHITE PINE**.
2			**CORE** will be manufacturer's choice, within the provisions of these standards, and:
2	1		**DISCOLORATION** of veneers caused by specified use of FR ULEF/NAUF particleboard and MDF cores is not the responsibility of the millworker or board suppliers.
3			**VERTICAL GRAIN** will have over 90% of the visible face, a minimum average of 10 annual growth rings per 1" (25.4 mm) in width, except at:
3	P	**Premium Grade**	15 annual growth rings per 1" (25.4 mm) in width.
4			For **TRANSPARENT FINISH**, boat, router, and/or sled patches will be limited to 12 in any 48: x 96" (1220 mm x 2440 mm) panel and proportionately reduced for smaller size panels.
5			**FACE GRADE REQUIREMENTS** for opaque or transparent finished **WESTERN RED CEDAR**, **WHITE PINE, vertical grain sliced DOUGLAS FIR** and **REDWOOD, and rotary sliced DOUGLAS FIR will be Grade - A.**
6			**SUMMARY TABLE of ALLOWABLE WOOD VENEER FACE GRADE CHARACTERISTICS** based on data generated and published by (Voluntary Product Standard - PS1 (2019)), nist.gov and the Decorative Hardwoods Association, ANSI/HPVA HP-1 - 2020, available at decorativehardwoods.org. The NAAWS Committee acknowledges and thanks DHA for its important contributions to the architectural woodwork industry. The Characteristics are as follows:

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04.7 SOFTWOOD VENEER REQUIREMENTS

Continued from previous page

6 Summary Table (continued)

		Table: 04-002 - ALLOWABLE WOOD VENEER FACE GRADE CHARACTERISTICS	WESTERN RED CEDAR	WHITE PINE	DOUGLAS FIR / REDWOOD	DOUGLAS FIR
		Grade Designation	A	A	A	A
		Veneer Cut - Plain Sliced, Quarter, or Rotary Cut	Yes	Yes	Virtical Grain	Slip Rotary Cut
		Sapwood - Allowance	Yes	Yes	01	Yes
		Heartwood - Allowance	Yes	Yes	Yes	02
		Color Streak or Spot - Allowance	Slight	Slight	No	Yes
		Color Variation - Allowance	No	No	Slight	Yes
		Stain, Blue or Brown - Allowance	No	No	No	Yes
		Type of Matching allowed: Book Matched Random Match Slip Matched End Match Rotary Sliced	n/a Yes n/a 30 n/a	n/a Yes n/a 30 n/a	Yes n/a Yes 30 n/a	n/a n/a n/a n/a Yes
		Burls - Allowance	Yes	Yes	Small	
6	1	Knots, Pin - Allowance	Yes	Yes	03	
		Knots, Sound / Tight - Maximum Size	2" (50.8 mm)	3-1/2" (80 mm)	No	No
		Knots, Spike - Maximum Size	2" (50.8 mm)	2" (50.8 mm)	No	
		Knot Holes, Repaired - Maximum Size	3/4" (19.0 mm)	3/4" (19.0 mm)	No	
		Pitch Streak - Allowance	Small	Small	04	05
		Pitch Pocket - Allowance	06	06	No	No
		Crow's Foot - Allowance	Slight	Slight	No	
		Cross Barr - Allowance	n/a	n/a	No	
		Rough Cut - Allowance	No	No	No	No
		Splits - Tapering, Hairline, Blended and Repaired	Yes	Yes	Yes	07
		Repair - Allowance	Blending	Blending	Blending	08
		Unfilled Worm Hole, open Splits, open joints, or dose - Allowance	No	No	No	09
		Chipped or Depressed Area - Allowance				10
		Crack or Check - Allowance				11
		Patch - Allowance				12
		Shim - Allowance				Yes

Number Codes

01 - Yes for Redwood & for Douglas Fir - Limited with No Bright Sapwood
02 - Yes; however, Heartwood must have 6 or more annual rings per 1" (25.4 mm)
03 - No for Douglas Fir and Yes for Redwood
04 - Small for Douglas Fir and No for Redwood.
05 - Average 3/8" (9.5 mm) wide and blended in color with wood
06 - Few to 1/8" x 1" (3.2 mm x 25.4 mm)
07 - Repaired - less that 1-1/4" (31.8 mm) x unlimited
08 - Maximum 18, excluding shims
09 - Yes for worm or borer holes
10 - Less than 1/2" x 2" (12.7 mm x 50.8 mm)
11 - Less than 3/16" (4.8 mm) wide
12 - Boat, Router, or Sled, Maximum 2-1/4" x 4-1/2" (57.2 mm x 114 mm)

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04.8 HPL (HIGH PRESSURE LAMINATE) REQUIREMENTS

1		Will **BE CONSTRUCTED** (in conformance with ISO 4586 (latest edition)) iso.org of multiple layers of thermosetting resin saturated Kraft paper in combination with a layer of decorative melamine saturated paper, fused together under heat and pressure with the following minimum performance and thickness properties, see Table 04-009 below, and: 12/01/2021
1	1	Laminate types used within this standard are abbreviated as "VGP" for vertical and "HGP" for horizontal surfaces, "CLS" for cabinet liner; "BKL" for backer, and "HGF" or "VGF" for flame retardant HPL in accordance with the latest ISO usage.
2		**CORE** will be manufacturer's choice, within the provisions of these standards.
3		If **FLAME SPREAD CLASS A** rating is required, it will be **CLASS A** rated core, requiring use of a flame retardant HGF or VGF-HPL on exposed surface with minimum 0.026" (0.7 mm) thick flame retardant BKL, and be **bonded** with a Class A rigid set adhesive.

Table: 04-009 - **HPL TYPES** and **MINIMUM PERFORMANCE REQUIREMENTS**

	HGP (Horizontal, General Purpose, Postformable Grade)	VGP (Vertical, General Purpose Postformable Grade)	CLS (Cabinet Liner)	BKL (Backer)
Nominal thickness inch / (mm)	0.039" (1.0)	0.028" (0.7)	0.020" (0.5)	0.020" (0.5)
Thickness tolerance ± inch / (mm)	0.005" (0.12)	0.004" (0.10)	0.004" (0.10)	0.004" (0.10)
Wear (cycles, min.)	**350**		50	n/a
% Dim change (cross-direction)	1.4	1.4	2.0	n/a
Stain	**Reagents 1 - 10 - No Effect** **Reagents 11 - 15 - Slight Effect**		Moderate Effect	n/a
Cleanability (cycles, maximum)	**20**			n/a
Fade	**Slight Effect**		Moderate Effect	n/a
High temperature	Gloss Finish > Slight Effect Other Finishes > No Effect		Moderate effect	n/a
Boiling water	Gloss Finish > Slight Effect Other Finishes > No Effect		Moderate effect	n/a
Impact drop heigth (inches, min.) with maximum indentation diameter of 0.40"	31.5	23.6	23.6	n/a
Test procedures and minimum requirements shall comply with ISO-4586 (latest edition), iso.org, for HPL.				

DIMENSIONAL BEHAVIOR OF HPL

Similar to that of wood; when humidity varies, the width of a laminate (cross-direction) undergoes greater dimensional changes than the length by a ratio of nearly two to one.

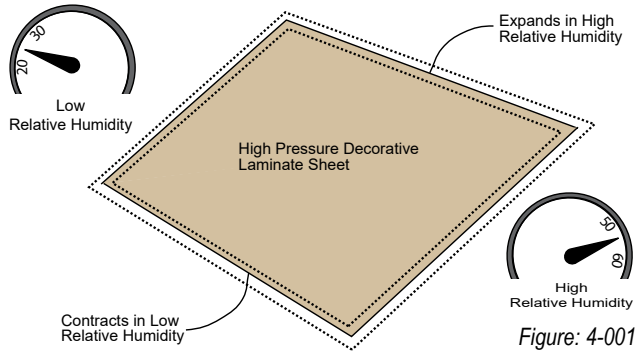

Figure: 4-001

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04.9 CPL (Continuous Pressure Laminate) REQUIREMENTS

1 Will **BE CONSTRUCTED** (in conformance with ISO 4586 (latest edition)) iso.org of multiple layers of thermosetting resin saturated Kraft paper in combination with a layer of decorative melamine saturated paper, fused together under heat and pressure with similar properties as HPL.

04.10 CGS (Compact Laminate) REQUIREMENTS

1 Will be a panel composed of resin impregnated decorative surface papers superimposed over a varying number of Kraft core sheets to achieve a desired thickness (minimum 5/64" (2.0 mm)), with the following minimum performance properties:

PROPERTY	VALUE	TEST PROCEDURE [1]
Compressive Strength	24, 000 psi minimum	ASTM-D-695
Density	90 lbs./ft^3	ASTM-D-792
Flame Test	Self-Extinguishing	ASTM-D-635
Flexural Strength	15,000 psi minimum	ASTM-D-790
High Temp. Resistance	No Visible Effect	ISO-4586
Impact Resistance	No Effect (1/2 lb. Ball at 120")	ISO-4586
Modulus of Elasticity	1,400,000 psi minimum	ASTM-D-790
Screw Pull Out [2]	340 lbs. (154 kg) minimum at 3/8" (9.5 mm penetration 680 lbs. (308 kg) minimum at 3/4" (19.0 mm) penetration	
Shear Strength	2,000 psi minimum	
Tensile Strength	15,000 psi minimum	ASTM-D-638
Thickness Tolerance	± 1/32" (0.8 mm) minimum	
Water Absorption	3% maximum	ASTM-D-570

[1] Latest edition
[2] Resistance based on 1/4" (6.4 mm) machine screw

04.11 TFL (Thermally Fused Laminate) REQUIREMENTS

1 Will be melamine, polyester, or foil resin impregnated paper thermally fused under pressure to an approved core, conforming to the following minimum performance properties taken in part from ISO-4586 (latest edition), (as adapted), iso.org:

PROPERTY	MINIMUM PERFORMANCE
Wear	Solid Color - 350 Cycles, Wood Grain - 100 Cycles
Stain	Agents 1-10 - No Effect, Agents 11-15 - Moderate Effect
Clean-ability, cycles maximum	20
Light (Fade)	Slight Effect
High Temperature	Slight Effect
Boiling Water	Slight Effect
Impact	10" (254 mm) Without Fracture

2 **CORE** will be manufacturer's choice, within the provisions of these standards.

04.12 BALANCE SHEET REQUIREMENTS

1		Where required within the Product Sections, includes:
1	1	At **WOOD VENEER,** wood veneer of the same thickness.
1	2	At **HPL,** HPL of the same thickness.
1	3	At other **OVERLAYS,** matching overlay of the same thickness.
1	4	Any independently tested material that maintains panel flatness as set forth in this standard.

04.13 BACKER REQUIREMENTS

1	Where required within the Product Sections, includes: Man made wood fiber veneers, impregnated with acrylic melamine, fortified, high load resin system, a minimum of 0.020" (0.5 mm). Synthetic polymer treated backing sheet 0.017" (0.4 mm) - 0.019" (0.5 mm) nominal thickness, designed for use with HPL. Minimum 0.015" (0.4 mm) nominal thickness, thermosetting resin impregnated Kraft paper. BKL-HPL, conforming to ISO-4586 (latest edition) iso.org.

04.14 HDO (High Density Overlay) REQUIREMENTS

1	Will be (in conformance with Voluntary Product Standard - PS1 (latest edition)), nist.gov, a thermosetting resin impregnated cellulose fiber sheet or sheets, not less than 0.012" (0.3 mm) in thickness after pressing.
2	Will be permitted in lieu of paint grade wood veneer for opaque finish.
3	**CORE** will be manufacturer's choice, within the provisions of these standards.

04.15 HARDBOARD REQUIREMENTS

1 Will be (in conformance with CAP/ANSI A135.4 (latest edition)), compositepanel.org, a panel manufactured of inter-felted lignocellulosic fibers, consolidated under heat and pressure to a density of 31 lb./ft^3 or greater with the following minimum performance properties based on 1/4" (6.4 mm) thickness, as follows for **TEMPERED GRADE**:

PROPERTY	PERFORMANCE
Water Absorption	20% Maximum
Thickness Swelling	15% Maximum
Modulus of Rupture	6000 psi
Tensile Strength - Parallel	3000 psi
Tensile Strength - Perpendicular	130 psi

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04.16 PARTICLEBOARD REQUIREMENTS

1 Will be (in conformance with ANSI A208.1 (latest edition)as published by the Composite Panel Association, compositepanel.org) a generic term for a composite panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers, bonded together with a bonding system, and which may contain additives to a density between 40-50 lb./ft^3 (640-800 kg/m^3), requiring:

1 1 **GRADE M2** or better with the following minimum properties:

PROPERTY	VALUE
Modulus of Rupture (M-2)	1885 psi
Modulus of Rupture (M-3)	2393 psi

1 2 **MOISTURE RESISTANT** particleboard will not exceed a maximum 5.5% thickness swell after 24-hour submersion in accordance the Linear Expansion with Change in Moisture Content requirements of ASTM D1037-12(2020) as published by ASTM International, astm.org. 12/01/2021

04.17 MDF (Medium Density Fiberboard) REQUIREMENTS

1 Will be (in conformance with ANSI A208.2 (latest edition) as published by the Composite Panel Association, compositepanel.org) a panel composed of cellulosic fibers and a bonding system cured under heat and pressure. MDF density is typically between 31 lbs./ft^3 (500 kg/m^3) and 62 lbs./ft^3 (1000 kg/m^3). For formaldehyde emission limits, thin MDF is defined as MDF with a thickness less than or equal to 0.315 inches (8.0 mm), requiring:

1 1 **GRADE 130** or better with the following minimum properties:

PROPERTY	VALUE
Modulus of Rupture (Grade 130)	3130 psi
Modulus of Rupture (Grade 155)	4050 psi

1 2 **MOISTURE RESISTANT** MDF will not exceed a maximum 5.5% thickness swell after 24-hour submersion in accordance with the Linear Expansion with Change in Moisture Content requirements of ASTM D1037-12(2020) as published by ASTM International, astm.org. 12/01/2021

04.18 EPOXY RESIN REQUIREMENTS

1 Will be a panel produced from a composite of epoxy resin, silica, inert fillers, and organic hardeners, cast and cured in ovens at elevated temperatures, homogenous throughout, and nonabsorbent, with the following minimum performance properties:

PROPERTY	VALUE	TEST PROCEDURE [1]
Compressive Strength	30, 000 psi minimum	ASTM-D-695
Density	120 lbs./ft^3	ASTM-D-792
Flexural Strength	11,000 psi minimum	ASTM-D-790
Hardness (Rockwell M)	100(Min.)	ASTM-D-785
Water Absorption	0.05% minimum	ASTM-D-570

[1] Latest edition

04.19 ENGINEERED STONE REQUIREMENTS

1 Will conform to the following minimum performance properties:

PROPERTY	MINIMUM PERFORMANCE	TEST METHOD [1]
Density	>2.05 g/cm3	EN 14617-1
Moisture Absorption	≤ 0.08 %	EN 14617-1
Flexural Strength	30 - 90 MPa	EN 14617-2
Abrasion Resistance	20 - 31 mm	EN 14617-4
Freeze / Thaw Resistance	> 0.95	EN 14617-5
Impact Resistance	> 3.5 J	EN 14617-9
Stain Resistance	No Effect	EN 14617-10
Chemical Resistance	Class 4	EN 14617-10
Fire Behavior	Class A	ASTM E84

[1] Latest edition

04.20 NATURAL STONE REQUIREMENTS

1 Will not be subject to minimum performance properties established by these standards, because it is a natural product.

04.21 SOLID SURFACE REQUIREMENTS

1

Will be a manufactured, filled cast polymeric resin panel. Fillers may be used to enhance both its performance properties and aesthetics. With a homogeneous composition throughout its thickness, solid surface requires no finish coat and is capable of being fabricated with inconspicuous seams and the following minimum performance properties:

PROPERTY	VALUE	TEST PROCEDURE [1]
Abrasion Resistance	Pass	ANSI-Z124.7
Bacterial Resistance	Pass	ASTM-G-22
Boiling Water Surface Resistance	No visible effect	ISO-4586
Color Stability (200 Hrs.)	No visible effect	ISO-4586
Fungal Resistance	Pass	ASTM-G-22 or ISO.846
Gloss (60° Gardner)	5-20 minimum	ISO-4586
Hardness (Rockwell M)	90 minimum	ASTM-D-785
	50 minimum	Barcol
High Temp. Resistance	No visible effect	ISO-4586
Impact Resistance	No failure	ISO-4586
Izod Impact	0.25 ft.-lbs./in. of notch	ASTM-D-256
Radiant Heat Resistance	No visible effect	ISO-4586
Specific Gravity [2]	1.5 gram/cm^3 minimum	
Stain Resistance	Pass	ANSI-Z-124
Surface Flammability	Meet or exceed applicable code and regulations	
Tensile Strength	4,000 psi minimum	ASTM-D-638
Tensile Modulus	500,000 psi minimum, or 25,000 psi minimum at 1/8" nominal material	ASTM-D-638
Tensile Elongation	1% maximum, or 10% maximum at 1/8" nominal material	ASTM-D-638
Thermal Expansion	2.3 x 10^{-5} in./in./F° max.	ASTM-D696
Water Absorption	1% maximum, 24 hr	ASTM-D-570

[1] Latest edition

[2] Approximate weight per 12" x 12" (305 mm x 305 mm): 1/8" (3.2 mm) 1.02 lbs. (0.544 kg), 1/4" (6.4 mm) 2.10 lbs. (0.953 kg), 1/2" (12.7 mm) 4.20 lbs. (1.905 kg), 3/4" (19.0 mm) 6.20 lbs. (2.812 kg).

1 1 Will be **COLOR** and **PATTERN MATCHED**, use of same batch materials is required for adjacent sheets.

1 2 **REPAIRS,** while fully functional might be visible.

APPLICABLE TOLERANCES, may be found in Sections 15 (Tolerances); however, these tolerances are only applicable to the exposed and semi-exposed portions of installed architectural woodwork products.

END OF SECTION 04

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

FINISHING

SECTION - 05

INCLUDING: **Factory Finishing**

05.1 SCOPE

1 All factory finishing of architectural woodwork.

2 **INCLUSIONS**

2.1 The application of transparent or opaque finish on all architectural woodwork specified to be factory pre-finished and/or jobsite finished within the architectural woodwork contract.

2.2 The application of primer prior to delivery to the jobsite when required within the architectural woodwork contract.

2.3 Raw wood parts on HPL or TFL cabinets, except as specified in the contract documents, such as wood finger pulls, or wood drawer bodies incorporated into the assembly.

2.4 All preparatory work, labor, equipment, materials, and related supplies to produce the specified finish.

3 **EXCLUSIONS**

3.1 All painting or priming of building surfaces not specified within the architectural woodwork contract.

3.2 All finishing of architectural woodwork specified within the painting specifications.

3.3 Jobsite touch up after delivery or installation.

3.4 Brush applied topcoat finishes, except as called out under the scope of work for the custom woodwork manufacturer, such as faux finishes.

3.5 Items to receive subsequent coats of finish materials by others.

3.6 Exterior finishing.

05.2 SURFACE DEFINITIONS

1 **EXPOSED, EXPOSED-EXTERIOR, EXPOSED-INTERIOR** and/or **SEMI-EXPOSED** finished surfaces include all surfaces visible after fabrication or installation.

2 **CONCEALED SURFACES** are all backs of panel and trim members.

05.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED** all work under this section will meet the same Grade as the item being finished, and the finishing system selected will be the choice of the finishing contractor.

05.4 GENERAL REQUIREMENTS

1 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within **Section 02** are primary to and work in conjunction with the following specific requirements unless a project's contract documents require otherwise.

2 **CARE** and **STORAGE REQUIREMENTS** are covered under **Section 13.**

3 **INSTALLATION REQUIREMENTS** are covered under **Section 14.**

4 **TOLERANCE REQUIREMENTS** are covered under **Section 15.**

05.4 GENERAL REQUIREMENTS (continued)

5 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

6 **NON-CLIMATE CONTROLLED INTERIOR** woodwork finishing is not covered in this section or these standards.

7 **GRADE CLASSIFICATIONS** of **CUSTOM**, and **PREMIUM** are used within these standards only in reference to the acceptable quality of workmanship, material, or installation in a completed architectural woodwork product. This Section deals with finish application, which is a component of finished products covered in Sections 06 - 12. Grade classifications are only for the purpose of identifying finish applications that can be used in finished products meeting those Grades. They are not intended to be used as a Grade or to judge a finish system.

8 **PRIMING,** when required in the contract documents, is addressed herein.

9 **CONTRACT DOCUMENTS** will govern if in conflict with these standards.

10 **AESTHETIC COMPLIANCE** requirements apply only to surfaces visible after manufacturing, installation and finishing.

11 **LISTING** of a finish system in these standards does not imply an endorsement of such or compliance with applicable codes and regulations.

12 **FACTORY** finishing is usually specified for high-quality work where superior appearance and performance of the finish is desired, and the finisher is responsible for:

12.1 Examining and accepting the woodwork as supplied prior to the commencement of finishing.

12.2 Meeting or exceeding the control sample for surface performance characteristics (such as color, texture, and sheen), including proper surface preparation, shading, and blending of color, and other requirements as defined in this standard when so referenced.

13 **FIELD** finishing is not covered by these standards.

14 **FINISHERS** will determine and report in writing before the start of finishing, any:

14.1 Material or finish system requirements in violation of applicable codes or regulations, and it **WILL NOT** be the responsibility of the finisher to comply with a specification requirement or finishing system that is illegal or otherwise not permitted in a particular area by some regulatory agency.

14.2 Conditions that might affect proper finish application.

14.3 Moisture content of product and/or surrounding wall surfaces, such as drywall or plaster, above 12%.

15 **INDUSTRY PRACTICES:**

15.1 **DOOR MATERIAL SUPPLIERS** typically offer only their own standard finishes. If one or more acceptable material suppliers are listed in a project's specifications, it indicates that each material suppliers standard finish system is acceptable.

15.2 **FINISHING** of **WOOD COMPONENTS** on **HPL** or **TFL** casework (including pulls, trims, moldings, and edgebanding) is included in the manufacturer's scope of work.

15.3 **FINISHING SYSTEMS** are applied per the material suppliers' recommendations.

15.4 **FILLED FINISH** is only required if so specified.

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05.4 GENERAL REQUIREMENTS (continued)

16 **APPLICATION TECHNIQUES** and other variances make the execution of the finish system difficult to determine. These standards provide the minimum requirements. The desired result is to provide a finish that is both durable and achieves the desired appearance.

17 **INCOMPATIBILITY** of finish to wood **will** be prevented, and it is the responsibility of the finisher to conduct, as applicable, a test sample to check for species of wood that reacts unfavorably with certain finishes and to apply a sealer, if required, before finishing to nullify such a chemical reaction.

18 **PANELING** requires adjacent panels to be finished together to achieve maximum uniformity of color, and if possible, entire elevations will be finished together.

19 **TRIM** and **FRAMES** require only the exposed faces and edges to be top-coated.

20 **PASSAGE DOORS** require two faces and both vertical edges to be finished. The top / bottom edges and hardware preparation areas at hinges and lock edges will be sealed, and:

20.1 An equal number of coats of the same material applied to each side pairs of doors; openings with sidelights and transoms to be finished together to achieve maximum uniformity of color.

20.2 **FINISHES**, other than those furnished by a material supplier, will be specified to be applied by the woodwork finisher.

21 **CASEWORK** requires all exposed exterior, exposed interior and semi-exposed surfaces be finished, all surfaces of cabinet doors / drawer fronts receive the same number of coats to prevent warping and/or twisting.

22 **SAMPLES** will be submitted and approved before finishing of product.

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Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

05.5 MATERIAL REQUIREMENTS

1	**PRIMING / SEALING** of **CONCEALED SURFACES** is required when factory finishing is required, and will be of a compatible material and conform to the following application requirements:		
1	1	**STANDING** and **RUNNING TRIM** backs will be sealed at 1 mil dry.	
1	2	**WOOD** wall and ceiling panel backs will be sealed at 2 mil dry.	
2	**FLOW PROPERTIES** require capability of drying and/or curing free of streaks, sags, or mottle.		
3	**CHEMICAL RESISTANCE,** if so specified, at exposed horizontal surfaces will pass a 24-hour exposure test, whereas exposed vertical surfaces and semi-exposed surfaces will pass a 1 hour exposure test (ASTM 1308, latest edition).		

05.6 APPLICATION REQUIREMENTS

1	**FINISHER** is responsible for sanding prior to the initial application of finishing materials and subsequent coats.		
2	**HANDLING, MACHINING**, or **TOOL MARKS** are not permitted.		
3	**INDENTATIONS** and **SCRAPES** at transparent finish will be steamed out.		
4	**MOISTURE EFFECTS**, such as raised grain or blue stain, will be removed.		
5	**PARTICLES** and **DUST** will be removed.		
6	**ADHESIVE SPOTS** will not be permitted.		
7	**SANDING SCRATCHES, ORANGE PEEL** (slight depressions in the surface similar to the skin of an orange), and **SAGS** (partial slipping of finish film creating a curtain effect) will be inconspicuous beyond 36" (914 mm), except at:		
7	P	**Premium Grade**	Sanding scratches, orange peel, and sags are not permitted.
8	**RUNS** (running of wet finish film in rivulets), **BLUSHING** (whitish haze, cloudy), **CHECKING** or **CRAZING** (crowfeet or irregular line separation), **BLISTERING** (small, swelled areas like water blisters on human skin), and **CRACKING** (formation like dried mud) are not permitted.		
9	**FILLED NAIL HOLES, FIELD REPAIRS, and TOUCH UPS** will be inconspicuous beyond 72" (1829 mm).		

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05.6 APPLICATION REQUIREMENTS

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10		**SANDING** before and during all finishing procedures is required, and:
10	1	Exposed surfaces being block sanded parallel with the grain direction and the appropriate grit paper to prevent unacceptable blotchy and/or nonuniform appearance after staining or finishing.
10	2	Removal of handling marks or effects of exposure to moisture.
10	3	Steaming out of deep scratches.
10	4	Easing of sharp edges with a light sanding.
10	5	Removal of all raised grain, cross sanding, burnishing and machining marks, sanding inconsistencies, and or defects.
10	6	Light sanding between coats per material suppliers' recommendations.
11		**FACTORY PRIMING** with one coat of primer applied to appropriate surfaces is required, however, sanding of the primed surfaces, after priming is not required.
12		**VENTILATION**, adequate and continuous, is required with enough heat to maintain temperatures above 65 °F for 24 hours before, during, and 48 hours after application of finishes.
13		**OVER SPRAY** protection is required to prevent spray or droppings from fouling surfaces not being finished, as is repair of damage as a result of inadequate or unsuitable protection.
14		**REMOVAL** of electrical plates, surface hardware, fittings, and fastenings prior to finishing operation is required, and:
14	1	Removed items are to be carefully stored, cleaned, and replaced on completion of work in each area, and use of solvent for cleaning that might remove permanent finish is not permitted.
15		**CLEANING** of surfaces with a dry brush or a tack cloth before applying sealer, stain, or primer is required.
16		**SCRATCHES**, dents, marks, screw and nail holes, and rough edges will be properly repaired before finishing.
17		**CONSISTENCY** of each coat will be as recommended by the material supplier.
18		**FILM THICKNESS** will conform to material supplier's data or recommendation.
19		**FILLER** (including paste types) when specified will be applied before sealers or topcoats.
20		**THOROUGHLY DRY** each coat before sanding or applying additional coats.
21		**SAPWOOD** treatment at:
21	1	**EXPOSED SURFACES,** sapwood must be blended in the final finish appearance.
21	2	**SEMI-EXPOSED SURFACES**, blending is not required.
22		**STAINING** at:
22	1	Dark stain finishes, requires the surface be wash coat sealed.
22	2	Oil stain requires the surface be wipe applied in small areas at a time.
22	3	Non grain raising dye stains can be spray applied.
22	4	Open grain species requires staining before applying sealer.

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05.6 APPLICATION REQUIREMENTS

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23	**GENERIC COATING SCHEDULE**:					
23	1	**SEMI-EXPOSED** surfaces, including wood drawer sides and cabinet interiors and [bracketed items if specified] requires:				
23	1	1	[Wash coat] (only at stained finish on close grain).			
23	1	2	[Stain].			
23	1	3	Sanding sealer.			
23	1	4	First topcoat, and at:			
23	1	4	P	**Premium Grade**	A second topcoat is required.	
23	2	**EXPOSED** surfaces, including wood components on HPL or TFL casework, with [bracketed items if specified] requires:				
23	2	1	[Wash coat] (only at stained finish on close grain).			
23	2	2	[Stain].			
23	2	3	Sanding sealer.			
23	2	4	First topcoat.			
23	2	5	Second topcoat.			
23	3	**CONCEALED** surfaces such as:				
23	3	1	**STANDING** and **RUNNING TRIM** backs will be sealed at 1 mil dry.			
23	3	2	**WOOD** wall and ceiling panel backs will be sealed at 2 mil dry.			

24 **SYSTEM COATING SCHEDULE, for the following NAAWS Finishing Systems:**

System - **1**, Lacquer, Nitrocellulose
System - **2**, Lacquer, Pre-Catalyzed
System - **3**, Lacquer, Post Catalyzed
System - **4**, Latex Acrylic, Water Based
System - **5**, Varnish, Conversion
System - **6**, Oil, Synthetic Penetrating (available in transparent only)
System - **7**, Vinyl, Catalyzed
System - **8**, Acrylic Cross Linking, Water-Based
System - **9**, UV Curable, Acrylated Epoxy, Polyester or Urethane
System - **10**, UV Curable, Water Based
System - **11**, Polyurethane, Catalyzed
System - **12**, Polyurethane, Water Based
System - **13**, Polyester, Catalyzed

For comparisons, characteristics, or recommendations about these systems, see "Finishing" in the **APPENDIX**.

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05.6 APPLICATION REQUIREMENTS

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24	**SYSTEM COATING SCHEDULE** (continued)					
24	**1**	**SYSTEM - 1, LACQUER, NITROCELLULOSE** including [bracketed items if specified] requires at:				
24	1	**1**	**CLOSE GRAIN** woods:			
24	1	1	**1**	[Wash coat, nitrocellulose] (only at stained finish), except at:		
24	1	1	1	**P**	**Premium Grade**	Wash coat, will be vinyl.
24	1	1	**2**	[Stain].		
24	1	1	**3**	Sealer, nitrocellulose, except at:		
24	1	1	3	**P**	**Premium Grade**	Sealer, will be vinyl.
24	1	1	**4**	First topcoat, and at:		
24	1	1	4	**P**	**Premium Grade**	A second topcoat is required.
24	1	**2**	**OPEN GRAIN** woods (including filled finish) requires:			
24	1	2	**1**	[Wash coat, nitrocellulose] (only at filled finish), except at:		
24	1	2	1	**P**	**Premium Grade**	Wash coat, will be vinyl.
24	1	2	**2**	[Stain].		
24	1	2	**3**	Filler (only at filled finish).		
24	1	2	**4**	Sealer, nitrocellulose, except at:		
24	1	2	4	**P**	**Premium Grade**	Sealer, will be vinyl.
24	1	2	**5**	First topcoat.		
24	1	2	**6**	[Second topcoat] (only at filled finish), except at:		
24	1	2	6	**P**	**Premium Grade**	Second topcoat is required, filled or not filled finish.

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24	**SYSTEM COATING SCHEDULE** (continued)			
24	2	**SYSTEMS - 2 and 3, LACQUER, PRE AND POST CATALYZED** including [bracketed items if specified] requires at:		
24	2	1	**CLOSE GRAIN** woods:	
24	2	1	1	[Wash coat, vinyl] (only at stained finish).
24	2	1	2	[Stain].
24	2	1	3	Sealer, vinyl.
24	2	1	4	First topcoat.
24	2	1	5	Second topcoat.
24	2	2	**OPEN GRAIN** woods (including filled finish):	
24	2	2	1	[Wash coat, vinyl] (only at filled finish).
24	2	2	2	[Stain].
24	2	2	3	Filler (only at filled finish).
24	2	2	4	Sealer, vinyl.
24	2	2	5	First topcoat.
24	2	2	6	Second topcoat.
24	3	**SYSTEM - 4, LATEX ACRYLIC, WATER BASED** including [bracketed items if specified] requires at:		
24	3	1	**CLOSE** and **OPEN GRAIN** woods;	
24	3	1	1	[Stain].
24	3	1	2	Sealer, water reduced.
24	3	1	3	First topcoat, water reducible acrylic.
24	3	1	4	Second topcoat, water reducible acrylic.

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24	**SYSTEM COATING SCHEDULE** (continued)					
24	**4**	**SYSTEM - 5, VARNISH, CONVERSION** including [bracketed items if specified] requires at:				
24	4	**1**	**CLOSE GRAIN** woods:			
24	4	1	**1**	[Wash coat, reduced conversion varnish] (only at stained finish), except at:		
24	4	1	1	**P**	**Premium Grade**	Wash coat, will be vinyl.
24	4	1	**2**	[Stain].		
24	4	1	**3**	Sealer, reduced conversion varnish, except at:		
24	4	1	3	**P**	**Premium Grade**	Sealer, will be vinyl.
24	4	1	**4**	First topcoat, and at:		
24	4	1	4	**P**	**Premium Grade**	Second topcoat is required.
24	4	**2**	**OPEN GRAIN** woods (including filled finish):			
24	4	2	**1**	[Wash coat, reduced conversion varnish] (only at filled finish), except at:		
24	4	2	1	**P**	**Premium Grade**	Wash coat, will be vinyl.
24	4	2	**2**	[Stain].		
24	4	2	**3**	[Filler] (only at filled finish).		
24	4	2	**4**	Sealer, reduced conversion varnish, except at:		
24	4	2	4	**P**	**Premium Grade**	Sealer, will be vinyl.
24	4	2	**5**	First topcoat, and at:		
24	4	2	5	**P**	**Premium Grade**	Second topcoat is required.
24	**5**	**SYSTEM - 6, OIL, PENETRATING** including [bracketed items if specified] requires at:				
24	5	**1**	**CLOSE** and **OPEN GRAIN** woods:			
24	5	1	**1**	First coat, penetrating oil.		
24	5	1	**2**	Brass wool rubdown.		
24	5	1	**3**	Second coat, penetrating oil.		
24	5	1	**4**	Wax coat.		

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24	**SYSTEM COATING SCHEDULE** (continued)					
24	6	**SYSTEM - 7, VINYL, CATALYZED** including [bracketed items if specified] requires at:				
24	6	1	**CLOSE GRAIN** woods:			
24	6	1	1	[Wash coat, vinyl] (only at stained finish), except at:		
24	6	1	1	**P**	**Premium Grade**	[Wash coat to be vinyl, catalyzed].
24	6	1	2	[Stain].		
24	6	1	3	Sealer, vinyl, except at:		
24	6	1	3	**P**	**Premium Grade**	Sealer to be vinyl, catalyzed.
24	6	1	4	First topcoat.		
24	6	1	5	Second topcoat.		
24	6	2	**OPEN GRAIN** woods including filled finish:			
24	6	2	1	[Wash coat, vinyl] (only at filled finish), except at:		
24	6	2	1	**P**	**Premium Grade**	[Wash coat to be vinyl, catalyzed].
24	6	2	2	[Stain].		
24	6	2	3	Sealer, vinyl, except at:		
24	6	2	3	**P**	**Premium Grade**	[Filler] is required (only at filled finish) and sealer to be vinyl, catalyzed.
24	6	2	4	First topcoat.		
24	6	2	5	Second topcoat.		
24	7	**SYSTEM - 8, ACRYLIC CROSS LINKING, WATER BASED** including [bracketed items if specified] requires at:				
24	7	1	**CLOSE GRAIN** woods:			
24	7	1	1	[Wash coat, acrylic] (only at stained finish).		
24	7	1	2	[Stain].		
24	7	1	3	Sealer, acrylic.		
24	7	1	4	First topcoat.		
24	7	1	5	Second topcoat.		
24	7	2	**OPEN GRAIN** woods, including filled finish:			
24	7	2	1	[Wash coat, acrylic] (only at filled finish).		
24	7	2	2	[Stain].		
24	7	2	3	Sealer, acrylic.		
24	7	2	4	[Filler] (only at filled finish).		
24	7	2	5	First topcoat.		
24	7	2	6	Second topcoat.		

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24	**SYSTEM COATING SCHEDULE** (continued)						
24	8	**SYSTEM - 9 and 10, UV CURABLE, ACRYLATED EPOXY, POLYESTER, URETHANE, APPLICABLE ONLY TO PREMIUM GRADE**, including [bracketed items if specified] requires at:					
24	8	**1**	**CLOSE** and **OPEN GRAIN** woods:				
24	8	1	**1**	[Stain].			
24	8	1	**2**	Sealer with B-stage curing.			
24	8	1	**3**	Sealer with full cure.			
24	8	1	**4**	First topcoat with B-stage curing.			
24	8	1	**5**	Second topcoat with full cure.			
24	**9**	**SYSTEM - 11 and 12, POLYURETHANE, CATALYZED, or WATER BASED** including [bracketed items if specified] requires at:					
24	9	**1**	**CLOSE GRAIN** woods:				
24	9	1	**1**	[Wash coat, reduced vinyl sealer] (only at stained finish).			
24	9	1	**2**	[Stain].			
24	9	1	**3**	Sealer, vinyl.			
24	9	1	**4**	First topcoat, and at:			
24	6	1	4	**P**	**Premium Grade**	A second topcoat is required.	
24	9	**2**	**OPEN GRAIN** woods (including filled finish):				
24	9	2	**1**	[Wash coat, reduced vinyl sealer] (only at filled finish).			
24	9	2	**2**	[Stain].			
24	9	2	**3**	[Filler] (only at filled finish).			
24	9	2	**4**	Sealer, vinyl.			
24	9	2	**5**	First topcoat.			
24	9	2	**6**	Second topcoat.			

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24	**SYSTEM COATING SCHEDULE** (continued)				
24	10	**SYSTEM - 13, POLYESTER, CATALYZED, APPLICABLE ONLY TO PREMIUM GRADE** and including [bracketed items if specified] requires at:			
24	10	1	**CLOSE** and **OPEN GRAIN** woods:		
24	10	1	1	[Stain].	
24	10	1	2	First sealer, polyester.	
24	10	1	3	Second sealer, polyester.	
24	10	1	4	Topcoat, polyester.	
25	**AFTER FINISHING** remove all spilled, splashed, spattered finish materials, fingerprints or other marks, and provide:				
25	1	A final dusting of all exterior and interior surfaces, including drawers.			
25	2	Properly labeled touch up materials to allow for minor touch up.			
26	**TOUCH UP** of:				
26	1	**FACTORY FINISHED** materials are the responsibility of the installation contractor.			
26	2	**JOBSITE FINISHED** materials are the responsibility of the finishing contractor.			

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END OF SECTION 05

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

MILLWORK

SECTION - 06

INCLUDING: Millwork Composed of Solid Wood and/or Sheet Products, such as Standing & Running Trim, Frames, Screens, Ornamental & Miscellaneous Woodwork

06.1 SCOPE

1 All exposed standing and running wood trim members, door frames, window frames, screens, and ornamental and miscellaneous architectural woodwork that are not structural in nature.

2 **INCLUSIONS**

2.1 Base, shoe, casing, picture, ceiling, apron, and stool molds.

2.2 Wood thresholds, plinth, corner blocks, and other exposed wood trim.

2.3 Ornamental & Miscellaneous Architectural woodwork Composed of Solid Wood and/or Sheet Products.

2.4 Decorative turned or boxed wood columns, pilasters, false beams and trellis, including brackets, corbels, pedestals.

2.5 Band sawn, scrolled, turned, or carved ornamental woodwork.

2.6 Solid, paneled, or veneered wood door jambs / frames with sidelights, louvers, transoms, and borrowed lights, including extensions, linings, stops, mullions, transom bars, sills, other components, and flame spread ratings.

2.7 Mill built sliding door and sash pockets, including operating hardware.

2.8 Cornice moldings, corner and edge boards, fascia and soffits, water tables, and casings.

2.9 Metal sash surrounds.

2.10 Miscellaneous moldings.

2.11 Decorative screens.

2.12 Sheet products applied in the form of multiple boards, or other sheet products.

2.13 Columns, pilasters, brackets, corbels, paneling, and moldings integral to a frame's design.

2.14 Elliptical, segment, or full circle head, arched, peaked, gothic, irregular, and divided entrance specialty units.

2.15 Frames, sidelights, clerestory, and fixed windows.

2.16 Glass and glazing unless specified otherwise; open sash may be included by agreement.

2.17 Ornamental woodwork making use of molded, shaped, and carved elements to create a decorative appearance.

2.18 Installation, if specified.

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06.1 SCOPE (continued)

3 **EXCLUSIONS**

3.1 Exterior and/or non-climate-controlled woodwork.

3.2 Any structural framing, timbers or sheet products, sheathing, siding, decking, or planking and s4s boards or battens.

3.3 Any composition or plaster wallboards or coverings, lath, shingles, or shakes.

3.4 Any bucks, grounds, stripping, furring, in wall / ceiling blocking, reglets, cant strips, or waste molding.

3.5 Wall, ceiling and soffit surfacing.

3.6 Non wood, carved, or embossed moldings, including paper, vinyl, or foil wrapped.

3.7 Commodity frames not governed by these standards.

3.8 Machining of frames for hardware supplied by others.

3.9 Any metal frames, or cores for metal frames.

3.10 Hardware.

3.11 Priming or painting, glass and glazing, weather stripping, operating hardware, and/or sash balances.

3.12 Flush or stile and rail doors.

3.13 Pre-manufactured or stock window units.

3.14 Metal sash, skylights, screens, or weather stripping / milling for same.

3.15 Roller screens and hardware.

3.16 Factory assembled shelving units.

3.17 Providing or preparing for electrical, telephone, mechanical, or plumbing equipment.

3.18 Supplying exposed materials other than those covered herein or specified to be included.

3.19 Priming and/or finishing of any kind.

06.2 SURFACE DEFINITIONS

1 **EXPOSED SURFACES** include visible surfaces of standing / running trim, door / window frames, screens, and miscellaneous woodwork, including:

1.1 Top horizontal surfaces less than 80" (2032 mm) above the finished floor, unless visible from above.

1.2 Bottom horizontal surfaces 42" (1067 mm) or more above the finished floor.

2 **SEMI-EXPOSED SURFACES** include:

2.1 Top horizontal surfaces 80" (2032 mm) or more above the finished floor, unless visible from above.

2.2 Bottom horizontal surfaces less than 42" (1067 mm) above the finished floor.

3 **CONCEALED SURFACES** include:

3.1 Non-visible surfaces attached to and/or covered by another.

3.2 Non-visible blocking, spacers, etc., used for attachment.

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06.3 DEFAULT STIPULATIONS

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS**, work will be unfinished, Custom Grade, solid stock intended for opaque finish.

06.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 3 and 4, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 5, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires back surfaces of panels and trim to be factory sealed.

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

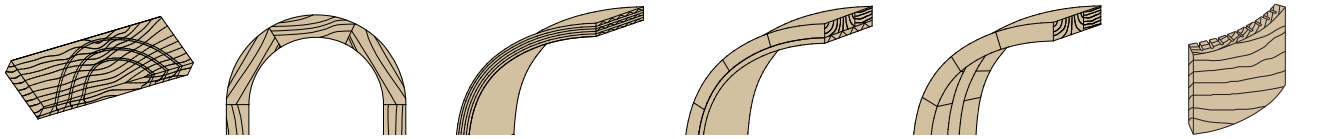
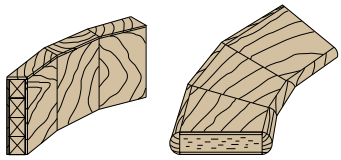
10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **STANDING** and **RUNNING TRIM** will be furnished as material only, not assembled.

12 **WOODWORK** not addressed herein will be manufactured from solid stock, laminated stock, veneered stock, or a combination thereof of manufacturer's choice.

IMPORTANT:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

06.5 MATERIAL REQUIREMENTS

1			**LUMBER, VENEER WRAPPED SURFACES** or **SHEET PRODUCTS** will be of the species and Grade specified; conforming in finished width, thickness, and length of lumber; without defects, either natural or manufactured, exceeding those permitted; and:
1	1		Solid lumber will be plain sawn.
2			**RADIUS WOODWORK** requires construction of solid machined, block laminated, laminated plies, core veneered, or kerfed solid stock:  Solid machined; Laminated Plies; Core Veneered; Block laminated; Kerfed Solid Stock
2	1		Chord segmentation is not permitted. 
2	2		Members of solid stock or block laminations will be furnished in such sections as to avoid pronounced cross grain and reduce joints to a minimum.
3			**OPAQUE FINISH** will be medium density fiberboard (MDF) or veneer species of manufacturer's choice, closed grain hardwood.
4			**TRANSPARENT FINISH,** will be of species specified or if not specified of manufacturer's choice, of plain sliced, book matched hardwood with running match within panel face, except:
4	P	**Premium Grade**	Will be balance match within panel face.
4	1		**END, SEQUENCE,** and **BLUEPRINT MATCHING** requires specific specification requirement.

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06.5 MATERIAL REQUIREMENTS

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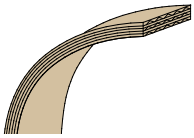
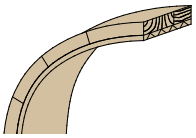
5			**EXPOSED SURFACES** require at:
5	1		**SHEET PRODUCT EDGES**, to be edgebanded with the same species as the face:
5	2		**TRANSPARENT FINISH,** one species for the entire project, and:
5	2	1	**RADIUS FRAMES** to be constructed of laminated plies  or core veneered  with intersections of radius and straight members to splined or half lapped, securely glued, and mechanically fastened.
5	2	2	**BLOCK LAMINATION** joints to be staggered.
5	2	3	**VISIBLE EDGES, REVEALS**, and/or **SPLINES**, to be full length and match the panel face for species.
5	2	4	**VENEER LAMINATIONS,** when exposed, to be resawn from the same or matched boards and reassembled in the same order and orientation as cut.
6			**SEMI-EXPOSED SURFACES** permit natural and manufacturing defects, provided the surface is filled solid and sanded smooth.
7			**CONCEALED SURFACES** permit voids, wane, and unfilled knots, and requires blocking or shims to be of a compatible material.
8			**EDGEBANDING** requires minimum thickness at: HPL Banding of 0.028 (0.7 mm) +/- 0.004 (0.1 mm) PVC, ABS, Polyester, Polypropylene Banding of 0.018 (0.46 mm) +/- 0.005 (0.13 mm) Veneer Banding of 0.02 (0.5 mm) +/- 0.0025 (0.06 mm)
9			**DOOR** and **WINDOW FRAMES** (interior only) of:
9	1		**FLAT STYLE DOOR** frames will be minimum of 3/4" (19.0 mm) in thickness except at hardware preps, except:
9	1	1	At doors weighing over 130 lbs. (59 kg.) frame shall be minimum 1-1/16" (27.0 mm) in thickness.
9	2		**RABBETED STYLE DOOR** frames will be minimum of 1-5/16" (33.3 mm) in thickness, except at:
9	2	1	At doors weighing over 130 lbs. (59 kg.) frame will be minimum of 1-1/2" (38.1 mm) in thickness.
9	2	2	Rabbet not to exceed 9/16" (14.3 mm) in depth.
9	3		**PLOUGHED STYLE DOOR** frames with T-stop, will be minimum of 1-1/16" (27.0 mm) in thickness, and stops will be minimum 3/4"(19.0 mm) in thickness set in 1/4" (6.4 mm) grove.
9	4		**SPLIT STYLE DOOR** frames with T-stop, will be minimum of 3/4" (19.0 mm) in thickness.
9	5		**VENEERED CONSTRUCTION DOOR** frames will be of sufficient veneer thickness to prohibit show through, and at: 
9	6		**FLAME SPREAD RATING** will be of material supplier permitted design and construction, conforming with the requirements of their applicable labeling service.
9	7		**WINDOW** frames will be minimum of 3/4" (19.0 mm) in thickness.

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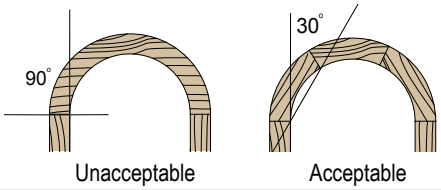
06.6 ASSEMBLY REQUIREMENTS

1			**JOINTS** at **ASSEMBLED WOODWORK** will be neatly and accurately made, securely glued, reinforced to prevent failure and:
1	1		Permits clamp nail, biscuit spline, butterfly, scarf, loose tenon, or dowel joinery.
1	2		Be **MECHANICALLY FASTENED,** with exposed fasteners countersunk and located in molding quirks or reliefs where possible.
1	3		Prohibits **VISIBLE FASTENERS** and/or associated covers / caps at exposed surfaces.
1	4		Permits use of **FILLER,** if inconspicuous when viewed at 24" (610 mm).
1	5		**TRIM** applied on flat surfaces will have the reverse side backed out, including door and window trim over 2" (50.8 mm) in width with non-exposed ends.
1	6		**SOLID MACHINED** and **BLOCK LAMINATED** members will be divided to minimize the exposure of cross grain in the face of the member, and:
1	6	1	The angle of grain at the face of the curved member will not exceed 30 degrees, unless a small part size requires otherwise. 
1	7		**INTERSECTIONS** at radius and straight members will be splined or half lapped, securely glued, and mechanically fastened.
1	8		**DADOES** will completely house the male member throughout the entire length of the joint.
2			**APPLIED MOLDINGS** will be spot glued and mechanically fastened.
3			**MITER JOINTS** and **CAPS** will be well fitted and cleaned.
4			**STILE** and **RAIL ASSEMBLIES** will be built up in large units and members will be mortised and tenoned, loose tenon, doweled, or splined.
5			**SHEET** and **LAMINATED LUMBER PANELS** will be permitted to move, float, expand or contract in reaction to ambient humidity changes.
6			**BUILT UP ITEMS** will be soundly fabricated with half lapped, mitered, shoulder mitered, tongued, or equivalent construction.
7			**STANDING & RUNNING TRIM** will require radius (in plan or elevation) moldings to be glued up for length in the longest practical lengths.

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06.6 ASSEMBLY REQUIREMENTS

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8	**DOOR FRAMES** (interior only) with:			
8	**1**			**FLAME SPREAD RATING** will be of the material suppliers standard design and construction, conforming to the requirements of their applicable labeling service.
8	**2**			**MOLDED EDGES**, other than square or with 1/16" (1.6 mm) or more in radius, will have mitered joints.
8	**3**			**SQUARE HEADS** will have jambs furnished machined KD (knocked down), stops cut to approximate length; however, not mitered or coped, and heads and sills dadoed to receive side jambs, or vice versa.
8	**4**			**SIDE JAMBS** will be dadoed into the sills and heads.
8	**5**			**TRANSOM BARS** will have them dadoed into side jambs.
8	**6**			**MULLIONS** will have them dadoed into sills and heads.
8	**7**			**FRAME PACKAGING** requires labeled pre-sized sets with pre-machined joinery, radius heads will have curved stops and casing attached to frame, and at:
8	7	**P**	**Premium Grade**	Frames will be pre-sized, built up assemblies in large sections for safe transportation and installation, with joints glued and fit tight, true, and secure. Radius heads will have joints at intersection of radius and straight members splined or half lapped.
9	**WINDOW FRAMES** (interior only) require:			
9	**1**			With molded edges, other than square or with 1/16" (1.6 mm) or more in radius, will have mitered joints.
9	**2**			With transom bars, will have them dadoed into side jambs.
9	**3**			With square edge members will have the heads and sills dadoed to receive side jambs, or vice versa.
9	**4**			With glazed openings will be trimmed on both sides with wood stops; however, one side will be removable, with stops shipped in properly labeled sets, cut to size; however, at:
9	4	**P**	**Premium Grade**	Stops will be tacked in place.
9	**5**			Machining for operating hardware (if templates or a physical sample is provided prior to shop drawing preparation); however, it is not required to be furnished or installed.
9	**6**			No machining for non-operating hardware, such as locking devices, pulls, lifts, etc., nor are they required to be furnished or installed.
9	**7**			When glass is furnished and installed, it will be cut slightly under size to prevent binding, and glazing materials or method of glazing of manufacturer's choice to prevent rattle.

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06.6 ASSEMBLY REQUIREMENTS

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10	**ORNAMENTAL MILLWORK** (interior only) requires:				
10	**1**	Column fabrication for opaque finish will allow maximum of one finger joint per 96" (2440 mm) or portion thereof in any individual member, with joints offset a minimum of 3" (76 mm) from adjacent joints, and joints perpendicular to the face of the column resulting in the appearance of a single horizontal line with column upright, and:			
10	1	**1**	Turnings will be clean, cut, sanded, and well matched for alignment and permits cut sawn edges at scroll work.		
10	**2**	**SHEET PRODUCTS:**			
10	2	**1**	Of **SOLID LUMBER** will be maximum 10" (254 mm) in width; however, at:		
10	2	1	**P**	**Premium Grade**	Solid lumber is not permitted.
10	2	**2**	With **RAISED PANEL RIMS** will be mitered and glued to sheet product body, and at:		
10	2	2	**P**	**Premium Grade**	They will be mitered, splined, or doweled to sheet product body.
10	2	**3**	With **LOOSE JOINTS** between sections requires preparation, utilizing mortise and tenon, loose tenon, dowel, or spline joinery.		
10	2	**4**	With **OUTSIDE CORNERS** will be prepared and shipped loose for installer fitting; however, at:		
10	2	4	**P**	**Premium Grade**	They will be prepared, glued, and braced.
10	2	**5**	With **APPLIED MOLDINGS**, contained wholly within an individual item or used as rim or panel retention members, require mitered corners and applied with glue and finish nails.		
10	2	**6**	With **CORES** covered by veneer or concealed by molding.		
10	2	**7**	With **INSIDE CORNERS** shipped oversize for installer fitting.		
11	At **MISCELLANEOUS MILLWORK** (interior only) such as:				
11	**1**	**DECORATIVE SCREENS** will be soundly constructed, with all members dadoed together and, where design permits, assembled in the mill.			
11	**2**	**BOXED BEAMS, COLUMNS, PILASTERS,** and overhead **TRELLISES** will be soundly constructed, with tongued, shoulder mitered, mortised and tenoned, loose tenon, or doweled joints; securely glued, nailed, and reinforced with glue blocks or metal brackets, as appropriate.			
11	**3**	**STAVED COLUMNS** will be of lock joint, tongue, or spline construction and securely glued with caps and bases furnished loose.			

END OF SECTION 06

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STAIRWORK & RAILS

SECTION - 07

INCLUDING: Wood Stairs, Integral Trim, Handrails, and Guardrails

07.1 SCOPE

1 Wood stairs and allied wood stair material.

2 **INCLUSIONS**

2.1 Wood stringers of skirt boards.

2.2 Treads, risers, nosing, and scotia.

2.3 Starting steps.

2.4 All wedges and glue blocks.

2.5 Newels, balusters, handrails, guardrails, and crooks.

2.6 Well hole trim.

2.7 Shoe rail, fillet, and spandrels.

2.8 All other wood parts of a stair.

2.9 Installation, if specified; if un-installed, stair materials will be furnished machined KD (knocked down).

3 **EXCLUSIONS**

3.1 Any rough horses, structural wood framing, or timbers.

3.2 Any metal handrail / guardrail brackets or safety nosing.

3.3 Any flooring.

3.4 Priming and/or finishing of any kind.

07.2 SURFACE DEFINITIONS

1 **EXPOSED SURFACES** include all visible surfaces of stringers, skirt boards, treads, risers, and balustrades.

2 **CONCEALED SURFACES** include all non-visible surfaces attached to and/or covered by another, and blocking or spacers used for attachment.

07.3 DEFAULT STIPULATIONS

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS**, all work will be unfinished, Custom Grade, solid stock intended for opaque finish.

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07.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires backs of panels and trim to be factory sealed.

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **WOODWORK** not addressed herein will be manufactured from solid stock, laminated stock, veneered stock, or a combination thereof.

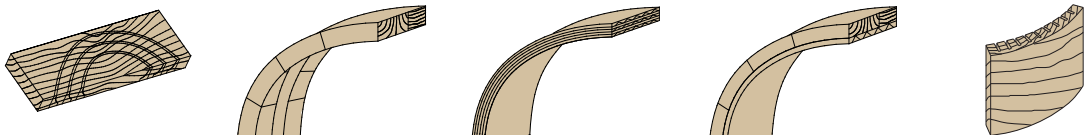
12 **STANDING** and **RUNNING TRIM** will be furnished as material only, not assembled.

13 **TRANSPARENT FINISH**, if species is not specified, the use of either hardwood or softwood (plywood or solid stock) of one species for the entire job is permitted at the manufacturer's option.

14 **STAIRWORK**, including handrail / guardrails, will conform to applicable codes and requirements, and nothing in these standards will overrule such.

IMPORTANT:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

07.5 MATERIAL REQUIREMENTS

1	**SPECIES** and **GRADE** of lumber or sheet products will be as specified.		
2	**TREADS** will be a minimum of 1" (25.4 mm) in thickness.		
3	**CLOSED STRINGERS** will be a minimum of 3/4" (19.0 mm) in thickness after machining and machining for treads and risers will be a minimum of 1/2" (12.7 mm) in depth.		
4	**RADIUS WOODWORK** will be constructed of solid machined, block laminated, laminated plies, core veneered, or kerfed solid stock,  Solid machined; Block laminated; Laminated Plies; Core veneered; Kerfed Solid Stock and solid stock or block lamination members will be furnished in such sections as to avoid pronounced cross grain and reduce joints to a minimum width, glue will be selected for color to avoid a prominent glue line.		
5	**SOFFIT** and **SPANDREL PANELS** will conform to Section 08.		
6	**OPAQUE FINISH** permits medium density fiberboard (MDF) or veneer species of manufacturer's choice, closed grain hardwood.		
7	**TRANSPARENT FINISH,** will be of species specified or if not specified of manufacturer's choice, of plain sliced hardwood with running match within panel face, except:		
7	**P**	**Premium Grade**	Will be balance match within panel face.
7	**1**	**MATCHING** of **ADJACENT LEAVES** will be book matched.	
7	**2**	**END, SEQUENCE,** and **BLUEPRINT MATCHING** requires specific specification requirement.	

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07.5 MATERIAL REQUIREMENTS

Continued from previous page					
8	**EXPOSED SURFACES** require:				
8	1	**SHEET PRODUCT EDGES** be edgebanded with the same species as the face.			
8	2	**END GRAIN** will be profiled or returned and glued, except at:			
8	2	P	**Premium Grade**	Will be returned and glued.	
8	3	**TRANSPARENT FINISH** intersections of radius and straight members are to be splined or half lapped, securely glued, and mechanically fastened, and:			
8	3	1	**BLOCK LAMINATION** segment joints will be staggered, adjacent segment ends will have similar grain angle.		
8	3	2	**VENEER LAMINATIONS** will be sawn from the same or matched boards and reassembled, except at:		
8	3	2	P	**Premium Grade**	They will be reassembled in the same order and orientation as cut.
8	3	3	Visible panel edges, reveals, and/or splines, will be full length, of same species as panel face.		
9	**CONCEALED SURFACES** allow defects such as voids, wane, or unfilled knots, and required blocking or shims will be of a compatible material.				
10	**EDGEBANDING** requires minimum thickness at: HPL Banding of 0.028 (0.7 mm) +/- 0.004 (0.1 mm) PVC, ABS, Polyester, Polypropylene Banding of 0.018 (0.46 mm) +/- 0.005 (0.13 mm) Veneer Banding of 0.02 (0.5 mm) +/- 0.0025 (0.06 mm)				
11	**BOXED** or **CURB STRINGERS**, will be of two or more members.				
12	**STRINGER TURNOUTS**, including quarter turns, half turns, and the like, will be of laminated or veneered face construction, and such turns will be a continuous part of the straight stringer, where feasible.				
13	**GLUE UP** is permitted of handrails, guardrails, newel posts, and balusters if thickness is greater than 1-3/4" (44.5 mm).				
14	**FACTORY FINISHING,** when specified, will have concealed surfaces factory sealed at 1 mil dry.				

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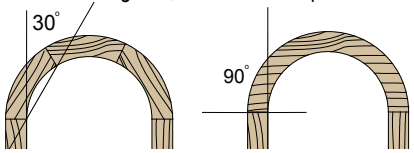
07.6 ASSEMBLY REQUIREMENTS

1			**JOINTS** at **ASSEMBLED WOODWORK** will be neatly and accurately made, securely glued, reinforced to prevent deflection, and will be:
1	1		Assembled at stringer aprons, fascia's, and flat base with clamp nail, biscuit spline, spline, butterfly, scarf, or dowel joinery.
1	2		**HANDRAILS / GUARDRAILS** will utilize stair bolts, and:
1	2	1	When mitered, screws are permitted if covered by fillet or plugs.
1	3		**MECHANICALLY FASTENED** with nails or screws, with fasteners countersunk and located in molding quirks or reliefs.
1	4		**TRIM** to be applied on flat surfaces will have the reverse side backed out, except at those members that have exposed ends, and trim over 2" (50.8 mm) in width with unexposed ends will be backed out.
1	5		**BAND SAWN** and **BLOCK LAMINATED** members will be divided to minimize the exposure of cross grain in the face of the member, and:
1	5	1	Grain angle at the face of curved members will not exceed 30 degrees, unless a small part size requires otherwise.  Acceptable Unacceptable
1	6		**INTERSECTIONS** at radius and straight members will be splined or half lapped, securely glued, and mechanically fastened.
2			**APPLIED MOLDINGS** will be spot glued and mechanically fastened.
3			**MITER JOINTS** will be well fitted and cleaned.
4			**BUILT UP ITEMS** will be soundly fabricated with half lapped, mitered, shoulder mitered, tonged, or equivalent construction.
5			**SHEET** and **LAMINATED LUMBER PANELS** will be allowed to move, float, expand or contract in reaction to ambient humidity changes.

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07.6 ASSEMBLY REQUIREMENTS

Continued from previous page

6			**STAIRWORK** will be furnished KD (knocked down), with:
6	1		**TRIM MEMBERS** cut to required length plus allowance for fitting.
6	2		**STARTING STEPS** with return riser assembled ready for installation.
6	3		**SCOTIA** and **SHOE MOLDS** temporarily attached.
6	4		**BALUSTERS** for open string stairs will be provided with dowel or tenon to fit into treads.
6	5		**CROOKS** and **RETURNS** will be doweled and provided with rail bolts ready for assembly.
6	6		**GLUE BLOCK**S will be provided at a minimum of 12" (305 mm) on center for each riser.
6	7		**PROFILE** for items such as nosing, handrail / guardrail, or balusters, if not indicated, will be manufacturer's choice.
6	8		**FACE STRINGERS** at open end stairs will be cut and mitered to receive treads and risers.
6	9		**SHOE RAIL** will be plowed to receive balusters and fillet.
6	10		**SCOTIA** or **COVE MOLD**, if indicated, will be provided for each riser; and for open string stairs, will be mitered with the end returned.
6	11		**CLOSED STRINGERS** will include machining to receive the treads, risers, and wedges.
6	12		**TREADS** at open string stairs will include boring or cutting required to receive balusters, and:
6	12	1	Exposed ends of treads will have a mitered return nosing, with the leading corner of the tread return mitered to the leading edge of the tread with a shoulder miter and doweled or biscuit spline joined.
6	13		**RISERS** will be rabbeted to receive the back edge of the tread, and at open string stairs will be mitered.
6	14		**RAILS** to receive balusters with square or rectangular heads will be plowed on under side and provided with fillet.
6	15		**NEWEL POSTS**, when built up, will be of shoulder miter, lock joint, tongues, or splined construction.

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END OF SECTION 07

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

WALL / CEILING SURFACING & PARTITIONS

SECTION - 08

INCLUDING: Veneer, Solid Wood, MDF, TFL, HPL, Solid Surface and CGS (Compact Laminate) Wall / Ceiling Surfacing and Partitions

08.1 SCOPE

1 All decorative, veneered or solid wood, MDF, TFL, HPL, Solid Surface and CGS (Compact Laminate) for architectural woodwork:

1.1 Wall Surfacing.

1.2 Ceiling Surfacing.

1.3 Partitions / die walls.

2 **INCLUSIONS**

2.1 All decorative, veneered or solid wood, MDF, TFL, HPL, Solid Surface and CGS (Compact Laminate) composite wall and ceiling surfacing, including wainscoting.

2.2 All decorative, veneered or solid wood, MDF, TFL, HPL, Solid Surface and CGS (Compact Laminate) composite partitions.

2.3 All doors, when specified to be blueprint matched to wood paneling, and:

2.3.1 Specified to be furnished by others, the paneling supplier will control matching.

2.4 Installation, if specified; includes furring or on-wall blocking, shims, and methods of attachment from the face of the wall and ceiling out.

3 **EXCLUSIONS**

3.1 Non-climate controlled interior or exterior architectural wall and ceiling surfacing.

3.2 Casework soffits, fascia or filler panels.

3.3 Room, closet, or access doors, unless sequence matched and blueprint matched with paneling.

3.4 Any bucks, grounds on in-wall blocking.

3.5 Composition or plaster wallboards or coverings.

3.6 Site built framing or sheathing.

3.7 Exposed base.

3.8 Fabric wrapped and/or acoustic panels or partitions.

3.9 Elevator interiors.

3.10 Natural or Engineered Stone

08.2 SURFACE DEFINITIONS

1 **EXPOSED SURFACES** include all visible wall and ceiling surfaces.

2 **CONCEALED SURFACES** include all non-visible blocking or spacers used for attachment, surfaces attached to and/or covered by another.

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08.3 DEFAULT STIPULATIONS

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS**:

1.1 **SURFACING for OPAQUE FINISH** - will be **CUSTOM GRADE,** panels will be MDF and where details show solid wood components, they will be, unfinished close grain hardwood.

1.2 **SURFACING for TRANSPARENT FINISH** - will be **CUSTOM GRADE**, panels will be plain sliced hardwood veneer and/or solid wood components, unstained, clear finished, species of manufacturer's choice.

1.3 **HPL SURFACING** - will be **CUSTOM GRADE,** VGP-HPL of standard, non-premium colors and finishes, selected from manufacturer's brand choice.

1.4 **TFL SURFACING** - will be **CUSTOM GRADE,** TFL of standard, non-premium colors and finishes, selected from manufacturer's brand choice.

1.5 **SOLID SURFACE SURFACING** - will be **CUSTOM GRADE**, Solid Surface of standard, non-premium colors and finishes, selected from manufacturer's brand choice, minimum 1/4" (6.4 mm) in thickness, directly applied with 1/4" x 1" (6.4 mm x 25.4 mm) trim battens at vertical butt joints on continuous horizontal runs.

1.6 **CGS (Compact Laminate) SURFACING** - will be **CUSTOM GRADE,** CGS of standard, non-premium colors with satin finish selected from manufacturer's brand choice, minimum of 1/8" (3.2 mm) in thickness with 1/8" x 1" (3.2 mm x 25.4 mm) battens at vertical joints on continuous horizontal runs.

08.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within **Section 02** (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Product Section 66 through 12, unless a project's contract documents require otherwise.

5 **LUMBER & SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 3 and 4, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires backs of panels and trim to be factory sealed.

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08.4 GENERAL REQUIREMENTS (continued)

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **FURRING, HANGING SYSTEMS** will be used as required, and will be in accordance with applicable codes and regulations.

12 **DEFINED GRAIN** and/or **PATTERN** of wall surfacing will be installed running vertically.

13 **WAINSCOT** will be 48" (1220 mm) or less in height above the finished floor.

IMPORTANT:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

08.5 MATERIAL REQUIREMENTS

1					**PARTITIONS** require:
1	1				**CORES** of particleboard or medium density fiberboard (MDF) up to and including 48" (1220 mm) in width or 84" (2134 mm) in height will be a minimum 11/16" (17.5 mm) in thickness, and:
1	1	1			Over 48" (1220 mm) in width or 84" (2134 mm) in height will be a minimum 1" (25.4 mm) in thickness.
1	1	2			**DOORS** or **GATES** up to and including 36" (914 mm) in width or 72" (1829 mm) in height will be a minimum 11/16" (17.5 mm) in thickness, and:
1	1	2	1		Over 36" (914 mm) in width or 72" (1829 mm) in height will be a minimum 1" (25.4 mm) in thickness.
1	2				**CGS** (Compact Laminate) panels doors and gates up to and including 48" (1220 mm) in width or 84" (2134 mm) in height will be a minimum 1/2" (12.7 mm) in thickness, and:
1	2	1			Over 48" (1220 mm) in width or 84" (2134 mm) in height will be a minimum 3/4" (19.0 mm) in thickness.
2					**CONCEALED SURFACES** permit defects such as voids, wane, or unfilled knots, and:
2	1				Requires **STRUCTURAL FRAMING MEMBERS** for items such as reception desk walls, die walls, podiums, benches, partitions etc., to be veneer core plywood, hardwood lumber, particleboard, MDF or SCL.
3					**EDGEBANDING** requires minimum thickness at: HPL Banding of 0.028 (0.7 mm) +/- 0.004 (0.1 mm). PVC, ABS, Polyester, Polypropylene Banding of 0.018 (0.46 mm) +/- 0.005 (0.13 mm). Veneer Banding of 0.02 (0.5 mm) +/- 0.0025 (0.06 mm).

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08.5 MATERIAL REQUIREMENTS

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4	**VENEER SURFACING** requires:				
4	**1**	**CORES** of particleboard or medium density fiberboard (MDF) be a minimum of 1/2" (12.7 mm) in thickness, except at:			
4	1	**P**	**Premium Grade**	Will be a minimum of 11/16" (17.5 mm) in thickness.	
4	**2**	**OPAQUE FINISH** faces to permit the use of paint grade hardwood, medium density fiberboard (MDF), or medium density overlay (MDO) without selection of color and/or grain and if MDF is used, edgebanding is not required. Also permits manufacturers' choice of veneer slicing without any requirement for matching of veneer leaves or adjacent panels, and:			
4	2	**1**	**VISIBLE REVEALS** and **SPLINES** will be manufacturers' choice of species.		
4	2	**2**	**EDGEBANDS** will be close grain material.		
4	**3**	**TRANSPARENT FINISH** requires veneer to be running matched, with adjacent panels sequenced pre-manufactured sets, except at:			
4	3	**P**	**Premium Grade**	Veneer will be balance matched when required to be end matched, sequenced pre-manufactured sets, except at trimmed ends of sequenced panel sets.	
4	3	**1**	**ADJACENT LEAVES** will be matched / sequenced.		
4	3	**2**	**ADJACENT PANELS** when **SEPARATED BY SOLID WOOD** greater than 2 1/2" (63.5 mm) wide, and at:		
4	3	2	**P**	**Premium Grade**	They will be balance matched, sequenced pre-manufactured sets, except at trimmed ends of sequenced panel sets.
4	3	**3**	**VISIBLE EDGES, REVEALS,** and/or **SPLINES** will match species of panel face, and:		
4	3	3	**1**	**WITHIN A PANEL**, have solid wood let into the core before the veneer is applied where the veneer is machined through; however, reveals of 1/8" (3.2 mm) or less in width let into MDF to a maximum depth of one third of the core thickness do not require solid wood if finished same as exposed finish.	
4	**4**	**FLAME SPREAD RATED** paneling be of panel material supplier standard and in conformance to the requirements of applicable labeling agencies, and:			
4	4	**1**	**DISCOLORATION** of veneers caused by use of **FR ULEF/NAUF** particleboard and MDF cores is not the responsibility of the millworker or board suppliers.		

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08.5 MATERIAL REQUIREMENTS

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5					**WOOD STILE** and **RAIL SURFACING** requires: plain sawn lumber and veneered sheet products that comply with those requirements spelled out for Veneered Wall Surfacing within this section, and:
5	1				**PANELS** will be manufacturer's choice of solid stock or veneered construction with edges veneer edgebanded with same species as face without requirement of mitering at corners, as may be permitted:
5	1	1			**If FLAT** will be either:
5	1	1	1		**SOLID WOOD,** minimum 3/4" (19.0 mm) in thickness and maximum 13-3/4" (349 mm) across the grain in width, except at:
5	1	1	1	P **Premium Grade**	Solid wood is not permitted.
5	1	1	2		**VENEERED, a m**inimum 1/2" (12.7 mm) in thickness.
5	1	2			If **RAISED** will be either:
5	1	2	1		**SOLID WOOD,** minimum 3/4" (19.0 mm) in thickness and maximum 13-3/4" (349 mm) across the grain in width, except at:
5	1	2	1	P **Premium Grade**	Solid wood is not permitted.
5	1	2	2		**VENEERED,** a minimum 11/16" (17.5 mm) in thickness.
6					**HPL SURFACING** requires:
6	1				VGP -HPL of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice.
6	2				**FLAME SPREAD RATING,** when required, be of the construction standard of the panel material supplier and conform to the requirements of applicable labeling agencies.
6	3				**CORES** of particleboard or medium density fiberboard (MDF) and will be a minimum of 1/2" (12.7 mm) in thickness, and at:
6	3	P	**Premium Grade**		Will be a minimum of 11/16" (17.5 mm) in thickness.
6	4				**BACKING SHEET** be a minimum of 0.020" (0.5 mm) thickness HPL, applied to the backside of the core using the same adhesive as the face lamination in the same machine or grain direction as the face laminate.
7					**TFL SURFACING requires:**
7	1				TFL of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice.
7	2				**FLAME SPREAD RATING,** when required, be of the construction standard of the panel material supplier and conform to the requirements of applicable labeling agencies.
7	3				**CORES** of particleboard or medium density fiberboard (MDF) and will be a minimum of 1/2" (12.7 mm) in thickness, and at:
7	3	P	**Premium Grade**		Will be a minimum of 11/16" (17.5 mm) in thickness.
8					**SOLID SURFACE SURFACING** requires brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice.
9					**CGS** (Compact Laminate) **SURFACING** requires brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and a minimum of 1/8" (3.2 mm) in thickness.

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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08.6 ASSEMBLY REQUIREMENTS

1	**JOINTS** at **ASSEMBLED WOODWORK** will be neatly and accurately made, securely glued, reinforced to prevent failure and:			
1	**1**	Permits clamp nail, biscuit spline, butterfly, scarf, loose tenon, or dowel joinery.		
1	**2**	Be **MECHANICALLY FASTENED,** with exposed fasteners countersunk and located in molding quirks or reliefs where possible.		
1	**3**	Prohibits **VISIBLE FASTENERS** and/or associated covers / caps at exposed surfaces.		
1	**4**	Permits use of **FILLER,** if inconspicuous when viewed at 24" (610 mm).		
1	**5**	**TRIM** applied on flat surfaces will have the reverse side backed out, including door and window trim over 2" (50.8 mm) in width with non-exposed ends, and at:		
1	5	**P**	**Premium Grade**	Filler is not permitted.
1	**6**	Be spot glued and mechanically fastened with a maximum of two positioning set nails per 12" (305 mm) of length before a joint, only to non-panel surfaces, panel is required to float.		
1	**7**	**BUILT UP ITEMS** will be soundly fabricated with half lapped, mitered, miter fold, shoulder mitered, tonged, or equivalent construction.		
1	**8**	**SHEET** and **LAMINATED LUMBER PANELS** will be permitted to move, float, expand or contract in reaction to ambient humidity changes.		
1	**9**	**EXPOSED SURFACES** requires end grain to be kept to a minimum, and at:.		
1	9	**P**	**Premium Grade**	End grain showing is not permitted.
1	**10**	**EXPOSED SURFACES** prohibit **CROSS SANDING**, excluding turned surfaces, **TEAR OUTS, KNIFE NICKS**, **HIT** or **MISS** machining, or **KNIFE MARKS** where sanding is required.		

Continued on next page

08.6 ASSEMBLY REQUIREMENTS

Continued from previous page

2	**VENEER SURFACING** requires:					
2	**1**	**PANELS** to be cut to size by the manufacturer and scribed to fit by installer.				
2	**2**	**SEQUENCING** of **PANELS WITHIN A ROOM** and:				
2	2	**1**	**ADJACENT PANELS** will be sequenced using running matched **PRE-MANUFACTURED SEQUENCED SETS FULL WIDTH PANEL UTILIZATION**, except at:			
2	2	1	**P**	**Premium Grade**	They will be balanced matched panels.	
2	2	**2**	**OPTIONAL SEQUENCE SYSTEMS MUST BE SPECIFIED** such as:			
2	2	2	**1**	**PRE-MANUFACTURED SEQUENCED SETS SELECTIVELY REDUCED PANEL UTILIZATION** with balanced panels (equally trimmed sides).		
2	2	2	**2**	**MADE TO ORDER SEQUENCED SETS** panels are required to be balance matched, including makeup panels.		
2	2	2	**3**	**MADE TO ORDER SEQUENCED BLUEPRINT SETS** and **COMPONENTS** required to be balance matched with veneer alignment at common size panels, make up panels, and components.		
2	2	2	**4**	**END SEQUENCED.**		
2	2	**3**	Pre-manufactured **BALANCED MATCH** panels with the width of outer leaves after trimming at the edges not to exceed 1-1/2" (38.1 mm) less than the adjoining leaf, except at:			
2	2	3	**P**	**Premium Grade**	It will not exceed 3/4" (19.0 mm) less than the adjoining leaf.	
2	2	**4**	Custom made to order **SEQUENCE BALANCE MATCH** panels with the width of outer leaves after trimming at edges not to exceed 1" (25.4 mm) less than the adjoining leaf, except at:			
2	2	4	**P**	**Premium Grade**	It will not exceed 1/2" (12.7 mm) less than the adjoining leaf.	
2	2	**5**	Panel to adjoining panel requires **VENEER GRAIN** aligned vertically and/or horizontally within a maximum of 3/8" (9.5 mm) variance, except at:			
2	2	5	**P**	**Premium Grade**	The maximum variance will be 3/16" (4.8 mm).	
2	2	**6**	**BLUEPRINT SEQUENCED PANELS** are required to be balance matched with veneer alignment at common size panels, make up panels, and components, and:			
2	2	6	**7**	When veneer flitch quantity does not allow for sequence matching for the entire room, flitch transition will be at changes in plane (e.g. corners), and/or wall openings and will be compatible for color and figure, except at:		
2	2	6	7	**P**	**Premium Grade**	It will be well matched for color and figure.

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08.6 ASSEMBLY REQUIREMENTS

Continued from previous page

2				**VENEER SURFACING** requires (continued)	
2	3			**BUTT JOINTS** to be factory prepared and have edges eased, and at:	
2	3	P	**Premium Grade**	Be grooved with splines furnished.	
2	4			**REVEAL JOINTS** and **CORNERS** o be factory prepared, have edges eased and articulation strip(s) furnished, and at:	
2	4	P	**Premium Grade**	Be machined for furnished articulation strip(s).	
2	5			**INSIDE CORNERS** to be shipped oversize for field fitting.	
2	6			**MITERED** outside corners to be factory prepared.	
2	7			**FIELD JOINERY** to be factory prepared to the greatest extent possible with feature strips and joint trim furnished oversize, where possible, to allow for jobsite fitting.	
2	8			**EXPOSED CORNERS** to be shoulder mitered, lock mitered, spline mitered, mitered with a biscuit spline, or miter folded unless specified and/or detailed otherwise.	
2	9			**MOLDINGS** within an individual panel face to be factory applied.	
2	10			**VENEER JOINTS** to be plumb, within 3/16" (4.8 mm), except at:	
2	10	P	**Premium Grade**	It will not exceed 1/8" (3.2 mm).	
2	11			**VENEER LOSS, SIDE,** between sequenced adjacent panels not to exceed 1-1/2" (38.1 mm), except at:	
2	11	P	**Premium Grade**	It will not exceed 1" (25.4 mm).	
2	12			**VENEER LOSS, END,** between sequenced adjacent end matched panels not to exceed 2" (50.8 mm), except at:	
2	12	P	**Premium Grade**	It will not exceed 1-1/2" (38.1 mm).	
2	13			**END MATCHED VENEER MISALIGNMENT** between sequenced adjacent panels not to exceed 3/8" (9.5 mm), except at:	
2	13	P	**Premium Grade**	It will not exceed 3/16" (4.8 mm).	
2	14			**FIGURE** and/or heart progression will be uniform and natural between adjacent sequenced panels and not exceed 1" (25.4 mm), except at:	
2	14	P	**Premium Grade**	It will not exceed 1/2" (12.7 mm).	
2	14	1		**DOORS** and other components that adjoin at blueprint panels not to exceed 2" (50.8 mm), except at:	
2	14	1	P **Premium Grade**	It will not exceed 1-1/2" (38.1 mm).	
3				**SOLID STILE** and **RAIL SURFACING** requires will be factory assembled in sections as large as practical for field installation, with field joints factory preparation to the greatest extent possible with feature strips and joint trim furnished oversize, where possible, to allow for jobsite fitting.	

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08.6 ASSEMBLY REQUIREMENTS

Continued from previous page

4	**HPL and TFL SURFACING** requires:				
4	**1**	**ADJACENT SHEETS** be pre-matched by the manufacturer and/or installer to minimize color variation within the scope of the material supplier's guarantee and be fabricated from the longest sheet lengths available.			
4	**2**	**PATTERNED** or **WOOD GRAIN** laminate **MATCH VERTICALLY,** provided the total height does not exceed the maximum length of the available sheet; however, it is not required to **MATCH HORIZONTALLY.**			
4	**3**	**ALIGNMENT VARIATIONS** at special patterns not exceed 1/8" (3.2 mm), except at:			
4	3	**P**	**Premium Grade**	It will not exceed 1/16" (1.6 mm).	
4	**4**	**RETENTION MOLDINGS** are permitted at field joints and will be secured to wall studs or in wall blocking.			
4	**5**	**VERTICAL** or **HORIZONTAL JOINTS** have a slight "V" and be splined full length or have biscuit splines at a minimum of 12" (305 mm) on center.			
4	**6**	**PANELS** be factory sized, except where field adjustment is required.			
4	**7**	**BUTT JOINTS** be factory prepared with edges eased, and at:			
4	7	**P**	**Premium Grade**	Grooved with splines furnished.	
4	**8**	**REVEAL JOINTS** and **CORNERS** be factory prepared with edges eased and articulation strip(s) furnished, and at:			
4	8	**P**	**Premium Grade**	Machined for furnished articulation strip(s).	
4	**9**	**INSIDE CORNERS** to be shipped oversize for field fitting.			
4	**10**	**OUTSIDE CORNERS** be factory prepared and shipped loose, and at:			
4	10	**P**	**Premium Grade**	If site conditions permit, glued and braced prior to shipping.	
4	**11**	**VISIBLE SPLINES** and **REVEALS** that are:			
4	11	**1**	1/4" (6.4 mm) or less in any face dimension by depth, require edges and bottom painted to match face.		
4	11	**2**	Greater than 1/4" (6.4 mm) in any face dimension by depth, require manufacturers' choice edgebanding or painting of edges and bottom to preclude show through of core, and at:		
4	11	2	**P**	**Premium Grade**	It requires matching edgebanding of partial edges.
4	**12**	**EDGEBANDING** of square edged panel parts is required at exposed vertical and horizontal edges of either HPL, PVC or ABS, a minimum of 0.018" (0.5 mm) in thickness, and color matched to the exposed face, and:			
4	12	**1**	Will be applied before or after the face laminate, at manufacturers option.		
4	12	**2**	Does **NOT** require mitering of corners.		
4	12	**3**	If **MITER FOLDED**, to be machined with the core.		

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08.6 ASSEMBLY REQUIREMENTS

Continued from previous page

5	**SOLID SURFACE SURFACING** will be per the material supplier's recommendations, and requires:			
5	**1**	**BUTT JOINT** components to be spaced approximately 1/8 " (3.2 mm) apart to allow satisfactory caulking or seaming, caulked with compatible color matched sealant, except at:		
5	1	**P**	**Premium Grade**	It will be seamed with compatible hard seam adhesive.
5	**2**	**VERTICAL JOINTS** in horizontal panel runs to be caulked or trimmed with an applied 1/4" x 1" (6.4 mm x 25.4 mm) batten using silicone or other material supplier approved adhesive, except at:		
5	2	**P**	**Premium Grade**	It will be hard seamed with material supplier approved hard seam adhesive.
5	**3**	**EXPANSION** joints where required by building design or material supplier recommendation.		
5	**4**	**VEINED / SWIRLED** solid surface may have random patterns that cannot be matched at seams. Pattern breaks, pattern changes and color variations may occur, and will not be considered a defect in materials or workmanship.		
5	**5**	When **DIRECTLY** applied to wall or ceiling surfaces to be a minimum of 1/4" (6.4 mm) in thickness, with butt joints caulked or covered with a trim batten, except at:		
5	5	**P**	**Premium Grade**	It will be a minimum of 1/2" (12.7 mm) in thickness, with hard seam, except at building expansion joints.
6	**CGS (Compact Laminate) SURFACING** will be per the material supplier's recommendations, and requires:			
6	**1**	**JOINT WIDTH** will be at least 1/8 " (3.2 mm) to allow satisfactory caulking penetration.		
6	**2**	**JOINTS** provide for panel movement in both horizontal and vertical directions, such as by use of **TRIMS** or **GASKETS** made of aluminum, PVC, and neoprene.		
6	**3**	At rabbeted or tongue and groove joints, panel thickness be a minimum of 3/8" (9.5 mm).		

END OF SECTION 08

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

PASSAGE DOORS

SECTION - 09

INCLUDING: Passage Doors of Flush and Stile & Rail Construction with Wood and HPL Faces

09.1 SCOPE

1 All flush and stile and rail wood doors with corresponding and adjacent transoms, fixed panels, and/or side lights.

2 **INCLUSIONS**

2.1 Flush doors, solid core, foam core, hollow core, fire rated, sound resistant, x-ray, or bullet resistant.

2.2 Stile and rail doors of veneered, solid, and/or laminated (solid) construction with or without fire, sound, or bullet resistant ratings.

2.3 Fire rated door accessories required to comply with the door material supplier's fire rated door approval, including treated or metal edges at pairs of fire rated doors as required.

2.4 Sound resistant accessories required to comply with the door material supplier's sound resistant certification, including gaskets and automatic door bottoms.

2.5 Glass stops.

2.6 Wood louvers.

2.7 **IF SPECIFIED:**

2.7.1 Glass or glazing; pre-fitting and machining for hardware; pre-hanging and machining for weather stripping; priming, sealing, and/or finishing; flashing and/or metal edge guards.

2.7.2 Installation, if specified.

3 **EXCLUSIONS**

3.1 Cabinet doors included with casework.

3.2 Wood cores for metal or vinyl clad doors.

3.3 Roll-up, metal, and fiberglass doors.

3.4 Access doors.

3.5 Metal grills or louvers.

3.6 TFL or vinyl faced doors.

09.2 SURFACE DEFINITIONS

1 **EXPOSED SURFACES** include both visible vertical edges and faces of doors, including applied moldings, lights, and louvers. Top edge, only if visible from above.

2 **SEMI-EXPOSED SURFACES** include top and bottom edges of doors, unless top edge is visible from above.

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09.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS**, work will be **CUSTOM GRADE**, solid core of manufacturer's choice, with paint grade faces and edges. If transparent finish is specified, doors will be factory clear finished.

09.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires backs of panels and trim to be factory sealed.

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14

9 **TOLERANCE REQUIREMENTS** are covered under Section 15

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **DOOR CONSTRUCTION** within these standards are primarily performance based rather than prescriptive based, allowing a wide variance of construction methods and/or component configurations, provided the end product meets or exceeds **WDMA's PERFORMANCE VALUES** contained within these standards, and **RESPONSIBILITY** for evidence of compliance rests on the manufacturer.

09.4 GENERAL REQUIREMENTS (continued)

12 **ANSI/WDMA HEAVY DUTY PERFORMANCE DUTY LEVEL** is required for both Flush and Stile and Rail doors, and If a higher Extra Heavy Duty or lower Standard Duty Performance Duty Level is required, it will be specified:

12.1 **DUTY LEVEL** performance requirements are spelled out within the Machine / Assembly Requirements. Duty Levels other than those required herein, will be so specified from the following:

12.1.1 **HEAVY DUTY LEVEL** typically involves doors for moderate usage and requires intermediate minimum performance standards.

12.1.2 **EXTRA HEAVY-DUTY** level typically involves doors where use is considered heavy and frequent, and requires the highest minimum performance standards.

12.1.3 **STANDARD DUTY** level typically involves doors where frequency of use is low and requires the lowest minimum performance.

13 **FLUSH SOLID CORE** doors require compliance to - ANSI/WDMA I.S. - 1A, (latest edition), in addition to **WDMA's** Heavy Duty Performance Values, except as modified herein. and:

13.1 **FIRE RATED** doors, available in 20, 45, 60, and 90 minute labels, will be of the material supplier's standard, conforming with the requirements of their applicable labeling service and fire rating specified, with edges, regardless of face species, conforming to the material supplier's approved labeling service, and:

13.1.1 **EDGES**, regardless of face species will conform in species, width, and fire-retardant treatment to the requirements of the material supplier.

13.1.2 **PREPARATION**, in accordance with NFPA 80, for locks, latches, hinges, remotely operated or monitored hardware, concealed closures, glass lights, vision panels, louvers, astragals, to be performed in conformance with the material supplier's licensing and label service agreement; however:

13.1.2.1 Preparation for surface applied hardware, function holes for mortise locks, holes for labeled viewers, a maximum of 3/4" (19.0 mm) wood and composite door undercutting, and protection plates may be performed at the jobsite.

13.1.3 **HANGING** and **FINISHING** will be in compliance with material suppliers' basic instructions.

13.2 **SOUND RESISTANT** doors will be of material supplier's standard, conforming to the requirements for a minimum STC 50 (Sound Transmission Class) or as specified when tested as an opening unit (versus sealed in place), and Include required special stops, stop adjusters, gaskets, and automatic threshold closing devices of the material supplier's standard.

13.3 **X-RAY** doors will be of material supplier's standard for the type of construction, thickness, edgebands, and moldings, and: **LEAD** thickness will be a minimum of 1/16" (1.6 mm) or as specified.

13.4 **BULLET RESISTANT** doors will be of material supplier's standard, conforming to the requirements of UL 752 "Bullet Resisting Equipment" or NIJ (National Institute of Justice) 0108.01 Performance Standards, and have a minimum NIJ Level 2 protection rating.

13.5 **ELECTROSTATIC SHIELDED** doors will be of material supplier's standard for type of construction, thickness, edgebands, and moldings, and have the number and location of electrical leads as specified.

09.4 GENERAL REQUIREMENTS (continued)

14 **FLUSH HOLLOW** and **FOAM CORE** doors will comply with WDMA's Standard Duty performance values.

15 **STILE** and **RAIL** doors with or without fire, sound, or bullet resistant ratings will comply with - ANSI/WDMA I.S. - 6A, (latest edition), **EXCEPT** as **MODIFIED** herein.

16 **FACTORY FINISHED** doors require both faces and vertical edges to be finished, along with the top and bottom edges and hardware prepared areas be sealed.

17 **WARRANTY** will be to the terms, conditions, and duration of the door material supplier, unless specified otherwise. Check with individual door material suppliers for warranty and fire approval requirements, and:

17.1 May vary between material suppliers-as to coverage, duration, items / conditions that void it, extent of replacement and cost coverage.

17.2 **EXCLUSIONS,** typically include:

17.2.1 Different Species, face materials, finishes, or laminates on opposite sides.

17.2.2 Different temperature and/or humidity conditions on opposite sides.

17.2.3 Less than 5" (127 mm) between cutouts or a cutout and the edge of a door, or:

17.2.4 Less than 6" (152 mm) at fire-rated doors between cutouts or a cutout and the edge of a door, unless approved by authorities with jurisdiction.

18 **HANDING** of a door is always determined from the outside which is always the bottom of the illustrations below:

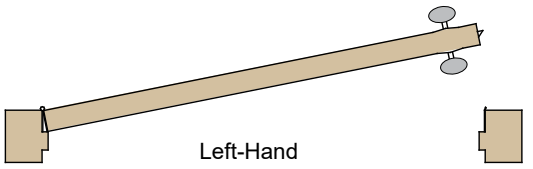

Figure: 09-001

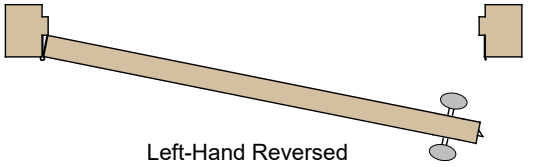

Figure: 09-002

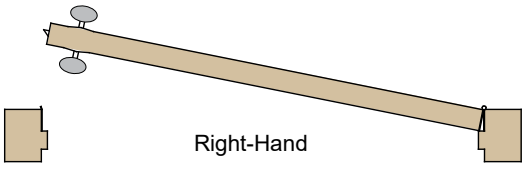

Figure: 09-003

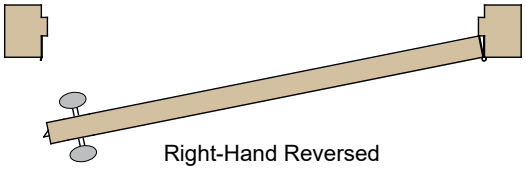

Figure: 09-004

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09.4 GENERAL REQUIREMENTS (continued)

19 **ANSI/WDMA HEAVY DUTY PERFORMANCE DUTY LEVEL** is required for both Flush and Stile and Rail doors, with minimum 1" (25.4 mm) hardwood or material qualified in accordance with WDMA TM 15 (latest edition) at flush door stiles and rails.

Table: 09-001 - **FLUSH WOOD DOOR MINIMUM PERFORMANCE STANDARDS** -
(Reprinted with permission from ANSI/WDMA I.S. 1A (latest edition), wdma.com

Performance Attribute	Performance Duty Level		
	EXTRA HEAVY DUTY	HEAVY DUTY	STANDARD DUTY
Adhesive Bond Durability, WDMA TM-6	Type I or Type II		
Cycle Slam, WDMA TM-7	1,000,000 cycles	500,000 cycles	250,000 cycles
Hinge Loading, WDMA TM-8	550 lbs. (2440 N)	475 lbs. (2110 N)	400 lbs. (1780 N)
Door Finish, Various ASTM test methods	TR-6 & OP-6 or equal * ***(Catalyzed Polyurethane NAAWS System -11)***	TR-4 & OP-4 or equal * ***(Conversion Varnish NAAWS System -5)***	TR-2 & OP-2 or equal * ***(Catalyzed Lacquer NAAWS System -2 or 3)***
Screw holding, WDMA TM-10 Door Face (blocked or unblocked) Vertical Door Edge Horizontal Door Edge **	 550 lbs. (2440 N) 550 lbs. (2440 N) 300 lbs. (1330 N)	 475 lbs. (2110 N) 475 lbs. (2110 N) 240 lbs. (1060 N)	 400 lbs. (1780 N) 400 lbs. (1780 N) 180 lbs. (810 N)
Telegraph, Section T-1 ***See NAAWS Test D in Section 15 - TOLERANCES***	Maximum 0.010" in any 3" span (0.3 mm in any 76 mm span)		
Warp Tolerance, Section T-2 ***See NAAWS Test F in Section 15 - TOLERANCES***	Maximum 0.25" per 3'6" x 7'0" (6.4 mm in any 1067 mm x 2134 mm) door section		
Squareness, Section T-3 ***See NAAWS Test E in Section 15 - TOLERANCES***	Diagonal variance 1/8" (3.2 mm)		

* Other formulations may exhibit similar performance characteristics, but must meet or exceed the performance levels for the systems specified to be considered equal.
** Horizontal door edge screw holding applies when hardware is to be attached.

Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

09.5 MATERIAL REQUIREMENTS

1				**IN LIEU OF TESTING** for WDMA's TM-7 (Slam Cycle) and TM-8 (Hinge Loading), these standards offer the following specific prescriptive requirements that are alternatively acceptable for flush solid core and stile and rail doors:
1	1			**FLUSH DOORS** require:
1	1	1		**COMPOSITE CROSS BANDS** of minimum 55 lbs. (24.9 kgs.) density.
1	1	2		**FACES** on both sides of the door of the same material and construction detail.
1	1	3		**SOLID CORE** be SCLC, SLC, particleboard, MDF, or agrifiber core conforming to ANSI A208.1 Grade LD-1 or LD-2 that meets the minimum requirements of WDMA - I.S. 1-A (latest edition).
1	1	4		**HOLLOW CORE** be honeycomb or expandable paper core that meets the minimum requirements of WDMA - I.S. 1-A (latest edition) with blocking size and location as specified.
1	1	5		**FOAM CORE** be rigid closed cell polyurethane or polystyrene panel core with blocking size and location as specified.
1	1	6		**STILES and RAILS** be minimum 1" (25.4 mm) thick hardwood or material that has been qualified in accordance with WDMA TM 15 {impact resistant} (latest edition), and:
1	1	6	1	Stiles, rails, blocking (for screw attached hardware) and core at non-SCLC or SLC core will be calibration sanded to uniform thickness.
1	1	7		At **OPAQUE FINISH,** composite face be minimum 3 ply construction and veneer face minimum 5 ply construction.
1	1	8		At **TRANSPARENT FINISH**, veneer face be minimum 5 ply construction.
1	1	9		At **HPL** face, be minimum 5 ply construction.
1	2			**STILE and RAIL** doors require:
1	2	1		**SOLID LUMBER, SCL, LVL,** or **STAVED BLOCK** core construction, with minimum of 1/4" (6.4 mm) hardwood edgebands at lock and hinge edges; with or without fire, sound or bullet resistant ratings, and:
1	2	1	1	If not solid lumber, minimum 5" (127 mm) wide stiles, top and intermediate rails, and 10" (255 mm) wide bottom rail.
1	2	2		**DOWEL** or mortise and tenon joinery.
1	2	3		**FLAT** or **RAISED PANELS** a minimum of 5/8" (15.9 mm) in thickness at the tongue of solid lumber or M2 Grade particleboard.
1	2	4		**OPAQUE** finish, face and edges be solid stock of close grain hardwood, veneer of sound close grain hardwood or MDO, of manufacturer's choice.
1	2	5		**TRANSPARENT** finish, face and edges be solid stock or veneer of species.

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09.5 MATERIAL REQUIREMENTS

Continued from previous page

2	**FLUSH DOORS FACES**, whether complying to 'WDMA's Duty Level' or the above 'NAAWS's Prescriptive' requirements, require:					
2	1	At the following common species: **ALDER**, Western Red **ANIGRE** **ASH** **BEECH** **BIRCH** **CHERRY** **HICKORY** **LAUAN** **MAHOGANY**, American or African **MAPLE** **PECAN** **POPLAR** **OAK,** Red & White **SAPELE** **WALNUT**				
2	2	At **OPAQUE** finish, be sound close grain hardwood veneer, MDO, MDF or minimum 1/8" (3.2 mm) thick standard grade hardboard at manufacturer's choice.				
2	3	At **TRANSPARENT** finish:				
2	3	1	**VENEERS** be running match with end component less than the Section 04 veneer characteristic requirement, and at:			
2	3	1	**P**	**Premium Grade**	They will be balanced center matched.	
2	3	2	**PAIRS** or **SETS** will be compatible for color and grain, or at:			
2	3	2	**P**	**Premium Grade**	They will be sequenced and well matched for color and grain.	
2	3	3	**TRANSOMS** be end matched for color and grain, except at:			
2	3	3	**P**	**Premium Grade**	They will be continuous match for color and grain.	
2	3	4	**DOOR FACE TO BE COMPATIBLE** in color and grain to other door faces in the same room or area, and it is the responsibility of the door supplier.			
2	3	5	**VISIBLE EDGES** and **REVEALS** will be matched to species of face, except that Maple may be used as an alternate to a Birch face.			
2	4	**VENEER FACE GRADE REQUIREMENTS** will conform to the Grade requirements of Section 04, for:				
2	4	1	**OPAQUE FINISH** requires close grain hardwood (excluding Alder, Western Red), Grade - **C**, except:			
2	4	1	**P**	**Premium Grade**	Requires Grade - **B.**	
2	4	2	**TRANSPARENT FINISH** (including Alder, Western Red), Grade - **A**, except (excluding Alder, Western Red) at:			
2	4	2	**P**	**Premium Grade**	Requires Grade - **AA.**	
2	4	3	**STAND ALONE DOORS**, including those in pairs and sets, are subject to a 1" (25.4 mm) reduction in the nominal minimum width of face components at both plain and rotary sliced veneers of *Table: O4-001* in Section 04, and:			
2	4	3	1	If **NOT OF A SPECIES LISTED ABOVE**, it will conform to the above as agreed on between the design professional and the manufacturer.		
2	4	3	2	**MATCHING WITHIN A DOOR FACE** to be running match, except at:		
2	4	3	2	**P**	**Premium Grade**	It will be center balanced match with the width of outer leaves after trimming not exceeding 1" (25.4 mm) less than its adjoining leaf.

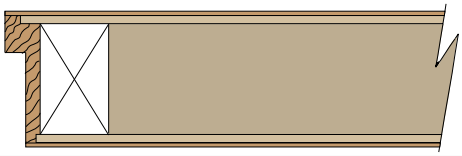
SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

09.6 ASSEMBLY REQUIREMENTS

1	**FLUSH** doors will be 3-, 5-, or 7-Ply of the manufacturer's choice, with use of water proof or water resistant adhesive of manufacturer's choice, and require:					
1	1	**BONDED CONSTRUCTION** (stiles and rails securely glued to core).				
1	2	**SANDING** of stiles, rails and core to uniform thickness after assembly and prior to applying decorative face.				
1	3	**CROSS BANDS** be of wood veneer or composite, particleboard is not permitted.				
1	4	**HORIZONTAL EDGES** run the full width between stiles without a gap.				
1	5	When veneer is applied to solid wood edge, cross band will not be set back greater that 1/4" (6.4 mm) from door edge. 				
1	6	**CUTOUTS at**:				
1	6	1	**NON RATED** doors (unless permitted by individual material supplier's warranty) will not exceed one half the door height or 40% of the door area, for the combined area of all cutouts for lights or louvers and be at least 5" (127 mm) from door edges, adjacent cutouts, or hardware mortises.			
1	6	2	**RATED** doors will be governed by the individual material supplier's fire rated approval and/or NFPA 80 for the combined area and location of cutouts for lights or louvers.			
1	7	**TRANSOM PANEL**:				
1	7	1	**BOTTOM RAILS** will allow side rails to run through and be compatible for color to the vertical edgeband of the door, except at:			
1	7	1	P	**Premium Grade**	They will be full width and be well matched for color to the vertical edgeband of the door.	
1	7	2	**TOP RAILS** of doors with rabbeted transoms compatible in color to the vertical edgeband of the door, except at:			
1	7	2	P	**Premium Grade**	They will be of the same species as the vertical edgeband of the door.	
1	7	3	**FACES**, for transparent finish to be end matched to the door, except at:			
1	7	3	P	**Premium Grade**	They will be continuous matched to the door.	
1	7	4	**END MATCHED VENEER MISALIGNMENT** between sequenced adjacent panels at:			
1	7	4	1	**Single Door Transom will not exceed** 3/8" (9.5 mm), except at:		
1	7	4	1	P	**Premium Grade**	It will not exceed 3/16" (4.8 mm).
1	7	4	2	Paired Door Transoms not to exceed 1/2" (12.7 mm), except at:		
1	7	4	2	P	**Premium Grade**	It will not exceed 3/8" (9.5 mm).

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09.6 ASSEMBLY REQUIREMENTS

Continued from previous page

1	**FLUSH** doors require: (continued)				
1	**8**	**DUTCH DOORS** without an applied shelf, if rabbeted, require the top edge of the bottom leaf and the bottom edge of the top leaf at:			
1	8	**1**	**OPAQUE FINISH** to be close grain hardwood of a species of the manufacturer's choice.		
1	8	**2**	**TRANSPARENT FINISH** to be of a species compatible in color with the face veneer, except at:		
1	8	2	**P**	**Premium Grade**	It will be the same species as the face veneer.
1	8	**3**	**HPL**, to be close grain hardwood of a species of the manufacturer's choice, and painted or stained to match the face laminate, if edges are so required.		
1	**9**	**VERTICAL EDGES at**:			
1	9	**1**	**OPAQUE** finish will be primed if doors are factory primed, be of close grain hardwood lumber, veneer, or MDO over backer of the manufacturer's choice, and permit one finger joint at either veneer edge that is tight, not raised, or not visible from a distance of 48" (1220 mm), except at:		
1	9	1	**P**	**Premium Grade**	Finger joints are not permitted.
1	9	**2**	**TRANSPARENT** finish will be of hardwood lumber or veneer over backer, compatible in color with the face veneer, allow flat grain Douglas Fir at Vertical Grain Douglas Fir faced doors, and permit one finger joint at each edge that is tight, not raised, uniform in color and grain, without discoloration, or not visible from 48" (1220 mm), except at:		
1	9	2	**P**	**Premium Grade**	They will be the same species and cut as the face veneer; however, if the material supplier's fire rated door approval prevents the use of matching vertical edges, then the species permitted under their approval will be permitted, and finger joint are not permitted.
1	9	**3**	**HPL** face will be unfinished close grain hardwood of manufacturer's choice, and at **OPAQUE** finish, permit finger joints at either edge that are tight, not raised, or not visible from a distance of 48" (1220 mm) or at **TRANSPARENT** finish, permit one finger joint at either edge that is tight, not raised, uniform in color and grain, without discoloration, and not visible from a distance of 24" (610 mm), except at:		
1	9	3	**P**	**Premium Grade**	Be HPL or PVC matching the face laminate or hardwood stained / painted and finished to match the face laminate at the manufacturer's choice.

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09.6 ASSEMBLY REQUIREMENTS

Continued from previous page

2	**STILE** and **RAIL** doors will be glued up with waterproof or water resistant adhesive at the manufacturer's choice and require:					
2	1	If needed, special stile or rail requirements to accommodate specified hardware.				
2	2	**CONSTRUCTION** of the stiles and rails at:				
2	2	1	**SOLID STOCK** will be softwood or hardwood of either one piece, two piece of thickness with opposing grain or three piece with balanced thickness and opposing grain of outer pieces, without finger joints, and edge gluing in accordance with Section 03, except at:			
2	2	1	**P**	**Premium Grade**	Solid stock is not permitted.	
2	2	2	**VENEERED softwood or hardwood** requires:			
2	2	2	1	**CORES** of either MDF (medium density fiberboard), SCL (structural composite lumber), edge glued wood blocks / strips (staved core), particleboard, agrifiber, laminated veneer lumber core, fire resistant composite core, or specialty door core types, and if:		
2	2	2	1	1	**STAVED CORE**, it will be of one species in any one door, staves (block / strips) will not exceed 2" (50.8 mm) in width by any length, have staggered end joints in adjacent rows, not permit voids between end joints or have open surface defects, and will be all bonded together under pressure.	
2	3	**PANELS** require:				
2	3	1	Machining of uniform thickness, fit snuggly into; however, floating without mechanical fastening in the stile and rail retention groves.			
2	3	2	**OPAQUE** finish permit use of MDF (medium density fiberboard).			
2	3	3	**TRANSPARENT** finish wood grain run vertically.			
2	3	4	**FLAT** type, be at least:			
2	3	4	1	1/4" (6.4 mm) in thickness at 1-3/8" (34.9 mm) thick doors.		
2	3	4	2	1/2" (12.7 mm) in thickness at 1-3/4" (44.5 mm) thick doors.		
2	3	4	3	5/8" (15.9 mm) in thickness at 2-1/4" (57.2 mm) thick doors.		
2	3	5	**RAISED** type, be at least:			
2	3	5	1	3/4" (19.0 mm) in thickness at 1-3/8" (34.9 mm) thick doors.		
2	3	5	2	1-1/8" (28.6 mm) in thickness at 1-3/4" (44.5 mm) thick doors.		
2	3	5	3	1-1/2" (38.1 mm) in thickness at 2-1/4" (57.2 mm) thick doors.		
2	3	5	4	Constructed of either solid stock in opening widths not to exceeding 14" (356 mm) or of mitered rim banded or membrane-pressed panel construction.		

Continued on next page

09.6 ASSEMBLY REQUIREMENTS

Continued from previous page

2			**STILE** and **RAIL** doors . . . . . require: (continued)
2	4		**JOINERY** to be either mortise and tenon, loose tenons or doweled and glued under pressure so that the stiles, rails, mullions, and muntins are bonded together, and:
2	4	1	**DOWELS** will be minimum 1/2" (12.7 mm) in diameter by 5" (127 mm) long, spaced a maximum of 2-1/2" (63.5 mm) on center, with a minimum of two dowels per joint in the top and intermediate rails, and a minimum of three per joint at the bottom rail.
2	4	2	**TENONS** will be minimum 15/32" (11.9 mm) thick by 1-1/32" (26.2 mm) wide by 3-1/2" (89 mm) long, spaced a maximum of 2 -1/2" (63.5 mm) on center, with a minimum of two tenons per joint in the top and intermediate rails, and a minimum of three per joint at the bottom rail.
2	4	3	**MORTISE** and **TENON** the tenon size will be minimum 1/2" (12.7 mm) thick by 1-1/2" (38.1 mm) wide by 3" (76 mm) long per joint in the top and intermediate rails, and 5" (127 mm) long per joint at the bottom rail.
2	5		**APPLIED MOLDINGS** will be of solid stock, free of finger joints, securely and soundly attached in contact with the adjacent surface, primed when doors are factory primed.
2	6		**GLAZING MATERIAL** required be secured in place with mitered wood glazing beads or clips with glass bedded in sealant that squeezes out on both sides, and:
2	6	1	Sealant will be a elastic type compound, which is designed for bedding glazing materials or is recommended for such use by the sealant material supplier.
2	6	2	Use of glazing gaskets, tape or high-density foam is acceptable.
2	6	3	Wood glass stops to be manufacturer prepared and bundled in appropriately labeled sets or pre-fit and tacked in the appropriate light opening, and in the absence of specifications or detail, profile will be manufacturer's choice.

END OF SECTION 09

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

CASEWORK

SECTION-10

INCLUDING: **Wood, HPL, TFL, and CGS (Compact Laminate) Faced Casework**

10.1 SCOPE

1 All wood, HPL, TFL, and/or CGS (Compact Laminate) casework, cabinets, and components of face frame or frameless construction, fabricated complete in the manufacturer's facilities to field dimensions, as qualified below.

2 **INCLUSIONS**

2.1 Altars, lecterns, and pulpits, bars and back bars, bookcases, cabinets, modular cabinets, carrels, counters, display cases, wardrobes.

2.2 Built up shelving, built up or machined and knocked down, clothes rods and supports.

2.3 Shelf standards and rests, cabinet doors, track and hardware for sliding doors, drawer guides and slides, file drawer rods and followers, hinges, pulls or knobs, casters, rough and finish hardware, which is part of the cabinet.

2.4 Metal brackets and fittings, which are an integral part of the cabinet, unless specified elsewhere.

2.5 Linoleum, vinyl, cork, or resilient covering integral to cabinet.

2.6 Glass, mirrors, and glass doors (including hardware) that is integral to architectural woodwork.

2.7 Filler panels, scribe strips, trim and moldings necessary for cabinet installation, soffit or fascia panels constructed from cabinet material.

2.8 Cut outs for sinks or similar units.

2.9 Pre-finishing, priming, painting, or sealing if so specified.

2.10 Cleat and standards / bracket supported shelves, including hook strips, cleats, rods, and required hardware.

2.11 Installation, if specified.

3 **EXCLUSIONS**

3.1 Field installation, unless specified to be included in this scope of work.

3.2 Cutting of holes for field applied vents, weeps, grills, or hardware unless part of the cabinet.

3.3 Fillers, build up, or sub tops for countertops, including tile and natural stone.

3.4 Vinyl, rubber, or carpet base.

3.5 In-wall and/or ceiling (partially concealed) support brackets and fittings that are part of or attached directly to building structure.

3.6 Security panels, unless so specified and detailed.

3.7 Tote trays (except at Cabinet Design Series) and base leveling adjusters, unless so specified.

3.8 Furring, metal strapping, in-wall blocking, grounds, or stub walls.

3.9 Mirrors, glass, or glazing, unless part of the cabinet.

3.10 Mechanical, plumbing and electrical including material and fixtures.

3.11 Metal, or ceramic tile.

3.12 Special equipment housed in cabinets.

3.13 Work not directly associated with the casework.

3.14 Sliding or fixed visible display surfaces (tack-board, marker-board, etc.) and accessories.

3.15 Ventilation grills.

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10.2 SURFACE DEFINITIONS

1 **EXPOSED-EXTERIOR** surfaces, defined as all exterior surfaces exposed to view, including:

1.1 All surfaces visible when doors and drawers are closed, including knee spaces.

1.2 Underside of cabinet bottoms over 42" (1067 mm) above the finished floor, including cabinet bottoms behind light valances and the bottom edge of light valances.

1.3 Cabinet tops under 80" (2032 mm) above the finished floor, or if 80" (2032 mm) and over and visible from an upper building level or floor.

1.4 Front edgeband of stretchers, ends, dividers, fixed shelves, tops, and bottoms.

1.5 Front edgeband of adjustable shelves exposed to view in open casework or behind transparent doors.

1.6 Sloping tops of cabinets that are visible.

2 **EXPOSED-INTERIOR** surfaces, defined as all interior surfaces exposed to view in open casework or behind transparent doors, including:

2.1 Interior faces of shelves (both fixed and adjustable), dividers (edgeband is an Exposed-Exterior Surface).

2.2 Interior face of ends (sides), backs, and bottoms (including pull outs).

2.3 Interior face of cabinet top members 36" (914 mm) or more above the finished floor.

2.4 Interior face of doors and applied drawer fronts.

3 **SEMI-EXPOSED** surfaces, defined as those interior surfaces only exposed to view when doors or drawers are opened, including:

3.1 Interior faces and edgeband of adjustable shelves.

3.2 Interior faces of dividers.

3.3 Interior face of ends (sides), backs, and bottoms (including a bank of drawers).

3.4 Interior face of cabinet top members 36" (914 mm) or more above the finished floor.

3.5 Drawer box sides, sub fronts, backs, edgebanding, and bottoms.

3.6 The underside of cabinet bottoms between 24" (610 mm) and 42" (1067 mm) above the finished floor.

3.7 Security and dust panels or drawer stretchers.

4 **CONCEALED** surfaces, defined as those exterior or interior surfaces that are covered or not normally exposed to view, include:

4.1 Toe space unless otherwise specified.

4.2 Sleepers, stretchers, and solid sub tops.

4.3 The underside of cabinet bottoms less than 24" (610 mm) above the finished floor.

4.4 The flat tops of cabinets 80" (2032 mm) or more above the finished floor, except if visible from an upper floor or building level.

4.5 The three non-visible edges of adjustable shelves.

4.6 The underside of countertops, knee spaces, aprons and drawer boxes that are less than 36" (914 mm) above the finished floor.

4.7 The faces of cabinet end of adjoining units that butt together.

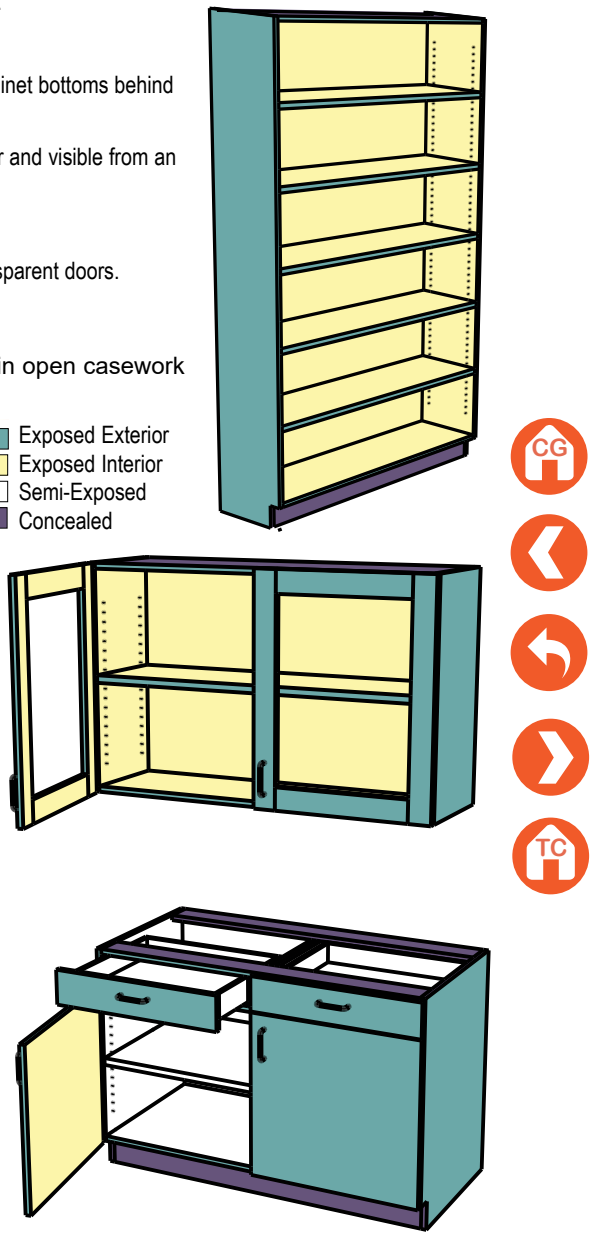

Figure: 10-001

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10.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS:**

1.1 At **EXPOSED KNUCKLE HINGES**, defaulting to **REVEAL OVERLAY** is manufacturer's choice, and if reveal overlay, the reveal will be determined by the hinge overlay.

1.2 **HPL FACED CASEWORK** - will be Custom Grade, VGP-HPL of standard, non-premium colors and finishes, selected from manufacturer's brand choice, and of frameless construction with overlay doors.

1.3 **TFL FACED CASEWORK** - will be Custom Grade, manufacturer's choice of TFL of non-premium colors and finishes selected from manufacturer's brand choice, and of frameless construction with overlay doors.

1.4 **WOOD FACED CASEWORK**:

1.4.1 **OPAQUE FINISH** will be Custom Grade, manufacturer's choice of MDF of frameless construction with overlay doors. Finish, sheen and system of manufacturers choice.

1.4.2 **TRANSPARENT FINISH** will be Custom Grade, manufacturer's choice of domestic hardwood veneer of frameless construction with overlay doors. Finish, sheen and system of manufacturers choice, without stain or shading.

1.5 **COMPACT LAMINATE CASEWORK** - will be Custom Grade, of standard, non-premium colors with satin finish selected from manufacturer's brand choice and edge treatment, and of frameless construction with overlay doors.

10.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards,

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Product Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER & SHEET PRODUCT COMPONENT REQUIREMENTS** (such as Veneer, MDF, HPL, TFL and CGS Compact Laminate) used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires backs of panels and trim to be factory sealed.

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

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10.4 GENERAL REQUIREMENTS (continued)

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **CASEWORK INTEGRITY** - These standards have established methods of testing and acceptable minimum levels of integrity for casework, which can be found in the **APPENDIX**.

12 **HARDWARE** - These standards have adopted ANSI/BHMA Standards (latest edition), Grade 2, as the basic minimum requirement for casework hardware.

13 **CABINET DESIGN SERIES (CDS) -** The Sponsor Associations have developed a series of numbered cabinet designs that are available for ease of specification and drawing. A numerical / elevation key to the drawings may be found in the **APPENDIX** and:

13.1 Autodesk Revit Families and AutoCAD "DWG / DXE / DXF" files of the elevations may be found at: naaws.com.

14 **STRUCTURAL MEMBERS**, grounds, in wall blocking, backing, furring, brackets, or other anchorage that becomes an integral part of the building's walls, floors, or ceilings, that are required for the installation of architectural woodwork are not furnished or installed by the architectural woodwork manufacturer or installer.

15 **WALL, CEILING**, and/or opening variations in excess of 1/4" (6.4 mm) or **FLOORS** in excess of 1/2" (12.7 mm) in 144" (3658 mm) of being plumb, level, flat, straight, square, or of the correct size are not acceptable for the installation of architectural woodwork, nor is it the responsibility of the installer to scribe or fit to tolerances in excess of such.

16 **SURFACING** with a defined grain and/or pattern is installed vertically, unless otherwise specified.

17 **HORIZONTAL REVEALS** between doors, drawer fronts, false fronts; and the top of the cabinet will be consistent throughout the project, and at:

17.1 **FRAMELESS CONSTRUCTION** will be 1/8" (3.2 mm) to 1/4" (6.4 mm).

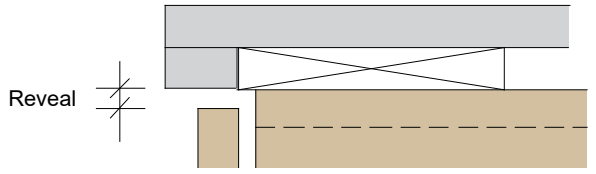

Figure: 10-002

17.2 **FACE FRAME CONSTRUCTION** will be 1/4" (6.4 mm) to 1" (25.4 mm).

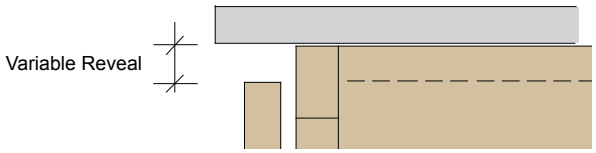

Figure: 10-003

18 **CORNERS** created by adjoining casework will have non usable space.

19 **BASE / TOEKICK** may be **INTEGRAL** (constructed as an integral part of the cabinet body) or **SEPARATE** (constructed as a separate member) at the option of the manufacturer.

20 **STORAGE, JANITOR CLOSET**, and/or **UTILITY ROOM CABINETS** will be built in conformance to Custom Grade, regardless of the overall project's Grade requirement, at the manufacturer's choice.

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10.4 GENERAL REQUIREMENTS (continued)

21 **TOE BASE HEIGHT VARIANCE** due to floor variations is not considered a defect. Casework is required to be installed level; shimming of the toe base, not to exceed 1/2" (12.7 mm), is acceptable. Floor variations exceeding 1/2" (12.7 mm) will be corrected before cabinets are installed; however, correction of such is not the responsibility of the cabinet installer.

22 **CASEWORK** will be assembled by the manufacturer using mechanical fasteners and adhesive, complete with doors, drawers, and hardware installed.

23 **PANEL COMPONENTS** will be balanced constructed of particleboard, MDF, or a non-telegraphing core in such a way as not to warp in its intended use.

24 **FRAMELESS CONSTRUCTION** requires edgebanding of adjoining units be beveled a maximum of 15° for the thickness of the edgebanding, and if adjoined, the total beveled "V" will not exceed 30°.

25 **SEPARATELY APPLIED COUNTERTOPS** are required at base cabinets 48" (1220 mm) or less in height.

26 **CABINETS OVER 72" (1829 mm**) high (excluding wardrobe cabinets) not abutting a structural wall or another cabinet on either side will have a fixed shelf approximately mid height, and:

26.1 **SEISMIC COMPLIANT CONSTRUCTION** (cabinets subject to NAAWS Seismic Casework Installation Requirements) requires a fixed shelf and anchor strip approximately mid height, and anchor strip and back will be securely fastened to the fixed shelf with #10 x 2-1/2" (50.8 mm) screws a maximum of 7" (178 mm) on center.

27 **MOISTURE RESISTANT BASE**, except at Laboratory Casework, will be specified and comply with the "Wet" Laboratory base requirements, see Laboratory Casework Requirements in this Section.

28 **SLIDING PRESENTATION BOARDS** require an integral stop be provided within the top and bottom track to prevent their stopping against the casework.

29 **CASEWORK REFINISHING / REFACING / REFURBISHING** Is typically required to be done in the field and is not covered by these standards; however, guidelines can be found in the **APPENDIX**.

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Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

10.5 MATERIAL REQUIREMENTS

1				**HARDWARE** will conform to ANSI/BHMA Standards (latest edition), buildershardware.com, minimum Grade 2 requirements with the exception of requiring "dynamic" load testing for a minimum of 50,000 cycles, and:
1	1			**HINGES** will be a minimum of 110° degree of opening capacity meeting ANSI/BHMA 156.9, and at:
1	1	1		**SCHOOLS** and **HOSPITALS**, hinges will be all-metal two-pivot type where less than 155° degree opening is required, and meeting ANSI/BHMA 156.9 **GRADE 1** where the required opening capacity equals or exceed 155° degrees.
1	1	2		**LABORATORY** casework, all cabinet hinges will be of all-metal construction, meeting or exceeding ANSI/BHMA 156.9 **GRADE 1** "performance" and "permanent set" test requirements.
1	2			**DRAWER SLIDE TESTING** will be based on a drawer slide nominal length of 22" (559 mm) mounted on a drawer box 22" (559 mm) in depth with a minimum width of 18" (457 mm) for load ratings up to 125 lbs. (56.7 kg) and 24" (610 mm) for load ratings of 125 lbs. (56.7 kg) and above, and slides not manufactured in lengths up to 22" (559 mm) will be tested in their longest production length.
1	3			Be **FURNISHED** and **INSTALLED** per material supplier's recommendations required to provide a complete casework assembly without impairment of the cabinet's structural integrity or functionality, and will not be mounted on, cut into or otherwise impair the usability of the top surface of fixed or adjustable shelves, and cabinet bottoms unless there is no other alternative. When fastener provisions are countersunk, fasteners will be countersunk.
1	4			Be of **UNIFORM PLATED** BHMA 626 or similar **POWDER COATED** finish on exposed surfaces, and:
1	4	1		Powder coat finish will be of a chemical family with sufficient chemical / solvent resistance to not be affected by a rubdown of the solvents or cleaning materials used for final cleanup of the fabricated product, including removal of over spray, glue.
1	4	2		Finishes will vary between material suppliers, and it can be expected to see variations from the same manufacturer between different production runs. These variations are not considered a defect, as long as they are compatible with the overall finish of the installed hardware.
1	5			Have the **MATERIAL SUPPLIER'S NAME** or unique brand marking stamped on hinges, slides, and locks for identification purposes.
1	6			Be of **FIRST-CLASS WORKMANSHIP**, free of manufacturing imperfections (such as tool or machine marks), and consistent in exposed finish appearance.

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10.5 MATERIAL REQUIREMENTS

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1	**HARDWARE** will conform to ANSI/BHMA (continued)				
1	**7**	**LOCKS**, will be furnished at locations specified on the contract documents; installed to withstand a minimum of 50 lb. (22.7 kg) pull force in the locked position and comply with ADA Standards Section 4.13.9 requiring lever style operation when so specified, and if:			
1	7	**1**	Non digital / electronic, be keyed differently or master keyed, only if so specified.		
1	7	**2**	Digital / electronic, as applicable will:		
1	7	2	**1**	Have non-volatile memory (not lost with low battery or when battery is changed).	
1	7	2	**2**	Require standards AA or AAA battery operation (no battery packs) with minimum 10,000 lock cycle life and have external battery replacement and/or external power override provisions.	
1	7	2	**3**	Be of cast or extruded metal construction with minimum 30,000 life cycle life expectancy.	
1	7	2	**4**	Have minimum 4-digit user access pin code and 5 digit master pin code.	
1	7	2	**5**	At single or multiple use access, if not specified, be at manufacturers option.	
1	**8**	At **DRAWER SLIDES** and **DRAWER AND SLIDE SYSTEMS** will conform to the following minimum type (roller or ball bearing) and load capacity requirements drawer box, at:			
1	8	**1**	**24" (610 mm) or LESS IN WIDTH**, either roller or ball bearing of:		
1	8	1	**1**	50 lbs. (22.7 kg.), at pencil drawers.	
1	8	1	**2**	75 lbs. (34 kg.), at general purpose drawers.	
1	8	1	**3**	100 lbs. (45.4 kg.) at file drawers.	
1	8	**2**	**OVER 24" (610 mm) IN WIDTH**, ball bearing of:		
1	8	2	**1**	50 lbs. (22.7 kg.), at pencil drawers.	
1	8	2	**2**	75 lbs. (34 kg.), at general purpose drawers.	
1	8	2	**3**	150 lbs. (68 kg.) at lateral file drawers 30" (762 mm) or less in width.	
1	8	2	**4**	200 lbs. (91 kg.), at lateral file drawers wider than 30" (762 mm).in width.	
1	**9**	At **SHELF RESTS** for bored holes, either include a minimum of 0.1969" (5.0 mm) metal pin or double 0.1969" (5.0 mm) plastic pins (meeting ANSI/BHMA, (latest edition), buildershardware.com Grade 1 requirements) and meet or exceed these standards' maximum shelf load requirement of 200 lbs. (91 kg), except:			
1	9	**1**	Softwood veneer core requires single pins with shoulder or double pin shelf rests.		
1	**10**	At **POCKET DOOR HARDWARE,** cabinet doors be a maximum of 23-5/8" (600 mm) in width and the maximum door height and weight will be within the material supplier's listed capacity.			
1	**11**	At **BASE ADJUSTERS**, be of the adjustable screw type, having a floor bearing surface of at least 1-1/8" (28.6 mm) in diameter at each foot, and will provide for leveling the cabinet from inside of the case through holes in the cabinet bottom with cover caps.			
1	**12**	**MULTIPLE HARDWARE OPTIONS,** when specified, will be the manufacturer's choice.			

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SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

10.5 MATERIAL REQUIREMENTS

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2				**SOLID LUMBER** is permitted only at drawer faces; aprons; valences; stile and rail doors; face frames; edging; drawer box sides, back and sub-fronts; dividers less than 6" (152 mm) in width; stretchers; nailers and sleepers.
3				**GRAIN** or **DIRECTIONAL PATTERNED** sheet products will run and match vertically within each cabinet unit, including doors, drawers, false fronts, and finished ends, and at: 
3	P		**Premium Grade**	Be sequenced horizontally within each cabinet unit. Cathedral grain will have the crown pointing up and run the same direction for the entire project, and will be well matched for color and grain across multiple cabinet faces in each room.
4				**SURFACES** behind **VISIBLE DISPLAY PANELS**, such as white board or tack board, are treated as semi-exposed.
5				**DRAWERS** require:
5	1			**CORES** at **SIDE**, **BACK** and **SUB FRONTS** to be MDF, particleboard, combination or veneer core of nominal 1/2" (12.7 mm) minimum thickness**,** and:
5	1	1		**CORE** at **BOTTOM** to be MDF, particleboard or minimum **5** ply hardwood veneer core with no inner voids of 1/4" (6.4 mm) minimum thickness, except at:
5	1	1	1	Drawers boxes wider than 30" (762 mm) to be 1/2" (12.7 mm) minimum thickness.
5	2			**DIVIDERS**, if hardboard will be tempered and smooth on both sides. Matching of other drawer box surfaces is only required if so specified, except at:
5	2	P	**Premium Grade**	Dividers will match other drawer box surfaces.
6				**EDGEBANDING** requires minimum thickness at: HPL Banding of 0.020 (0.5 mm) +/- 0.004 (0.1 mm). PVC, ABS, Polyester, Polypropylene Banding of 0.018 (0.46 mm) +/- 0.005 (0.13 mm). Veneer Banding of 0.020 (0.5 mm) +/- 0.0025 (0.06 mm).

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10.5 MATERIAL REQUIREMENTS

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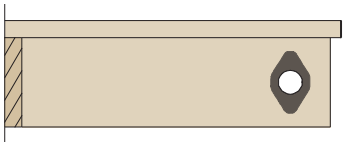
7	**CLOSET** and **UTILITY SHELVING** will be TFL, and:					
7	1	**SHELF THICKNESS** will be a minimum of 3/4" (19.0 mm).				
7	2	**CLOTHES RODS,** when wood to be a minimum of 1-3/8" (34.9 mm) in diameter.				
7	3	**ENDS** and **BACK CLEATS** will be a minimum of 3/4" (19.0 mm) thick by:				
7	3	1	3-1/2" (89 mm) wide when receiving a clothes rod or hooks. 			
7	3	2	1-1/2" (38.1 mm) wide when not receiving a clothes rod or hooks. 			
8	**WOOD FACED CASEWORK** requires at:					
8	1	**EXPOSED-EXTERIOR** surfaces at:				
8	1	1	**OPAQUE FINISH** permits use of MDF; close grain hardwood solid stock or close grain hardwood veneer of manufacturer's species choice.			
8	1	2	**TRANSPARENT FINISH** requires specified species, cut, and match, and use of one species for the entire project, and:			
8	1	2	1	**VENEER** to be plain sliced, "A" Grade hardwood, except rotary cut at Birch; book matched between adjacent leaves and running match panel face; end matched or blueprint and sequenced only if so specified, except:		
8	1	2	1	P	**Premium Grade**	Requires "AA" Grade.
8	1	2	2	**STILE** and **RAIL** construction drawer and false fronts will match door profile with solid wood or veneered panel run horizontally, and at:		
8	1	2	2	P	**Premium Grade**	They will match door profile with veneer panel run vertically.
8	2	**EXPOSED-INTERIOR** surfaces, except at doors and drawer fronts, requires at:				
8	2	1	**OPAQUE FINISH** permits use of MDF; close grain hardwood solid stock or close grain hardwood veneer of manufacturer's species choice, except **INSIDE FACE** of door and drawer fronts will be the same species and cut as the Exposed-Exterior surface.			
8	2	2	**TRANSPARENT FINISH** "B" Grade veneer of the same species as the Exposed-Exterior surface, except:			
8	2	2	P	**Premium Grade**	Requires "A" Grade.	

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10.5 MATERIAL REQUIREMENTS

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8	**WOOD FACED CASEWORK** requires (continued)						
8	**3**	**SEMI-EXPOSED** surfaces require consistent color or species to be used throughout entire project, and at:					
8	3	**1**	**OPAQUE FINISH** use of TFL or pre-finished MDF, close grain hardwood solid stock or veneer of manufacturer's species choice, and:				
8	3	1	**1**	**DRAWER BOXES** to be of consistent color or species used throughout entire project, and at:			
8	3	1	1	**P**	**Premium Grade**	They will be pre-finished.	
8	3	**2**	**TRANSPARENT FINISH** to be of consistent color or species used throughout entire project and permits solid wood or veneer of manufacturer's species choice, or HPL, or TFL of the manufacturer's color choice, except at:				
8	3	2	**P**	**Premium Grade**	Solid wood or veneer of compatible species to the exposed surface is required.		
8	3	2	**1**	**DRAWER BOXES** to be of consistent color or species used throughout entire project of solid hardwood or veneer of manufacturer's species choice or TFL of the manufacturer's color choice and at:			
8	3	2	1	**P**	**Premium Grade**	For **TRANSPARENT FINISH,** it will be pre-finished and of solid wood or veneer of manufacturer's choice of species compatible to exposed face.	
9	**HPL FACED CASEWORK** requires at:						
9	**1**	**EXPOSED-EXTERIOR** surfaces to be VGP-HPL of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and:					
9	1	**1**	Be of one color or pattern per room, with a maximum of five different colors or patterns per project.				
9	**2**	**EXPOSED-INTERIOR** surfaces require VGP-HPL or TFL compatible to Exposed-Exterior surface in color, grain, or pattern, except at:					
9	2	**P**	**Premium Grade**	VGP HPL, the same as the Exposed-Exterior surface.			
9	2	**1**	Inside face of door and drawer fronts to be the same material and thickness as the face; color, grain and pattern to match Semi-Exposed surfaces, and at:				
9	2	1	**P**	**Premium Grade**	The same material, pattern, color, and thickness as the door face.		
9	2	**2**	Inside face of framed glass doors to be: The same material, pattern, color, and thickness as the door face.				
9	**3**	**SEMI-EXPOSED** surfaces require HPL or TFL of the manufacturer's choice of color, and:					
9	3	**1**	**DRAWER BOX** surfaces to be consistent color used throughout entire project of VGP-HPL or TFL of the manufacturer's color choice, except at:				
9	3	1	**P**	**Premium Grade**	It will match the color of other semi-exposed surfaces.		

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10.5 MATERIAL REQUIREMENTS

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10	**CGS** (Compact Laminate) **CASEWORK** requires:		
10	1		**EXPOSED-EXTERIOR** surfaces to be CGS (Compact Laminate) of brand, thickness, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, a minimum 3/8" (9.5 mm) in thickness, and:
10	1	1	To be of one color per room, with a maximum of five different colors per project.
10	2		**EXPOSED-INTERIOR** surfaces will be the same as the Exposed-Exterior surface.
10	3		**SEMI-EXPOSED** surfaces, including drawer boxes, require manufacturers' choice color, and:
10	3	1	**DRAWER** sides, back, and sub fronts, be a minimum thickness of 1/2" (12.7 mm), and drawer bottoms will be a minimum of 1/4" (6.4 mm) in thickness.
10	3	2	**DIVIDERS** to be 1/8" (3.2 mm) minimum thickness.

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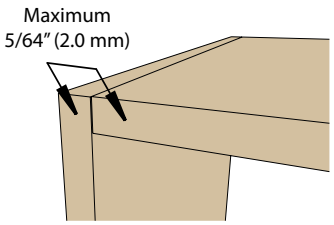
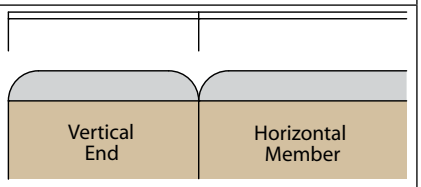
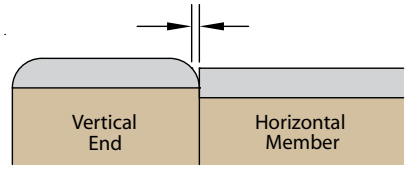
10.6 ASSEMBLY REQUIREMENTS

1					**FIXED HORIZONTAL** cabinet members, including tops and bottoms, will be either flush or set back a maximum of 5/64" (2.0 mm) at their intersection with vertical members and will be uniform throughout the room, and:	
1	1				Radius, beveled or square edges and ends are allowed at horizontal and vertical members, provided:	
1	1	1			The "V" or gap that is formed where a member with a square end meets a member with a radius does not show the core of the square edge member, the "V" or gap is uniform throughout the room, and does not exceed 0.015" (0.4 mm), except at:	
1	1	1	P	**Premium Grade**	It will not exceed 0.007" (0.2 mm).	
2					Allows use of **FILLER,** if inconspicuous when viewed at 24" (610 mm) per gap tolerances, except at:	
2	P			**Premium Grade**	Filler is not permitted	
3					**SHEET** and **LAMINATED LUMBER PANELS** will be allowed to move, float, expand or contract in reaction to ambient humidity changes.	
4					**JOINERY**, other than that provided for within Section 10, is permitted, provided it is fully documented in a text / illustration explanation, and each material application has been independently tested to show compliance to the minimum requirements of the Cabinet Structural Integrity Tests within the **APPENDIX**.	
5					**BOTTOM EDGES** of drawer fronts and aprons at knee spaces will be edgebanded.	
6					**VISIBLE EDGES** require edgebanding to run parallel to the long direction of the edge regardless of grain and/or pattern; dadoes or lock joints will not run through the edgeband; tee banding must be so specified; and at:	
6	1				**ADJUSTABLE SHELVES**, only the front edge to be edgebanded.	
6	2				**BOTTOM EDGE** of the end of upper cabinets to be edgebanded.	
6	3				**TOP EDGE** of the cabinet ends, when visible from above, will be edgebanded to match the Exposed-Exterior surface.	
6	4				**DOORS** and **DRAWER FRONTS** see additional requirements within this Product portion.	

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10.6 ASSEMBLY REQUIREMENTS

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7 **DRAWERS** (including trays and sliding bins) requires components to be of the same material and color for the entire project, be assembled square and true within a tolerance not to exceed 1/32" (0.8 mm) in width or length, and 1/16" (1.6 mm) diagonally, and:

7 **1** **JOINERY** provided for herein has been tested and proven compliant to the unique NAAWS requirements outlined in the **APPENDIX**. These tests are unique to NAAWS and were created specifically for the needs of architectural casework.

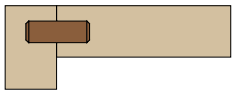
The test procedures and their success establishes the minimum acceptable level of integrity and performance for drawer joinery incorporated within NAAWS 4.0.

These testing requirements meet or exceed the performance levels of ANSI/AWI 0641-2019.

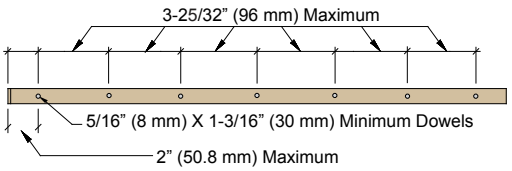
All members to be securely fastened together, using one or more of the following tested and approved methods of joinery for:

7 1 **1** ANSI/AWI 0641-2019 **MINIMUM PERFORMANCE LEVEL THREE (3) REQUIREMENTS** can be met with the following methods of joinery:

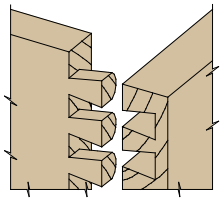
7 1 1 **1** **GLUED IN DOWEL** joints, dowel to be a minimum of 15/64" x 1-3/16" (6 mm x 30 mm), glued and clamped with minimum of two dowels per joint,



spaced with first dowel a maximum of 2" (50.8 mm) from the front with subsequent dowels will be a maximum of 3-25/32" (96.0 mm) on center, unless joint is less than 9-1/2" (241 mm) wide, then maximum spacing will not exceed 2-1/2" (63.5 mm).



7 1 1 **2** **MULTIPLE DOVE TAIL** (limited to solid wood, MDF or minimum 7-ply hardwood veneer core plywood with exposed core) will be glued and clamped with a minimum of two dove tails per joint, additional mechanical fasteners are not required.



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10.6 ASSEMBLY REQUIREMENTS

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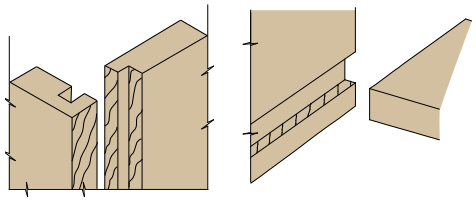
7 **DRAWERS** (including trays and sliding bins) requires (continued)

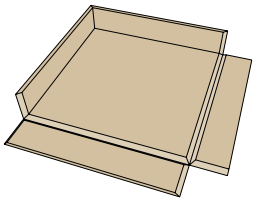
7 **1** **JOINERY** provided for herein (continued)

7 1 **2** ANSI/AWI 0641-2019 **MINIMUM PERFORMANCE LEVEL FOUR (4) REQUIREMENTS** can be met with the following methods of joinery:

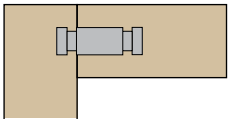
7 1 2 **1** **LOCK JOINTED** (rabbeted and/or dado).



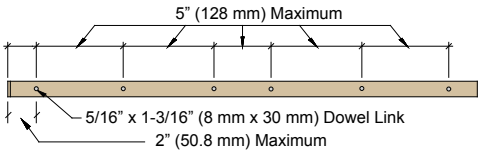
7 1 2 **2** **MITER FOLDED** will be integral with sides, back, sub-front, and bottom, with core of particleboard or medium density fiberboard, securely glued and pin nailed with a minimum of two fasteners per joint and a maximum of 4" (102 mm) on center, starting a maximum of 2-1/2" (63.5 mm) from any joint end.



7 1 2 **3** At **DOWEL LINK** laterally engaged joints, fasteners will be of metal or synthetic construction, and be a minimum of 5/16" x 1-3/16" (8 mm x 30 mm) with a minimum of two dowel links per joint and glued at panel edge hole only,



spaced with first dowel link a maximum of 2" (50.8 mm) from the front, and subsequent dowel links spaced a maximum of 5" (127 mm) on center, unless joint is less than 9-1/2" (241 mm) wide, then maximum spacing will not exceed 2-1/2" (63.5 mm).



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10.6 ASSEMBLY REQUIREMENTS

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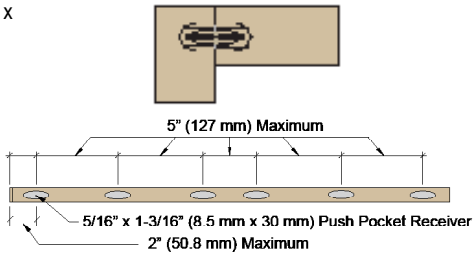
7	**DRAWERS** (including trays and sliding bins) requires (continued)			
7	1	**JOINERY** provided for herein (continued)		
7	1	2	ANSI/AWI 0641-2019 **MINIMUM PERFORMANCE LEVEL FOUR** (continued)	
7	1	2	4	At **PUSH POCKET** laterally engaged joints, fasteners will be of synthetic construction, 5/16" x 1-3/16" (8 mm x 30 mm), glued at panel edge hole only, with a minimum of two push pocket fasteners per joint, spaced with first push plate a maximum of 2" (51 mm) from each joint end to the center of the push pocket, and subsequent push pockets spaced a maximum of 5" (127 mm) on center, unless joint is less than 9-1/2" (241 mm) wide, then maximum spacing will not exceed 2-1/2" (63.5 mm).
7	2	**JOINERY OTHER THAN THAT PROVIDED ABOVE** is permitted provided it is fully documented in a text / illustration explanation, and has been independently (Federal or Provincial / State regulated university, college or technical (post high school) school, or licensed testing facility) tested to show compliance to NAAWS's Casework Joinery Integrity Testing for drawers as qualified within the **APPENDIX**.		
7	3	**BOTTOMS**:		
7	3	1	**DADOED / PLOWED** into sides, back, front, and/or sub front, and be securely glued to form a rigid unit; plow to be a minimum of 3/8" (9.5 mm) from the bottom of the drawer sides, back, front, or sub front; depth shall not exceed 40% of overall thickness, and if:	
7	3	1	1	**RUN THROUGH**, it will be securely attached to the drawer box back with mechanical fasteners at minimum of 4" (102 mm) on center, starting a maximum of 2-1/2" (63.5 mm) from any joint end.
7	3	2	**APPLIED** (plant on), supported by the drawer slide and mechanically fastened at minimum of 4" (102 mm) on center to the entire box, starting a maximum of 2-1/2" (63.5 mm) from any joint end.	
7	3	3	**INTEGRAL MITER FOLDED** securely glued and pin nailed at a minimum of two fasteners per joint and a maximum of 4" (102 mm) on center, starting a maximum of 2-1/2" (63.5 mm) from any joint end.	



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10.6 ASSEMBLY REQUIREMENTS

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7	**DRAWERS** (including trays and sliding bins) requires (continued)		
7	4		Will be **PROPERLY FITTED** to the cabinet, and fit front to back, less a maximum of 2" (50.8 mm) of interior cabinet depth, and fill opening top to bottom to the greatest extent possible, while remaining fully functional.
7	5		**FRONTS** and **FALSE FRONTS** will:
7	5	1	Match the cabinet doors, except where the drawer and false fronts are too small to allow a match.
7	5	2	Be securely attached to drawer sub front with pan / binder head, countersunk flathead, or oval head screws with a minimum of two screws at each end a maximum of 1-1/2" (38.1 mm) from the inside corners of the drawer box and a maximum of 12" (305 mm) on center, and fasteners used to attach drawer pulls or knobs through both the sub front and drawer front will be considered a fastener.
7	5	3	At false fronts, be securely attached to the cabinet body.
7	6		**CONSTRUCTION** without sub front, sides to be blind dovetail to the front, except Drawer and Slide Systems.
7	7		**SLIDES** will be as specified or manufacturer's choice if not specified, operate smoothly, and:
7	7	1	**FILE DRAWERS** require full extension slides, clear inside height sufficient for hanging file folder tabs, file direction of manufacturer's choice, system stand or rails will be at option of the manufacturer, and at legal sized drawers they will accommodate both legal and letter sized files.
7	8		**CLOSING STOPS** will be provided at the rear of both drawer sides, unless such is built into the slides to prevent the drawer front from impacting the cabinet body, and stop silencers are not permitted.
7	9		**SPRING LOADED TIP DOWN STOPS** will be provided (design permitting) to prevent the drawer from pulling out of the cabinet, unless such is built into the drawer slides.
7	10		**LOCKS** will be furnished only where shown on contract documents, unless specifications denote specific location requirements, strikes are required which will withstand a minimum of 50 lb. (22.7 kg) pull force in the locked position, and:
7	10	1	Security or dust panels are required at locked banks of drawers when each drawer is keyed differently.
7	11		**TRAYS**, **BINS** and similar items will be similarly constructed.
7	12		**DRAWER and SLIDE SYSTEMS** will conform to hardware material supplier's assembly specifications.

Continued on next page

10.6 ASSEMBLY REQUIREMENTS

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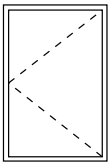
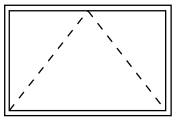
8	**DOORS** require:			
8	1		**FLUSH OVERLAY** is the default for either **FRAMELESS** or **FACE FRAME** casework, except at **EXPOSED KNUCKLE HINGES**, defaulting to **REVEAL OVERLAY** is at the option of the manufacturer, and if reveal overlay, the reveal will be determined by the hinge overlay.	
8	2		**BACK BEVELED DOORS**, to be edgebanded.	
8	3		**CORE THICKNESS** to be a minimum of 11/16" (17.5 mm).	
8	4		**MAXIMUM SINGLE CABINET DOOR SIZE** at:	
8	4	1	**VERTICAL** hinge axis openings will be 24" (610 mm) in width and 84" (2134 mm) in height, and larger doors are more susceptible to warp, which will not be the responsibility of the manufacturer / installer.	
8	4	2	**HORIZONTAL** hinge axis openings will be 48" (1220 mm) in width and 24" (610 mm) in height.	
8	5		**DOOR THICKNESS** of 1-3/8" (34.9 mm) or greater be governed by Section 09.	
8	6		**STOP SILENCERS** to be installed at the top and bottom of hinged cabinet doors (on the closing edge) to properly align the door and silence its closing.	
8	7		**CORE** to be particleboard or MDF, and:	
8	7	1	**VENEER, OSB, or LUMBER CORES** are **SUSCEPTIBLE TO** warping, telegraphing, or delamination, and are not **RECOMMENDED**.	
8	7	2	**COMBINATION CORES** are **SUSCEPTIBLE TO** warping and are not **RECOMMENDED**.	
8	8		**LOCKS** to be furnished **ONLY** where shown on cabinet elevations of contract documents, unless specifications denote specific location requirements, and will withstand a minimum of 50 lb. (22.7 kg) pull force in the locked position, and strikes are required, and:	
8	8	1	Strikes are required at spring loaded latches, except when automatic latches are used.	

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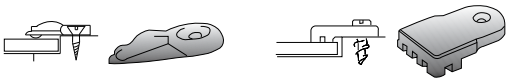
8	**DOORS** (continued)			
8	9	**GLASS** will be clear laminated or tempered, and:		
8	9	1		Stops will be continuous, removable, on inside only, and glass clips are permitted, with a minimum of 6 per door (4 per door if glass is glued in place) and at: 
8	9	1	**1**	Opaque finish, be synthetic or solid stock of the manufacturer's choice.
8	9	1	**2**	Transparent finish, be synthetic or solid stock of compatible species to adjacent surface and compatible color to the Exposed-Interior surface.
8	9	1	**3**	HPL or TFL, be synthetic or solid stock and compatible color to Interior Exposed surface.
8	9	1	**4**	Exposed rabbet will be compatible color painted or finished to the Interior Exposed surface.
8	**10**	When **HINGED**:		
8	10	1	**DOORS TO STOP** against the cabinet body at the bottom (except at handicapped units), sides, and top; and at:	
8	10	1	**1**	Flush inset doors will have stops within 2" (50.8 mm) of top and bottom.
8	10	1	**2**	Paired doors below a drawer require a rail, stretcher, or divider (full or partial).

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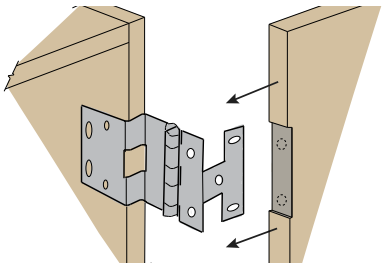
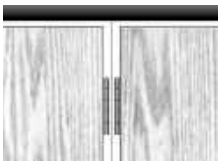
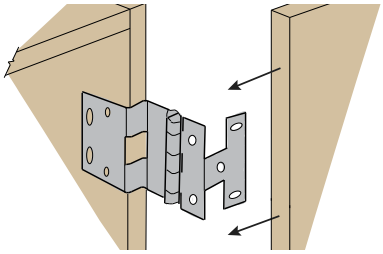
8	**DOORS** (continued)				
8	**10**	When **HINGED** (continued)			
8	10	**2**	**HINGES** will operate properly without binding, be self-closing or provided with a catch, and align horizontally when adjacent and exposed, and:		
8	10	2	**1**	At **Grade "1"** hinges, doors:	
8	10	2	1	**1**	Under 48" (1220 mm) in height will have a minimum of two hinges.
8	10	2	1	**2**	48" (1220 mm) to 84" (2134 mm) height will have a minimum of three hinges.
8	10	2	1	**3**	Over 84" (2134 mm) in height will have a minimum of four hinges.
8	10	2	**2**	At **Grade "2"** hinges, doors:	
8	10	2	2	**1**	Under 40" (1016 mm) in height will have a minimum of two hinges.
8	10	2	2	**2**	40" (1016 mm) to 60" (1524 mm) in height will have a minimum of three hinges.
8	10	2	2	**3**	60" (1524 mm) to 80" (2032 mm) in height will have a minimum of four hinges.
8	10	2	2	**4**	Over 80" (2032 mm) in height will have a minimum of five hinges and an additional hinge for every 18" (457 mm) of additional height.
8	10	2	**3**	At **FLUSH OVERLAY** construction, wrap around hinges will be let into the edge of the door to maintain proper gap tolerance, and exposed door edges resulting from the notching for hinges are not required to be finished, except at: 	
8	10	2	3	**P**	**Premium Grade** Exposed door edge is required to be painted or stained to match
8	10	2	**4**	At **REVEAL OVERLAY** construction, wrap around hinges are not required to be let into the edge of the door, and the reveal will be determined by the hinge overlay.  	
8	10	2	**5**	At **CONCEALED CUP HINGE** assembly installation, when required to be installed with screws, requires dowel / euro screws or screws recommended by the material supplier.	

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10.6 ASSEMBLY REQUIREMENTS

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8	**DOORS** (continued)						
8	10	When **HINGED** (continued)					
8	10	3	At **LOCKING PAIRS** will be equipped with an automatic releasing latch or use of an elbow catch / latch and a stop block on the inactive leaf adequate to prevent the latch of the elbow catch / latch from being defeated by applying vertical pressure on the door, and at tall storage cabinets with full height doors, and:				
8	10	3	1	With fixed mid height shelf will be equipped with elbow catch / latch and stop block on the inactive leaf at the fixed shelf.			
8	10	3	2	Without fixed mid height shelf will be equipped with spring actuated chain bolt with shelf depth adjusted accordingly.			
8	11	When **STILE** and **RAIL CONSTRUCTION** (see the Hinged and Sliding sub-headings for additional requirements as applicable):					
8	11	1	**STILES** and **RAILS**:				
8	11	1	1	Of **SOLID LUMBER** construction will be a minimum of 2-1/2" (63.5 mm) in width, a minimum of 3/4" (19.0 mm) in thickness, and within a tolerance of +/- 1/32" (0.8 mm) of specified thickness.			
8	11	1	2	Of **VENEERED** or **OVERLAID** construction will be MDF or particleboard core a minimum of 3-1/2" (89 mm) in width, and with approval, framed glass doors may be manufactured from flush panels without stile and rail considerations, provided all other door requirements are met, and all exposed edges will be edgebanded or finished to match adjacent surfaces.			
8	11	1	3	Stiles will run the full height of the door, and rails, including top, cross, and bottom will run between stiles, mullions will run between rails, doors over 60" (1524 mm) in height will have an intermediate rail, grain or directional pattern will run vertically on stiles and horizontally on rails.			
8	11	1	4	Molded profile (sticking) will be the manufacturer's choice, unless specified otherwise.			
8	11	1	5	Clearance will be a minimum of 3/8" (9.5 mm) between hardware machining and glass cutout.			
8	11	1	6	Joinery will be mating male / female sticking, glued under pressure, except at:			
8	11	1	6	P	**Premium Grade**	Joinery will be mortise and tenon, dowels or loose tenon, glued under pressure.	
8	11	2	**PANEL** core will be covered by veneer, overlay, or rim banding, and direction of grain or pattern will run vertically, and adjacent door panels for transparent finish will have a pleasing match for color and grain, and:				
8	11	2	1	When flat will be a minimum of 1/4" (6.4 mm) in thickness, edge glued solid lumber is permitted if at least 1/2" (12.7 mm) in thickness and width across grain is 13-3/4" (349 mm) or less, except at:			
8	11	2	1	P	**Premium Grade**	Solid lumber is not permitted.	
8	11	2	2	When raised will be a minimum of 1/2" (12.7 mm) in thickness, edge glued solid lumber is permitted for panels less than 13-3/4" (349 mm) in width across grain, and solid lumber is permitted for rimming panels if mitered and glued under pressure, except at:			
8	11	2	2	P	**Premium Grade**	Solid lumber is not permitted.	
8	11	2	3	Regardless of retention method, will have the freedom and room to expand and contract in reaction to ambient humidity changes.			
8	11	2	4	Applied moldings will be spot glued, and finish nailed.			

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10.6 ASSEMBLY REQUIREMENTS

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8	**DOORS** (continued)				
8	**12**				When **SLIDING**, thickness to be a minimum of 1/4" (6.4 mm) for doors 24" (610 mm) and under in height or 3/4" (19.0 mm) for doors over 24" (610 mm) in height, vertical edges are considered exposed, top and bottom edges are concealed and not required to be edgebanded or filled, and:
8	12	**1**			**DOORS** more than 1.5 times as tall as they are wide will be mounted with overhead metal track and roller hanger to prevent tipping and binding.
8	12	**2**			At **HANGING TRACK SYSTEMS**, exposed track is acceptable and door heights of 34" (864 mm) or less will be installed on the appropriate fiber or metal track, with top guide, over 34" (864 mm) will be installed on either the overhead metal track with nylon roller hangers, or the metal bottom track with sheaves and top guide.
8	12	**3**			At **FACE FRAME CONSTRUCTION**, a continuous vertical filler strip will be provided in the opening behind the face frame and in front of the rear sliding door.
8	**13**				When **FLIPPER** or **POCKET**, doors and installation will be in conformance with and not exceed material suppliers' recommendations.
8	**14**				When **FRAMELESS GLASS**, be a minimum of 1/4" (6.4 mm) thick, clear tempered glass, laminated glass must be so specified, exposed edges shall be ground, except at:
8	14	**P**	**Premium Grade**		Edges will be Flat polished.
8	14	**1**			Carriers with metal track and top guide, and if needed to prevent sagging, bottoms of upper cabinets will be increased in thickness, provided with a hardwood track member of sufficient thickness, or provided with a strong back support screwed and glued to the underside.
9	**APRONS** require minimum thickness of 3/4" (19.0 mm) and edgebanding of bottom edge.				
10	**ENDS** (including free standing end panels) and **DIVISIONS** are required of minimum 3/4" (19.0 mm) thickness, and:				
10	**1**				**EXPOSED ENDS** will be applied or of integral construction; if integral it will be rabbeted or plowed to receive backs, and horizontal members (excluding countertops) will not extend beyond the exposed end, and at.
10	1	**1**			**APPLIED END PANELS** will extend to the leading edge of all cabinet components, and be mechanically fastened to the cabinet body, except at:
10	1	**P**	**Premium Grade**		**APPLIED ENDS** are not allowed.
10	**2**				**CONCEALED ENDS** allow tops and bottoms to extend past, if applicable.
10	**3**				**TOP EDGES** of the end of cabinets if exposed or visible from above be edgebanded with material of matching color and pattern to Exposed-Exterior surface.
10	**4**				**BOTTOM EDGES** of wall cabinet ends will be edgebanded with material compatible to the exposed faces, and at:
10	4	**P**	**Premium Grade**		With material of matching color and pattern to the Exposed-Exterior surface.
10	**5**				**PANELED CONSTRUCTION** stiles and rails be a minimum of 3/4" (19.0 mm) thickness, with minimum of 1/4" (6.4 mm) panel thickness, and hardboard is not permitted for transparent finish.
10	**6**				**DIVIDERS** are required behind vertical face frame members and to separate drawer compartments from shelf or open compartments.

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10.6 ASSEMBLY REQUIREMENTS

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11					**TOPS** and **BOTTOMS** (Base cabinets with separate countertops are not covered within this heading; see "Stretchers") requires minimum 3/4" (19.0 mm) thickness, and:
11	1				**BOTTOMS** of wall hung cabinets will be secured to ends, dividers, and back; with joints permitted where ends are flush with bottoms in each unit; not exceed 46-1/2" (1181 mm) in width; and when 42" (1067 mm) or more in length and made of particleboard or MDF the core thickness will be at least 1" (25.4 mm), and:
11	1	1			If cabinet ends extend below the bottom, the interior exposed surface of the end will be compatible to the exposed surface, and at:
11	1	1	P	**Premium Grade**	Will be same material as the exposed surface.
11	1	2			**EXPOSED-INTERIOR** requires uniform in thickness for the entire elevation or connected elevations, except when concealed behind a minimum 1-1/2" (38.1 mm) face frame member.
11	2				**TOPS** of wall hung and tall cabinets are not considered load bearing.
11	3				**FRAMELESS CONSTRUCTION**, permit joints where exposed ends are flush with tops, and cabinet end will be edgebanded to match other exposed surfaces.
12					**SECURITY** and **DUST PANELS** will be a solid piece of plywood, particleboard, MDF, or CGS (Compact Laminate) of minimum 1/2" (12.7 mm) in thickness, or if front and rear stretchers are used, a 1/4" (6.4 mm) panel may be let into the stretchers and shall be furnished above locked doors and drawers, only if each drawer or door is keyed differently.
13					**STRETCHERS** at base cabinets with separate countertops will be provided at both the front and the back of the cabinet body, except at sink compartments, which may run front to back and:
13	1				Be of solid stock or veneer core plywood a minimum of 3/4" (19.0 mm) in thickness and 2" (50.8 mm) in width.
13	2				Be of particleboard or MDF a minimum of 3/4" (19.0 mm) in thickness and 5" (127 mm) in width and reinforced as necessary to support the countertop.
13	3				In lieu of stretchers, a panel member a minimum of 3/4" (19.0 mm) in thickness, the full length and depth of the cabinet opening may be used.
13	4				At drawer banks, when the total drawer opening height exceeds 30" (762 mm), an intermediate front stretcher is required.

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10.6 ASSEMBLY REQUIREMENTS

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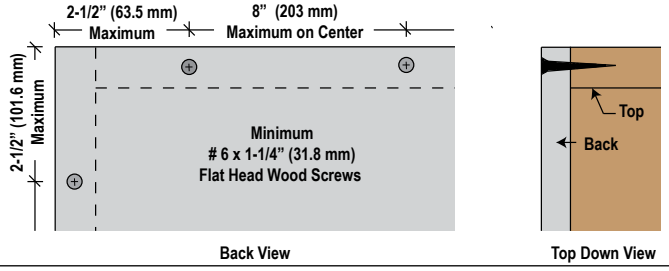
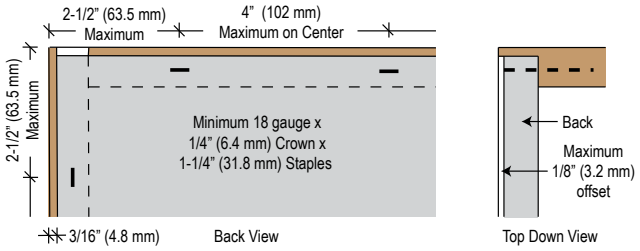
14 **BACKS** are required, and:

14 **1** **EXPOSED BACKS** will be a minimum of 1/2" (12.7 mm) in thickness and may be integral at a single cabinet; however, at multiple adjoining cabinets will have a securely applied back panel(s).

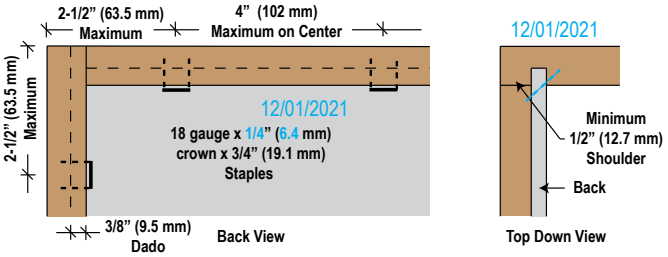
14 **2** **PLANT ON BACKS** will be a minimum of 1/2" (12.7 mm) in thickness and will be secured to the case body with minimum # 6 x 1-1/4" (31.8 mm) flat head wood screws at a maximum of 8" (203 mm) on center, starting within 2-1/2" (63.5 mm) of each corner both vertically and horizontally; and nailed or stapled to divisions and/or fixed shelves at a maximum of 8" (203 mm) on center as may be applicable. Glue is not required.



14 **3** **RABBETED BACKS** will be a minimum of 1/2" (12.7 mm) in thickness and will be secured to the case body with minimum 18 gauge x 1/4" (6.4 mm) crown x 1-1/4" (31.8 mm) staples at a maximum of 4" (102 mm) on center, starting within 2-1/2" (63.5 mm) of each corner both vertically and horizontally; and nailed or stapled to divisions and/or fixed shelves at a maximum of 8" (203 mm) on center as may be applicable. Glue is not required.



14 **4** **PLOWED / DADOED BACKS** will be a minimum of 1/4" (6.4 mm) in thickness, set in a 3/8" (9.5 mm) dado, have a minimum shoulder of 1/2" (12.7 mm), be secured to the case body with minimum 18-gauge x 1/4" (6.4 mm) crown x 3/4" (19.1 mm) staples set proud of back at a maximum of 4" (102 mm) on center, starting within 2-1/2" (63.5 mm) of each corner both vertically and horizontally and nailed or stapled to divisions and/or fixed shelves at a maximum of 8" (203 mm) on center, and requires: 12/01/2021



14 4 **1** **USE OF** melamine reactive adhesive in the plow / dado perimeter during assembly or minimum 3/16" bead of hot-melt adhesive at the shoulder perimeter after assembly; however, before installation of anchor strips.

14 4 **2** **ANCHOR STRIPS** (nailers) of solid stock, plywood, particleboard, or medium density fiberboard at the top and bottom of the wall side of the cabinet back, a minimum of 1/2" (12.7 mm) in thickness by 2-1/2" (63.5 mm) in width, attached to back; and:

14 4 2 **1** Will be flush with perimeter cabinet edges or recessed a maximum of 1/8" (3.2 mm).

14 4 2 **2** **CABINET HEIGHTS** over 60" (1524 mm) require an intermediate anchor strip.

14 4 2 **3** **RABBETED** or **PLANT-ON CABINET BACKS** of 1/2" (12.7 mm) or greater thickness do not require anchor strips.

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14	**BACKS** are required (continued)			
14	**5**		**BACKS** for base and tall cabinets may be either plant-on, rabbeted/plowed or a combination. Where combination methods are used, backs must be stapled to fixed perimeter case members at a maximum of 4" (102 mm) on center and to divisions and/or fixed shelves at a maximum of 8" (203 mm) on center as may be applicable. Glue is not required.
14	**6**		Attachment of base, tall, and wall hung cabinet backs by other than the above requirements for non-plow / dado or plowed / dadoed is permitted, provided it has been independently tested to show compliance to the NAAWS Cabinet Integrity Testing as outlined in the **APPENDIX**.
15	**TOE BASES, KICKS**, and **SLEEPERS** will be either separate from or integral to the cabinet body at the manufacturer's choice, a minimum of 4" (102 mm) high and 3/4" (19.0 mm) in thickness, sleepers will be provided at separate toe bases a maximum of 48" (1220 mm) on center, and:			
15	**1**		Moisture resistant base, if specified, requires base components be material complying with the Base Cabinet Submersion Test, as explained in the **APPENDIX**.
15	**2**		**LEVELERS** may be used at the manufacturer's choice; however, removable toe kicks are required, and at:
15	2	**1**	**CABINETS OVER** 15-1/2" (394 mm) in depth, will require four levelers per unit up to 37-1/2" (953 mm) in width and six per unit up to 48" (1220 mm) in width.
15	2	**2**	**CABINETS LESS THAN** 15-1/2" (394 mm) in depth, levelers are only required at the front and will require two levelers per unit up to 37-1/2" (953 mm) in width and three per unit up to 48" (1220 mm) in width.
15	**3**		**MOVEABLE TOES** at ADA base cabinets will be designed to minimize the vertical gap required by their offset installation whether used in paired or single door application, and:
15	3	**1**	**METAL TOE** assemblies are allowed provided they are of minimum 18 gauge fabrication with a uniform plated BHMA 626, buildershardware.com, or similar powder coated finish.
15	3	**2**	**PLASTIC TOE** assemblies are allowed provided they are of minimum 0.10" (2.5 mm) in thickness and formed of high impact polystyrene or equal.
16	**SHELVES** will be of a minimum 3/4" (19.0 mm) in thickness and uniform in thickness at each elevation or connected elevations at open casework, and requires at:			
16	**1**		**ADJACENT OPEN CABINETS**, adjustable shelves that are able to be aligned horizontally, provided the adjacent cabinets are of the same base, wall or tall storage type.
16	**2**		**CABINETS OVER 72"** (1829 mm) high will have a fixed shelf at approximate mid-height if:
16	2	**1**	Not immediately abutting a structural wall or another cabinet at both ends.
16	2	**2**	If to be installed with NAAWS Seismic Installation requirements.
16	**3**		**GLASS SHELVING** will be tempered with all four edges polished.

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16	SHELVES (continued)			
16	4			**FIXED SHELVES** will be secured to ends, dividers, and back; not exceed 46-1/2" (1181 mm) in width; and when 42" (1067 mm) or more in length, unsupported, and made of particleboard or MDF the core thickness will be at least 1" (25.4 mm).
16	5			**ADJUSTABLE SHELVES** will conform in thickness to the following tables of maximum adjustable shelf length listings; laminations will be a rigid glue line (contact adhesive is not permitted) and based on:
16	5	1		**MOE** (Modulus of Elasticity) estimates listed.
16	5	2		**CREEP** is not taken into consideration or considered a defect.
16	5	3		**TOTAL WEIGHT,** will not exceed 200 lbs. (90.7 kg) on any one shelf and will be uniformly dispersed while being subject to load capacities of either:
16	5	3	1	**40 lbs.** per sq. ft. (195.3 kg/m2) for commercial shelving.
16	5	3	2	**50 lbs.** per sq. ft. (244.1 kg/m2) for schools, hospitals, and library bookshelves.
16	5	4		**FORMULA** subject to a maximum 1/4" (6.4 mm) deflection. **INFORMATION** and **RATINGS** represented in calculations are believed to be reliable; however, due to variations in use not known or out of our control, no warranties or guarantees are made as to the end results. **OTHER ACCEPTABLE CORE MATERIALS** that may meet the minimum requirements of these standards ay be determined by documented use of the formula.

$$L = \frac{(DEWt^3)/(0.1563s^4)}{W/144}$$

L = lbs./SF of uniformly distributed load
D = deflection (inches)
E = MOE (psi)
t = thickness (inches)
W = width (front to back) of shelf (inches)
s = span of shelf (inches)

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Continued from previous page

16 **SHELVES** require (continued)

16 5 At **ADJUSTABLE SHELVES** (continued)

16 5 5 *Table 10-001,* **SHELF LENGTH CONFORMANCE TABLE**

16 5 5 1 **MAXIMUM ADJUSTABLE SHELF LENGTH** based on panel composition and thickness.

	Panel Description	Thickness	MAXIMUM SHELF LENGTH (▭ = 50 lbs./sf (244.1 kg/m2) loading; ▭ = 40 lbs./sf (195.3 kg/m2) loading)
16 5 5 1 1	**PARTICLEBOARD CORE,** 1-M-2, with TFL two sides (MOE: 400,000+/-)	3/4" (19.0 mm)	30" (762 mm) / 32" (813 mm)
		1" (25.4 mm)	37" (940 mm) / 39" (991 mm)
16 5 5 1 2	**PARTICLEBOARD CORE, 1-M-2,** with hardwood veneer two sides (MOE: 640,000+/-)	3/4" (19.0 mm)	34" (864 mm) / 36" (914 mm)
		1" (25.4 mm)	42" (1067 mm) / 44" (1118 mm)
16 5 5 1 3	**PARTICLEBOARD CORE, 1-M-2,** with vertical grade HPL two sides (MOE: 710,000+/-)	3/4" (19.0 mm)	35" (889 mm) / 37" (940 mm)
		1" (25.4 mm)	43" (1092 mm) / 45" (1143 mm)
16 5 5 1 4	**MDF CORE** with TFL two sides (MOE: 500,000+/-)	3/4" (19.0 mm)	32" (813 mm) / 34" (864 mm)
		1" (25.4 mm)	39" (991 mm) / 42" (1067 mm)
16 5 5 1 5	**MDF CORE** with hardwood veneer two sides (MOE: 580,000+/-)	3/4" (19.0 mm)	33" (838 mm) / 35" (889 mm)
		1" (25.4 mm)	41" (1041 mm) / 43" (1092 mm)
16 5 5 1 6	**MDF CORE** with VGP-HPL two sides (MOE: 710,000+/-)	3/4" (19.0 mm)	35" (889 mm) / 37" (940 mm)
		1" (25.4 mm)	43" (1092 mm) / 45" (1143 mm)

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10.6 ASSEMBLY REQUIREMENTS

Continued from previous page

16 **SHELVES** require (continued)

16 5 At **ADJUSTABLE SHELVES** (continued)

16 5 5 *Table 10-001,* **SHELF LENGTH CONFORMANCE TABLE** (continued)

16 5 5 1 **MAXIMUM ADJUSTABLE SHELF LENGTH** based on panel composition and thickness. (continued)

MAXIMUM SHELF LENGTH

= 50 lbs./sf (244.1 kg/m2) loading

= 40 lbs./sf (195.3 kg/m2) loading

	Panel Description	Thickness	MAXIMUM SHELF LENGTH
16 5 5 1 7	**SOLID YELLOW POPLAR** (MOE: 1,500,000+/-)	3/4" (19.0 mm)	42" (1067 mm) / 45" (1143 mm)
		1" (25.4 mm)	52" (1321 mm) / 55" (1397 mm)
16 5 5 1 8	**SOLID NORTHERN RED OAK** (MOE: 1,800,000+/-)	3/4" (19.0 mm)	44" (1118 mm) / 46" (1168 mm)
		1" (25.4 mm)	54" (1372 mm) / 57" (1448 mm)
16 5 5 1 9	**COMBINATION CORE** with TFL two sides (MOE: 585,000+/-)	3/4" (19.0 mm)	33" (838 mm) / 35" (889 mm)
		1" (25.4 mm)	41" (1041 mm) / 43" (1092 mm)
16 5 5 1 10	**COMBINATION CORE** with VGP-HPL two sides (MOE: 650,000+/-)	3/4" (19.0 mm)	34" (864 mm) / 36" (914 mm)
		1" (25.4 mm)	42" (1067 mm) / 44" (1118 mm)
16 5 5 1 11	**VENEER CORE** with hardwood veneer two sides (MOE: 750,000+/-)	3/4" (19.0 mm)	35" (889 mm) / 37" (940 mm)
		1" (25.4 mm)	43" (1092 mm) / 45" (1143 mm)
16 5 5 1 12	**VENEER CORE** with VGP-HPL two sides (MOE: 775,000+/-)	3/4" (19.0 mm)	36" (914 mm) / 38" (965 mm)
		1" (25.4 mm)	44" (1118 mm) / 46" (1168 mm)

Continued on next page

10.6 ASSEMBLY REQUIREMENTS

Continued from previous page

16 **SHELVES** require (continued)

16 5 At **ADJUSTABLE SHELVES** (continued)

16 5 5 *Table 10-001,* **SHELF LENGTH CONFORMANCE TABLE** (continued)

16 5 5 1 **MAXIMUM ADJUSTABLE SHELF LENGTH** based on panel composition and thickness. (continued)

MAXIMUM SHELF LENGTH

= 50 lbs./sf (244.1 kg/m2) loading

= 40 lbs./sf (195.3 kg/m2) loading

	Panel Description	Thickness	MAXIMUM SHELF LENGTH
16 5 5 1 13	**EUROPEAN MULTI-PLY** with hardwood veneer two sides (MOE: 1,000,000 +/-) 12/01/2021	3/4" (19.0 mm)	38" (965 mm) / 40" (1016 mm)
		1" (25.4 mm)	48" (1219 mm) / 50" (1270 mm)
16 5 5 1 14	**EUROPEAN MULTI-PLY** with VGP-HPL two sides (MOE: 1,000,000 +/-) 12/01/2021	3/4" (19.0 mm)	39" (991 mm) / 41" (1041 mm)
		1" (25.4 mm)	49" (1245 mm) / 51" (1295 mm)
16 5 5 1 15	**CGS** (Compact Laminate) **RECOMMENDATIONS ONLY** based on data researched from CGS Material suppliers. (MOE: 1,300,000 +/-)	3/8" (9.5 mm)	44" (1118) mm) / 46" (1168 mm)
		1/2" (12.7 mm)	54" (1372 mm) / 57" (1448 mm)
		5/8" (15.9 mm)	63" (1600 mm) / 68" (1727 mm)
		3/4" (19.0 mm)	74" (1880 mm) / 80" (2032 mm)
16 5 5 1 16	**TEMPERED GLASS** **RECOMMENDATIONS ONLY** based on data researched from LOF and ASTM C1036, astm.org.	1/4" (6.4 mm)	12" (305 mm) / 14" (356 mm)
		5/16" (7.9 mm)	16" (406 mm) / 18" (457 mm)
		3/8" (9.5 mm)	21" (533 mm) / 24" (610 mm)
		1/2" (12.7 mm)	28" (711 mm) / 32" (813 mm)
		5/8" (15.9 mm)	35" (889 mm) / 40" (1016 mm)
		3/4" (19.0 mm)	43" (1092 mm) / 47" (1194 mm)

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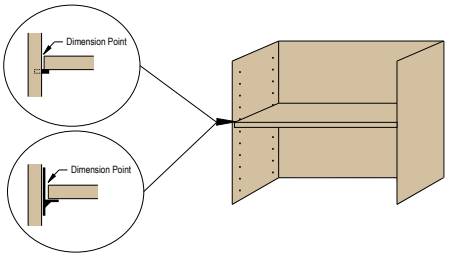
16						**SHELVES** require (continued)
16	5					At **ADJUSTABLE SHELVES** (continued)
16	5	7				**LENGTH** be a maximum of 1/8" (3.2 mm) less than the inside cabinet width plus any additional offset created by the shelf rests used, and if the gap between the end of a shelf and the inside cabinet body exceeds 1/4" (6.4 mm) both ends of the shelf must be edgebanded.
16	5	8				**Depth** be a maximum of 1/4" (6.4 mm) less than the inside cabinet depth.
16	5	9				**SHELF SUPPORTS SYSTEM** center lines will not exceed a minimum of 1" (25.4 mm) to a maximum of 4" (102 mm) from the front and back of the interior cabinet body or conflict with hinge placement; the dimension between the center line of the rests will not be less than 60% of the shelf's depth, and:
16	5	9	1			Three rests are required at each end of shelves over 29-3/4" (756 mm) in depth.
16	5	9	2			Will extend vertically within 6" (152 mm) of the interior top or bottom of the cabinet shelf space.
16	5	9	3			At **BORED HOLE SHELF REST** systems be supported on evenly spaced, cleanly bored holes a maximum of 2" (50.8 mm) on center.
16	5	9	4			At **METAL SHELF STANDARD** systems, top and bottom spacing shall be consistent throughout the project, and when:
16	5	9	4	1		Surface mounted, shelves will be notched.
16	5	9	4	2		Recessed in a plow, standard will be slightly proud of the face and cover the plow end.
17						**PULLOUT SHELVES** require:
17	1					**BREAD / CUTTING BOARDS** to be solid stock a minimum of 3/4" (19.0 mm) in thickness, with tongue and groove edgebands front and back, securely glued with waterproof adhesive.
17	2					**WRITING** or **UTILITY SHELVES** be a minimum of 3/4" (19.0 mm) in thickness, of a smooth compatible material to the Exposed-Interior surface, be edgebanded three edges, operate smoothly in channels or other rigid guides, and extend a minimum of 15" (381 mm) in cabinets 22" (559 mm) or greater, or 2/3 of the cabinet depth in narrower cabinets.



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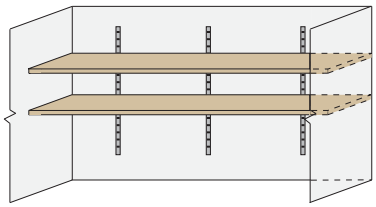
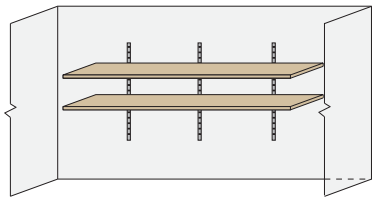
18			**CLOSET & UTILITY SHELVING**, will include shelves and dividers cut to width in lengths suitable for installer fitting; however, furnished un-assembled with cleats furnished as lineal footage, and:
18	1		Shelves with unsupported length exceeding 36" (914 mm) will be a minimum of 1" (25.4 mm) in thickness, or:
18	1	1	Have a minimum 3/4" x 2" (19.0 mm x 50.8 mm) applied front-drop edge. 
18	2		Exposed edges of sheet good cleats and shelves are defined as visible in normal use position, and will be edgebanded to match face with edges eased, and sequence of lamination optional.
18	3		Adjoining adjustable shelves will have ends edgebanded.
18	4		When miter folded, will have no open gaps, and will be filed or sanded just enough to remove sharpness.
18	5		Gaps between the end of the shelf and the wall up to 1/4" (6.4 mm) are allowed. 
18	6		Ends of shelves held more than 1/4" (6.4 mm) away from a wall will be edgebanded. 
19			**CLOTHES RODS** require wood, a minimum of 1-1/4" (31.8 mm) in diameter or metal, a minimum of 1-1/16" (27.0 mm) diameter, of the manufacturers' choice, and supported at a maximum of 48" (1220 mm) on center and each end by rosettes or hook strips with bored holes.
20			**WARDROBES** 60" (1524 mm) or wider require a horizontal member at the top rail of sliding doors rigidly supported with a vertical 1-3/8" (34.9 mm) round pole or two strips a minimum of 3/4" x 1-1/4" (19.0 mm x 31.8 mm) forming a "T" member securely positioned behind the door lap.
21			**MOVEABLE CABINETS** require:
21	1		**GLIDES** to be metal and adjustable.
21	2		**CASTERS** to have a minimum weight capacity of 90 lbs. (40.8 kg) per caster.
21	3		**METAL FRAME** or **DIAPHRAGM TYPE DOUBLE BOTTOM** (see **CDS** drawings) at cabinets over 42" (1067 mm) in height, with doors and without fixed vertical or horizontal stabilizing partitions.
21	4		**LOCK JOINT CORNERS** at bottoms or tops be reinforced with a continuous metal angle or wood cleat securely screwed and set with adhesive into the inside of both corner sides.

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22 **CASEWORK** requires components to be assembled square, within a tolerance not to exceed 1/32" (0.8 mm) difference in measurement at top versus bottom, and 1/16" (1.6 mm) diagonally, all joints securely glued, unless specifically stated otherwise, and:

22 **1** Exposed fasteners are not permitted at Exposed-Exterior surfaces; however, where permitted for access panels, they will be plated (bugle head drywall screws are not permitted).

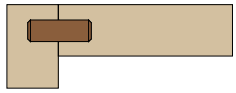
22 **2** **JOINERY** provided for herein has been tested and proven compliant to the unique NAAWS requirements outlined in the **APPENDIX**. These tests are unique to NAAWS and were created specifically for the needs of architectural casework.

The test procedures and their success establishes the minimum acceptable level of integrity and performance for casework / drawer joinery and in wall blocking requirements incorporated within NAAWS 4.0.

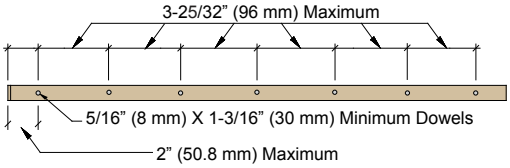
These testing requirements meet or exceed the highest and most demanding performance levels of ANSI/AWI 0641-2019.

All members to be securely fastened together, using one or more of the following tested and approved methods of joinery:

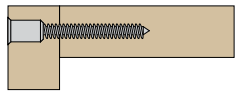
22 2 **1** At **GLUED IN DOWEL** joints, dowel to be a minimum of 5/16" x 1-3/16" (7.9 mm x 30.2 mm), glued and clamped with minimum of two dowels per joint,



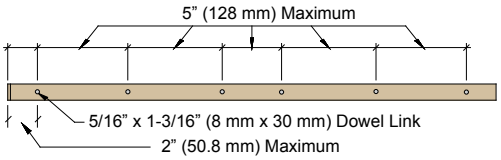
spaced with first dowel a maximum of 2" (50.8 mm) from the front with subsequent dowels a maximum of 3-25/32" (96.0 mm) on center, unless joint is less than 9-1/2" (241 mm) long, then maximum spacing will not exceed 2-1/2" (63.5 mm).



22 2 **2** At **THREAD IN DOWEL SCREW** joints, dowel screw to be a minimum of 9/32" x 2" (7.1 mm x 50.8 mm), with minimum of two dowel screws per joint, glue is not required,



spaced with first dowel screw a maximum of 2" (50.8 mm) from the front, with subsequent dowel screws a maximum of 5" (127 mm) on center, unless joint is less than 12" (305 mm) long, then maximum spacing will not exceed 4" (102 mm).



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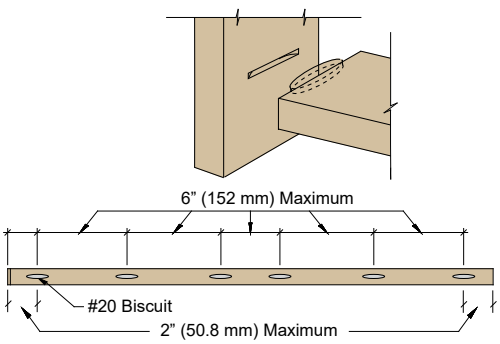
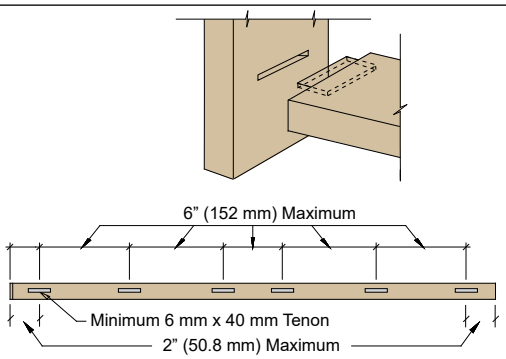
22			**CASEWORK** (continued)
22	2		**JOINERY** (continued)
22	2	3	At **BISCUIT SPLINE** joints, biscuits will be a minimum #20 (56 mm), glued and clamped with a minimum of one biscuit per joint up to 4" (102 mm) in length, spaced with first biscuit a maximum of 2" (50.8 mm) from each joint end to the center of the plate, and subsequent plates spaced a maximum of 6" (152 mm) on center. 
22	2	4	At **LOOSE TENON** joints, tenons will be hardwood, a minimum 3/16" x 3/4" x 1-3/16" (4.8 mm x 19.0 mm x 30 mm), glued and clamped with a minimum of one tenon per joint up to 3" (76 mm) in length, spaced with first tenon a maximum of 2" (51 mm) from each joint end to the center of the tenon, and subsequent tenons spaced a maximum of 6" (152 mm) on center. 

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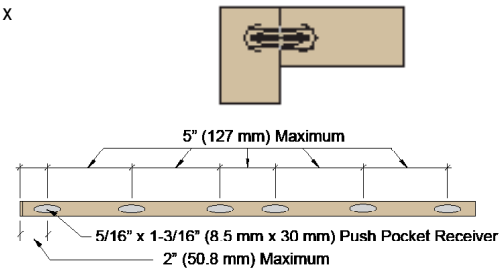
22			**CASEWORK** (continued)
22	2		**JOINERY** (continued)
22	2	5	At **PUSH POCKET** laterally engaged joints, fasteners will be of synthetic construction, 5/16" x 1-3/16" (8 mm x 30 mm), glued at panel edge hole only, with a minimum of two push pocket fasteners per joint, spaced with first push plate a maximum of 2" (51 mm) from each joint end to the center of the push pocket, and subsequent push pockets spaced a maximum of 5" (127 mm) on center, unless joint is less than 9-1/2" (241 mm) wide then maximum spacing will not exceed 2-1/2" (63.5 mm).
22	2	6	At glued **MORTISE / DADO** and **RABBET / TENON** joints the entire length of the joint shall be glued in both the groove and at the base of the rabbet with melamine reactive adhesive. 12/01/2021
22	3		**JOINERY, OTHER THAN THAT PROVIDED FOR WITHIN SECTION 10,** is permitted provided it is fully documented in a text / illustration explanation, and has been independently (Federal or Provincial / State regulated university, college or technical (post high school) school, or licensed testing facility) tested to show compliance to NAAWS's Casework Joinery Integrity Testing as qualified within the **APPENDIX**.



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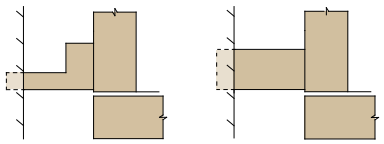
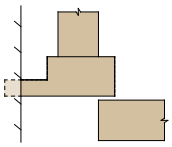
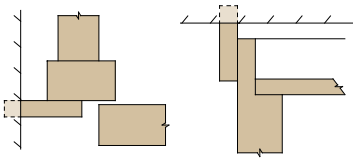
23				**SCRIBING** will be furnished by the manufacturer, will match exposed surfaces, be furnished in maximum available lengths, joints not allowed in material less than 96" (2440 mm), permits color compatible caulking not to exceed 1/8" (3.2 mm), and:
23	1			**SCRIBE FILLERS** will not exceed 1-1/2" (38.1 mm) in width. 
23	2			**SCRIBE ALLOWANCE** will not exceed 1-1/2" (38.1 mm) in width greater than the vertical face frame member. 
23	3			**SCRIBE MOLDS** will not exceed 1-1/2" (38.1 mm) in width, and at: 
23	3	P	**Premium Grade**	Scribe molds are not permitted.
23	4			**TRIM MEMBERS** used at the inside corner of the adjoining angled cabinets (which is not a scribe or subject to the 1-1/2" (38.1 mm) maximum scribe allowance) will be equal and not exceed 2" (50.8 mm) beyond the cabinet front and/or drawer pull.
23	5			**SOFFIT** or **FASCIA PANELS** will be a minimum of 3/4" (19.0 mm) in thickness, and prohibits joints in material less than 96" (2440 mm) at horizontal grain or directional pattern and 48" (1220 mm) at vertical grain or directional pattern, and grain direction (if any) will run vertical, or be manufacturer's choice if less than 12" (305 mm) tall, except at:
23	5	P	**Premium Grade**	Less that 1-1/2" (38.1 mm) tall.

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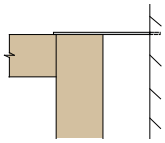
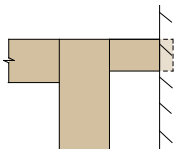
24					**CLOSURE** provision is required at voids or open spaces between cabinets and walls, such as at the top of tall and upper cabinets and the bottom of upper cabinets caused by scribing or angle turns, and:
24	1				At **NON-VISIBLE VOIDS**:
24	1	1			1-1/2" (38.1 mm) or less in width, a piece of VGP-HPL may be used as a closure cap. 
24	1	2			Exceeding 1-1/2" (38.1 mm) in width, a minimum 3/4" (19.0 mm) closure filler will be provided of manufacturer's choice. 
24	2				At **VISIBLE VOIDS**, a minimum 3/4" (19.0 mm) closure filler will be provided matching the adjacent surface.
25					**WOOD FACED CASEWORK** requires at:
25	1				**VISIBLE EDGES** at sheet products be edgebanded, unless specified otherwise, the sequence of edge / face lamination will be the manufacturer's choice, and at:
25	1	P	**Premium Grade**		Door and drawer front edges showing more than 1/4" (6.4 mm) on face will be mitered, except at the ends of wall hung cabinets, the sequence of edges will be the bottom edge first.
25	1	1			**FINGER JOINTS** are permitted if adjoining pieces are compatible for color and grain, except at:
25	1	1	P	**Premium Grade**	They will be well matched for color and grain with a maximum of one in 96" (2440 mm) of length, and top drawer box edges of solid stock sides will be stop shaped.
25	1	2			**FRONT** and **FALSE FRONT** be edgebanded at all four edges, except when back beveled with MDF core or of solid wood, and at: 12/01/2021
25	1	2	1		**OPAQUE** finish, require filled and sanded edges at minimum 7-ply hardwood plywood and particleboard, and no edgebanding at medium density fiberboard.
25	1	2	2		**TRANSPARENT** finish, have edgebanding matched to exposed surfaces.
25	2				**DOORS** require, at transparent finish, edgebanding on all four edges matching exposed surfaces, and:
25	2	1			When sliding, interior faces will be veneer of balancing species.
25	3				**FACE FRAMES** require (not applicable to HPL or TFL faced casework) solid stock a minimum of 3/4" (19.0 mm) in thickness with grain running vertically on stiles and horizontally on rails, joints to be mortised and tenoned, doweled, metal dowel screwed, pocket screwed or biscuit splined, and securely glued. Frames to be securely glued and mechanical fastened at a maximum of 8" (203 mm) on center to cabinet bodies, and may be face nailed, except at:
25	3	P	**Premium Grade**		Exposed nailing is not permitted, and exposed corners will be shoulder mitered, lock mitered, spline mitered, or mitered with a biscuit spline.
25	4				**TOPS** and **BOTTOMS** minimum of 3/4" (19.0 mm).
25	5				**FLUSH INSET DOORS** use of the bottom member of the face frame is required.

Continued on next page

10.6 ASSEMBLY REQUIREMENTS

Continued from previous page

26	**HPL** casework, requires at:	
26	**1**	**EXPOSED EDGES** require HPL, PVC or ABS well matched to the exposed face, a minimum of 0.018" (0.5 mm) and maximum of 0.12" (3.0 mm) thickness of manufacturer's choice, PVC and ABS edgebanding thicker than 0.04" (1.0 mm) be radiused on edges and corners and unless specified otherwise, the sequence of the edge / face lamination will be the manufacturer's choice.
26	**2**	**DRAWERS** require front and false front to be edgebanded at all four edges, except when back beveled.
26	**3**	**DOORS** require: edgebanding on all four edges matching exposed surfaces, with glass stops of hardwood solid stock painted to match HPL or a synthetic (vinyl, neoprene, plastic) gasket / retainer; however, synthetic stops are acceptable on the inside only, and when **SLIDING**, interior face will be of the same thickness and material as the exterior faces.
27	**CGS** (Compact Laminate) casework, requires at:	
27	**1**	**EDGEBANDING** is not required.
27	**2**	**DOOR, DRAWER / FALSE FRONT, APRON, TOP, FIXED BOTTOM** and **BREAD / CUTTING BOARD** thickness be a minimum of 1/2" (12.7 mm).
27	**3**	**SHELF** thickness to be a minimum of 3/8" (9.5 mm).
27	**4**	**END** and **DIVISION** thickness to be a minimum of 1/2" (12.7 mm) and applied ends are permitted.
27	**5**	**SECURITY** and **DUST PANEL** thickness to be a minimum of 1/4" (6.4 mm).
27	**6**	**STRETCHER** thickness to be a minimum of 1/2" (12.7 mm) and 2" (50.8 mm) in width.
27	**7**	**JOINERY**, use of a 9/32" x 1-1/4" (7.1 mm x 31.4 mm) thread cutting, machine screw with the first screw 1-15/16" (49.2 mm) from each edge or end and subsequent screws 5" (127 mm) on center, and glue is not required.

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10.7 LABORATORY CASEWORK REQUIREMENTS

1		**FOLLOWING REQUIREMENTS** for laboratory casework are in addition to those otherwise set forth within these standards and will be in concert with that of the Scientific Equipment and Furniture Association (SEFA), sefalabs.com Recommended Practices.
2		**INCLUSIONS**: wood, HPL or CGS (Compact Laminate) faced laboratory casework and matching furniture / fixture accessories
3		**EXCLUSIONS:** Metal casework or fabrications, Cylinder restraint assemblies, Pipe drop enclosures, Drying racks, Hoods or containment units, Slotted channel framing, Service fittings and fixtures, HAVC, Electrical or Communications, Stainless steel or other metal accessories.
4		**CASEWORK** requires:
4	1	**ADJUSTABLE SHELF** load capacities of **50 lbs.** per sq. ft. (244.1 kg/m2).
4	2	**DRAWERS SLIDES** to be full extension suspension, ball bearing with minimum load capacity of 100 lbs. (45.4 kg).
4	3	**"WET" LAB** toe bases be constructed of veneer core plywood with moisture resistant adhesive or moisture resistant MDF with a 24-hour thickness swell factor of 5.5% or less. 12/01/2021
4	4	**MECHANICAL CHASE ACCESS** at all base and peninsula cabinets, including drawer banks, and will be neatly cut and as large as practical without interfering with installation requirements.
4	5	**TALL CABINETS**, 72" (1829 mm) or taller, to have a fixed shelf approximately mid height.
4	6	**REAGENT SHELVES**, to have a seismic rail or lip at front edge, including those behind doors, solid or glass.
4	7	**SLIDE BOLTS** or **ELBOW CATCHES** on inactive door at locking pairs and at tall storage cabinets over 72" (1829 mm), slide bolts will have minimum 18" (457 mm) reach.
5		**TABLES** require compliance to SEFA's (Scientific Equipment and Furniture Association, sefalabs.com) Table Structural Integrity Test as explained in the **APPENDIX** with:
5	1	Minimum 2" x 2" (50.8 mm x 50.8 mm) solid wood legs, with cross or "I" bracing, minimum 1-1/2" (38.1 mm) diameter, non-marring, 150 lb. (68 kg) capacity, level adjustable glides, and minimum 4" (102 mm) tall vinyl or rubber leg shoes.

SUGGESTION

RESOURCE GUIDE

CG TC

END OF SECTION 10

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

COUNTERTOPS & HORIZONTAL SURFACES

SECTION - 11

INCLUDING: Tops, Wall Caps, Splashes, Sills and Benches; of HPL, ~~TFL~~, Wood, Solid Surface, CGS Compact Laminate, Epoxy Resin, and Natural / Engineered Stone 12/01/2021

11.1 SCOPE

1 All HPL, ~~TFL~~, including Class A Flame Spread-Rated and Chemical-Resistant, Solid Surface, Natural / Engineered Stone, Epoxy Resin, CGS Compact Laminate, and wood facings, tops, splashes, sills, ledges, and benches. 12/01/2021

2 **INCLUSIONS**

2.1 HPL, Class A Flame Spread-Rated HPL, Chemical-Resistant HPL, ~~TFL~~, Solid Surface, Natural / Engineered Stone, Epoxy Resin, CGS Compact Laminate, and Wood Countertops with approved backing sheet, as applicable. 12/01/2021

2.2 Splashes, sub-tops and spacers.

2.3 Exposed edges; cutouts for sinks; electrical boxes; and fixtures indicated on drawings.

2.4 Integral solid surface sinks and epoxy sinks.

2.5 Windowsills and ledges.

2.6 Support members that are surface-mounted.

2.7 Benches.

2.8 Installation, if specified.

3 **EXCLUSIONS**

3.1 Stripping, furring, in wall blocking, or grounds.

3.2 Furnishing or installation of sink rims or sinks not listed above.

3.3 In-wall support members.

3.4 All grounds, backing members, or other items unrelated to the furnishing and installation of countertops and sinks.

3.5 Fixtures, plumbing, and data equipment.

3.6 Sink outlets and fittings.

3.7 Welded metal support material or structure.

3.8 Flooring and ceiling surfaces.

3.9 Cutouts in sub-tops, where stone / solid surface tops are not in contract.

11.2 SURFACE DEFINITIONS

1 **EXPOSED SURFACES**

1.1 All visible surfaces of an installed countertop.

1.2 The exposed underside surface over 42" (1067 mm) off the finish floor.

2 **CONCEALED SURFACES**

2.1 The underside surface 42" (1067 mm) or less off the finished floor.

2.2 All non-visible surfaces attached to and/or covered by another surface.

2.3 All non-visible blocking, spacers, etc., used for attachment.

11.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS:**

1.1 **SPLASHES**, back or end, where indicated will be a minimum of 3" (76 mm) high above the deck surface.

1.2 **HPL COUNTERTOPS** - will be **CUSTOM GRADE** (unless the related casework is premium grade, then the countertops will be **PREMIUM GRADE**); HGP-HPL of standard , non-premium colors and finishes, selected from manufacturer's brand choice and readily available sheet sizes; **wi**th manufacturer's choice of edge treatment.

1.3 **WOOD COUNTERTOPS** - will be **CUSTOM GRADE** (unless the related casework is Premium Grade, then the countertops will be **PREMIUM GRADE**) hardwood plywood intended for an opaque finish, with manufacturer's choice of edge treatment.

1.4 **SOLID SURFACE COUNTERTOPS** - will be **CUSTOM GRADE** (unless the related casework is Premium Grade, then the countertops will be **PREMIUM GRADE**) of standard, non-premium colors with satin finish, selected from manufacturer's brand choice and with manufacturer's choice of edge treatment.

1.5 **CGS** (Compact Laminate) **COUNTERTOPS** - will be **CUSTOM GRADE,** of standard, non-premium colors with finish selected from manufacturer's brand choice and with manufacturer's choice of edge treatment.

1.6 **EPOXY RESIN COUNTERTOPS** - will be **CUSTOM GRADE,** of standard, non-premium colors with satin finish, selected from manufacturer's brand choice and with manufacturer's choice of edge treatment, and including compatible sink and accessories.

1.7 **NATURAL / ENGINEERED STONE COUNTERTOPS** - will be **CUSTOM GRADE**, of standard, non-premium colors with standard finish, selected from manufacturer's brand of choice and with manufacturer's choice of edge treatment.

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11.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the tolerances requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** (such as HPL, ~~TFL~~, Solid Surface, CGS Compact Laminate, and Epoxy Resin, Natural / Engineered Stone) used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein. 12/01/2021

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires back of wood countertops and trim to be factory sealed.

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **COUNTERTOP MANUFACTURERS** are responsible for furnishing wall cleating necessary for proper setting of their countertops where there is no casework for support.

12 **NATURAL STONE** referenced in these standards typically refers to granite, marble, slate, soapstone, and limestone. Natural stone countertops are cut directly from the earth and have little processing besides smoothing and shape formation and will often need to be sealed because natural materials are porous (soapstone is a notable exception to this generalization).

13 **ENGINEERED STONE** referenced in these standards is a composite material made of crushed stone bound together by an adhesive, (most commonly polymer resin, with some newer versions using cement mix). This category includes engineered quartz, polymer concrete and engineered marble stone. It also known Agglomerated Stone.

14 **BUILD-UP** materials required for installation of a countertop are the responsibility of the countertop manufacturer.

15 Defined **GRAIN** and/or **PATTERN** shall run parallel to the front edge in any given elevation.

16 **HORIZONTAL REVEALS** between the lower edge of the countertop and the upper edge of the adjacent door or drawer front will be consistent. Coordination of such is the responsibility of the cabinet manufacturer.

Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

11.5 MATERIAL REQUIREMENTS

1		**EDGEBANDING** requires minimum thickness at: HPL Banding of 0.036 (0,91 mm) +/- 0.005 (0.13 mm). PVC, ABS, Polyester, Polypropylene Banding of 0.039 (1 mm) +/- 0.005 (0.13 mm). Veneer Banding of 0.02 (0.5 mm) +/- 0.0025 (0.06 mm).
2		**SOLID WOOD** requires 3/4" (19.0 mm) minimum thickness solid stock of one species for the entire project.
3		**VENEERED WOOD** requires core be a minimum of 11/16" (17.5 mm) particleboard, medium-density fiberboard, veneer core, or otherwise approved engineered core, except at:
3	1	**SINK TOPS** and their splashes requires use of veneer core with moisture resistant adhesive or moisture resistant MDF or particleboard with a 24-hour thickness swell factor of 5.5% or less.
4		**HPL** requires minimum HGP-HPL, or CPL of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and:
4	1	**CORE**, will be a minimum of 11/16" (17.5 mm) particleboard, medium-density fiberboard, veneer core, or otherwise approved engineered core.
4	2	**SINK TOPS** and their splashes requires use of veneer core with moisture resistant adhesive or moisture resistant MDF or particleboard with a 24-hour thickness swell factor of 5.5% or less.
4	3	**FLAME SPREAD RATED** countertops require Class A Flame Spread Rated HPL, core and backing sheet. Core will be a minimum of 11/16" (17.5 mm) thick and backing sheet a minimum of 0.028" (0.7 mm) HPL.
5		**SOLID SURFACE** requires Solid Surface of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and nominal 1/2" (12.7 mm) minimum in thickness for countertops and back splashes.
6		**CGS** (Compact Laminate) requires CGS (Compact Laminate) of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and minimum 1/2" (12.7 mm) in thickness.
7		**EPOXY RESIN** requires Epoxy Resin of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and minimum 3/4" (19 mm) in thickness.
8		**NATURAL / ENGINEERED STONE** requires stone of brand, color and finish specified, if not specified, it will be of standard, non-premium color and finish selected from manufacturer's brand choice, and minimum 2CM (13/16" (20.6 mm)) in thickness, and at:
8	1	**NATURAL STONE,** thickness of the material used throughout a project will not vary in excess of 1/8" (3.2 mm).

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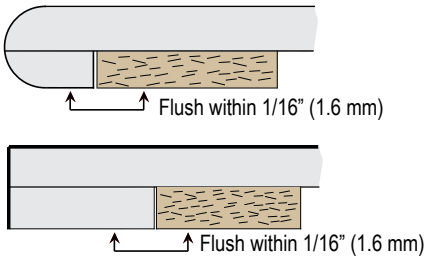
11.6 ASSEMBLY REQUIREMENTS

1		**ADHESIVE** or **JOINT FILLER** material, if used, will be inconspicuous and match the adjacent surface for smoothness.
2		**SQUARENESS** will be within ±1/64" (0.4 mm) for each 12" (305 mm).
3		**CUTOUTS** will be within ±1/8" (3.2 mm) of locations and +1/8" to 0" (3.2 mm to 0.0 mm) for size.
4		**SCRIBING**, if needed, requires countertop be provided with extra length.
5		Tops requiring more than one sheet of surface material will be pre-matched to minimize color variation within the scope of the material supplier's guarantee, be fabricated from the longest lengths available, and top widths exceeding product availability will have manufacturer-assembled joints.
6		**FILLERS** will be furnished by the countertop manufacturer.
7		**EDGE APPLICATION SEQUENCE** will be the manufacturer's choice, except at HPL.
8		**BACK SPLASHES** require end splashes at wall ends.
9		**REMOVABLE LEDGES** and/or **ACCESS PANELS** will be attached with flat-head screws, set flush, and if chemical resistance is required, screws will be stainless steel.
10		**SHEET** and **LAMINATED LUMBER PANELS** will be permitted to move, float, expand or contract in reaction to ambient humidity changes.
11		**EDGE OVERHANGS** will be consistent, and:
11	1	Be a minimum of 1/2" (12.7 mm) and a maximum of 1-1/4" (31.8 mm) over the outer most cabinet face and finished end, and be parallel with the cabinet face or end within +/- 1/8" (3.2 mm) in any 96" (2440 mm) run of countertop, and at appliance ends, be flush to a maximum of 1/4" (6.4 mm) over the cabinet end.
11	2	If specified with drip groove, it will be continuous 1/8" x 1/8" (3.2 mm x 3.2 mm) and 3/8" (9.5 mm) back from the front edge and sealed.
11	3	If specified flush, it will not exceed 1/8" (3.2 mm) over the outer most cabinet face and finished end and be parallel with the cabinet face or end within +/- 1/16" (1.6 mm) in any 96" (2440 mm) run of countertop.
12		**BOTTOM OF COUNTERTOP BUILD UP** and/or **SUBTOP / FRONT RAIL / STRETCHER** will be surface flush within 1/16" (1.6 mm), free of glue residue, and sanded or filled smooth with edges eased at knee spaces or cantilevers, and: 
12	1	**BUILD-UP MEMBERS** will be of the same core material as the countertop with backing sheet applied. The use of moisture-resistant core, or a color-coded, water-resistant sealer may be substituted for backing sheet.
13		**EXPOSED EDGES** will be finished and eased. If edges are to be covered, the use of the longest available edging material is required.

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11.6 ASSEMBLY REQUIREMENTS

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14				**METAL TRIM RIMS** (furnished by others) at sinks or self-rimming sinks must overlap the countertop and/or sink by a minimum of 3/16" (4.8 mm).
15				**SPANS** and/or **CANTILEVERS** of countertops may require reinforcement to prevent deflection, see applicable portions of Section 14 (Installation) for minimum requirements.
16				**CANTILEVERS**, with or without a sub-top, will not exceed 12" (305 mm) from a support, whether in the front, back, or end, unless otherwise further qualified herein.
17				**SOLID WOOD** requires:
17	1			**SHOP ASSEMBLED JOINTS** will be fit tight and flush with the use of splines, dowels, loose tenons, or biscuit splines for alignment, securely fastened with draw-bolt-type mechanical fasteners and adhesive.
17	2			**WIDE WIDTH GLUE-UP** of boards exceeding 3" (76 mm) in width be alternately set with crown up and crown down.
17	3			**CURVED** front edges be solid machined, steam bent, bent solid lumber or laminated plies at the option of the manufacturer, in full compliance with all other applicable requirements of these Standards including Section 06.
16	4			**SOLID WOOD EDGES** and **APPLIED MOLDINGS** will be glued, and finish nailed, however at:
17	4	P	**Premium Grade**	They will be splined, biscuit splined, or doweled and pressure glued without the use of fasteners through the exposed face.
18				**VENEERED WOOD** requires:
18	1			**SHOP ASSEMBLED JOINTS** be fit tight and flush with the use of splines, dowels, loose tenons, or biscuit splines for alignment, securely fastened with draw-bolt-type mechanical fasteners and adhesive, and:
18	1	1		Butt joints are not permitted at L-shaped countertops.
18	2			**BUILT-UP MEMBERS** be of required core material with backing sheet applied or use of moisture-resistant core or a color-coded, water-resistant sealer may be substituted for backing sheet.

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11.6 ASSEMBLY REQUIREMENTS

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19	**HPL** requires:			
19	1			**CUTOUTS** have a minimum of 1/8" (3.2 mm) radius at inside corners, with edges subject to moisture sealed with a color-toned (for verification), water-resistant sealer before trim or sink rims are installed.
19	2			**COVED SPLASHES** of 1/4" +/- 1/16" (1/6 mm) radius, requiring a square cove stick the same thickness as the core material with voids filled with glue between the HPL and the cove stick.
19	3			**DRIP GROOVE**, if specified, be a continuous 1/8" x 1/8" (3.2 mm x 3.2 mm) groove 3/8" +/- 1/16" (9.5 mm +/- 1.6 mm) from the front edge, smoothly sanded and sealed with a color-toned (for verification) water-resistant sealer.
19	4			**MITER-FOLD** is permitted.
19	5			**BACKING SHEET** to cover the underside of countertops, the backside of splashes and be the same material for the entire project.
19	6			**LAMINATIONS** to be made securely to the core with moisture resistant adhesive applied as recommended by the adhesive material supplier, and adhesive for solid color core laminate application will conform to material supplier's recommendation.
19	7			**FLAME SPREAD-RATED** countertops require a non-formed HPL edge, screwed-on back splash and adhesive be rigid set with Class A Flame Spread.
19	8			**HPL EDGE** be applied after top laminate, except at:
19	8	**P**	**Premium Grade**	It will be applied before top laminate.
19	9			**L-SHAPED** countertops may be butt jointed except at wood grain or directional pattern which require an approximate 45º diagonal joint.
19	10			**SHOP PREPARED FIELD JOINTS** will be fabricated with splines, biscuits or dowels and draw-bolt-type mechanical fasteners.
19	11			**SHOP ASSEMBLED JOINTS** will be glued and fastened together with splines or dowels and draw-bolt-type mechanical fasteners.

Continued on next page

11.6 ASSEMBLY REQUIREMENTS

Continued from previous page

19 HPL requires (continued)

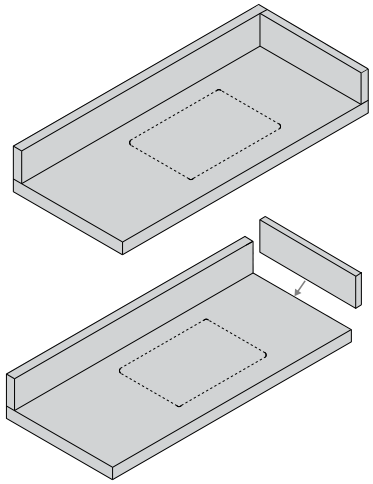
19 12 **ASSEMBLY** of back and end-splash (where indicated on contract documents) requires;
Raw core at joint between the countertop deck and the back / end splash will be sealed before assembly, if not coved.

Back splash (coved or square) will be butt joint applied with mechanical fasteners.

End splash will be attached or sent loose at the manufacturers option.

Back and end splashes, unless coved, will be caulked with clear or compatible color water resistant caulking to leave a visible bead not exceeding 1/8" (3.2 mm).

Scribe allowance will be provided, as appropriate, and un-backed scribe span will not exceed ½" (12.7 mm) at ends and back walls.



19 13 **FINISHED END CAPS** may be applied after top laminate.

19 14 **REMOVABLE COMPONENTS** will be attached with flat-head screws, set flush, and if chemical resistance is required, the screws will be stainless steel.

Continued on next page

11.6 ASSEMBLY REQUIREMENTS

Continued from previous page

20	**SOLID SURFACE** will conform to the material supplier's recommendations, and requires:			
20	1			**MANUFACTURED JOINTS** will be precision-machined and glued with the material supplier's hard seaming material or equal. Silicone is not permitted at joints, except where hot areas meet cold areas.
20	2			**EDGE** detail requires either miter-fold, single drop or build-up of manufacturers' profile choice, a minimum of 1" (25.4 mm) nominal thickness, except at:
20	2	P	**Premium Grade**	A minimum of 1-1/2" (38.1 mm) nominal thickness.
20	3			**COVED** splash is only required when so specified and end splashes will be sent loose without cove.
20	4			**JOINTS AT** L-shaped tops with a grain or pattern appearance will have an approximate 45º diagonal joint, butt joints are not permitted.
20	5			**EXPOSED FINISH** will be the manufacturer's standard matte finish.
20	6			**EXPANSION CLEARANCES** of at least 1/8" (3.2 mm) will be provided.
20	7			**SEALANTS** and/or **ADHESIVES**, as recommended by individual material suppliers, will be used to achieve the best performance and color match.
20	8			**CANTILEVERS,** with or without a sub-top, will not exceed 12" (305 mm) for 3/4" (19.0 mm) or 6" (152 mm) for 1/2" (12.7 mm) thick material, whether in the front, back, or end.
20	9			**VEINED / SWIRLED** solid surface may have random patterns that cannot be matched at seams. Pattern breaks, pattern changes and color variations may occur, and will not be considered a defect in materials or workmanship.
21	**CGS** (Compact Laminate) requires:			
21	1			**FRONT EDGES** be a minimum of 1/2" (12.7 mm) in thickness.
21	2			**JOINTS** will be in accordance with material suppliers' recommendations.
21	3			**EDGE FINISH** will be machined with satin sheen.
21	4			**NO-DRIP / LIPPED EDGE TOPS** will be raised a minimum of 1/4" (6.4 mm) above the work surface; the width of the raised area will be determined by the manufacturer.
21	5			**BACK SPLASHES** will be separate, flat-butted.
21	6			**CANTILEVERS,** with or without a sub-top, will not exceed 18" (457 mm) for 1" (25.4 mm) ,12" (305 mm) for 3/4" (19 mm), or 6" (152 mm) for 1/2" (12.7 mm) thick material, whether in the front, back, or end.

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11.6 ASSEMBLY REQUIREMENTS

Continued from previous page

22	**EPOXY RESIN** requires:	
22	1	**EXPOSED EDGES** be smoothly machined and finished compatible with the top face.
22	2	**NO-DRIP / LIPPED EDGE TOPS** be raised a minimum of 3/16" (4.8 mm) above the work surface, and drip grooves are not required.
22	3	**BACK SPLASHES** will be separate, flat-butted.
22	4	**CANTILEVERS,** with or without a sub-top, will not exceed 12" (305 mm) for 1" (25.4 mm) or 6" (152 mm) for 3/4" (19.0 mm) thick material, whether in the front, back, or end.
23	**NATURAL / ENGINEERED STONE** requires:	
23	1	**EXPOSED EDGES** be finished the same as the top surface.
23	2	**BACK SPLASHES** will be separate, flat-butted.
23	3	**CANTILEVERS,** with or without a sub-top, will not exceed 6" (152 mm) for 2CM (13/16" (20.6 mm)) or 10" (254 mm) for 3CM (1-3/16" (30.2 mm)) thick material, whether in the front, back, or end.
23	4	**VEINED / SWIRLED** natural and engineered stone may have random patterns that cannot be matched at seams. Pattern breaks, pattern changes and color variations may occur, and will not be considered a defect in materials or workmanship.

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END OF SECTION 11

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

HISTORIC RESTORATION WORK

SECTION-12

INCLUDING: **Stripping, Repairs, and Finishing**

12.1 SCOPE

1 Restoration, fabrication, installation, and finishing of all existing and/or new historic architectural woodwork.

2 **INCLUSIONS**, include those delineated within Sections 06 - 11, as applicable.

3 **EXCLUSIONS**, include those delineated within Sections 06 - 11, as applicable.

12.2 SURFACE DEFINITIONS

1 **INCLUDE** those delineated within Sections 06 - 11, as applicable.

12.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED IN THE CONTRACT DOCUMENTS**, all work will match existing and it is the responsibility of the manufacturer to observe the project before bid and match all materials for species, grain, and overall appearance.

12.4 GENERAL REQUIREMENTS

1 **EXCEPTION** - These standards are a guide from which the design professional is free to deviate. When the design professional, as part of the contract documents, deviates from these standards, the contract document takes precedence over the Standards. Such deviations cannot be adjudicated using the Standards as a basis.

2 **EXTERIOR ENVIRONMENTS** and woodwork products for such are not covered by these standards.

3 **INTERIOR, NON CLIMATE CONTROLLED ENVIRONMENTS** are not covered for product joint flushness or gap tolerances of woodwork products in these standards; however, prior to installation, the flushness and/or gap tolerances of woodwork products intended for non-climate controlled environments will meet the test requirements herein.

4 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Product Section 06 through 12, unless a project's contract documents require otherwise.

5 **LUMBER & SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

6 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

6.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is factory finished.

6.2 **FACTORY FINISHING** when specified, requires back of panels and trim to be factory sealed.

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12.4 GENERAL REQUIREMENTS (continued)

7 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

8 **INSTALLATION REQUIREMENTS** are covered under Section 14.

9 **TOLERANCE REQUIREMENTS** are covered under Section 15.

10 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

11 **GRADE** classification is not applicable to this section **b**ecause of the nature of historic woodwork.

12 Historic woodwork restoration, including, repairs, reconstruction, materials, new fabrication, installation, and finishing, will be of a **SINGLE SOURCE RESPONSIBILITY**, except:

12.1 Stripping may be done by a specialty contractor.

Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

12.5 MATERIAL REQUIREMENTS

1	**WOOD** will match the species, grain, general pattern, and cut of existing, similar, and/or adjacent woodwork, and will so be identified by the designer.
2	Will **COMPLY** with **SECTIONS 03 - 11**, as applicable.
3	**MEMBERS** will be of the same profile and dimension as existing; however, they may be glued up to achieve this.
4	**DEFECTS**, either natural or manufactured, will not exceed those permitted by the contract documents.

12.6 ASSEMBLY REQUIREMENTS

1	Will **COMPLY** with **SECTIONS** 06 - 11, as applicable.
2	**MACHINE** new and replacement woodwork to dimensions, profiles, and details to match existing.
3	**EXISTING MOLDINGS**, when handmade and not necessarily uniform in profile, replacement moldings will be profiled to an agreed representative sample.
4	**PLYWOOD BACKING**, if approved, may be used in the fabrication of built up panel assemblies, door and/or window frames, and stacked base trim, provided the exposed profile and configuration matches existing.

12.7 REPAIR REQUIREMENTS

1	**MATCH EXISTING** for recommended methods of repair by governing authorities.
2	At **TRANSPARENT FINISH**, be made with wood of the same species, grade, cut, color tone, and grain pattern.
3	**CARPENTRY METHODS** will be the same as exhibited in the existing work.
4	**EXPOSED FASTENERS** will match existing.
5	**DISSIMILAR METALS** will be isolated from one another.
6	**WOOD PATCHES** of boat, butterfly and/or diamond shape will be used so as to minimize those joint surfaces at 90 degrees to the member's grain direction.

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12.8 STRIPPING REQUIREMENTS

1			**COATING STRIPPERS** will be environmentally approved, and:
2			**BEFORE STRIPPING** procedures begin, all surfaces will be tested (with the process and results recorded) to provide the least intrusive and damaging methods, and approval by the design professional or conservator is required for the selected method, and:
2	1		Heat based methods of coating removal are permitted, provided the recommendations found in the National Park Service - Preservation Brief 10 Exterior Paint Problems on Historic Woodwork are followed or as permitted by the Historic Sites and Monuments Board of Canada.
3			**COMPLETELY REMOVE existing finish** using multiple applications of stripper and hand scrapers without gouging, splintering, or otherwise damaging sound wood.
4			**STRIPPING RESIDUALS** will be thoroughly removed, including wax, and:
4	1		**STRIPPED SURFACES** will be tested for evidence of acid and alkali, and:
4	1	1	All stripped surfaces found not to be pH neutral will be neutralized and retested.
4	1	2	A written summary report, including before and after pH levels, will be submitted to the design professional.
5			**SAND** all surfaces by hand with steel wool and the appropriate grit sandpaper to remove all signs of raised grain.
6			**SEAL** all exposed surfaces with an approved sanding sealer.

12.9 FINISHING REQUIREMENTS

1	Will **COMPLY** with **SECTIONS 5** as modified by the plans and specifications.
2	**REQUIRE** use of applications and techniques best suited to match the existing and/or desired finish.

END OF SECTION 12

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CARE & STORAGE

SECTION - 13

GENERAL

- 13.1 Scope
- 13.2 n/a
- 13.3 n/a
- 13.4 General Requirements

PRODUCT

- 13.5 Care & Storage Requirements

INCLUDING: General, Product and Care / Storage Requirements

13.1 SCOPE

1 Primary governance over Sections 05 - 12 and 14 as may be applicable.

13.2 SURFACE DEFINITIONS

1 n/a

13.3 DEFAULT STIPULATION

1 n/a

13.4 GENERAL REQUIREMENTS

1 **THESE REQUIREMENTS GOVERN** all work covered by **SECTIONS 05** through **12** and **SECTION 14** of these standards unless a project's contract documents require otherwise.

2 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

3 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

3.1 **PRIMING** is not the responsibility of the manufacturer and/or installer, unless the material is furnished pre-finished.

3.2 **FACTORY FINISHING** when specified, requires concealed surfaces be factory sealed.

4 **INSTALLATION REQUIREMENTS** are established within Sections 14.

5 **TOLERANCE REQUIREMENTS** are established within Sections 15.

6 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

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13.4 GENERAL REQUIREMENTS (continued)

7 **CUSTOM GRADE** is the primary quality characterized herein and adequately covers most high quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation. **PREMIUM GRADE** however, may be specified for use in those areas of a project where the highest level of quality, materials, workmanship, and installation is required, or be mixed within a single project creating limitless design possibilities with a wide variety of lumber / veneer species, TFL, HPL, factory finishes, and profiles.

8 **PREMIUM GRADE** requirements are provided as an exception and highlighted in separate table rows colored in gold.

9 **DIMENSIONAL CHANGE** in wood products resulting from **IMPROPER DESIGN, IMPROPER RELATIVE HUMIDITY EXPOSURE** during site storage and installation**,** and/or **HUMIDITY EXTREMES** after occupancy **ARE NOT THE RESPONSIBILITY OF THE ARCHITECTURAL WOODWORKER**.

10 **OFF GAS REDUCTION** by raising the temperature in a building for a sustained period is unacceptable and will negatively affect the appearance and performance of architectural woodwork. Open joints, warped paneling / doors, and other defects caused by such are not to be considered a defect.

11 **SEVERE DAMAGE** to woodwork can result from noncompliance to **CARE & STORAGE REQUIREMENTS** and the **MANUFACTURER / INSTALLER** will not be held responsible for any damage that might develop by not adhering to the requirements.

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Important:
Section 02 (Fundamental Requirements), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

13.5 CARE / STORAGE REQUIREMENTS

1 **THESE REQUIREMENTS GOVERN** over all work covered by **SECTIONS 05 THROUGH 14** of these standards **UNLESS A PROJECT'S CONTRACT DOCUMENTS REQUIRE OTHERWISE,** and:

CLIMATE-CONTROLLED areas will be maintained with an operational HVAC system, and relative humidity meeting the range appropriate for the region as follows:

Geographical Location	Optimum Moisture Content	Optimum Relative Humidity
Most of U.S. and Canada	5-10%	25-55%
Damp Southern Coastal areas of the U.S. and Canadian Eastern Coastal Provinces	8-13%	43-70%
Dry Southwestern U.S.	4-9%	20-50%
Alberta, Saskatchewan, and Manitoba in Canada	4-9%	20-50%

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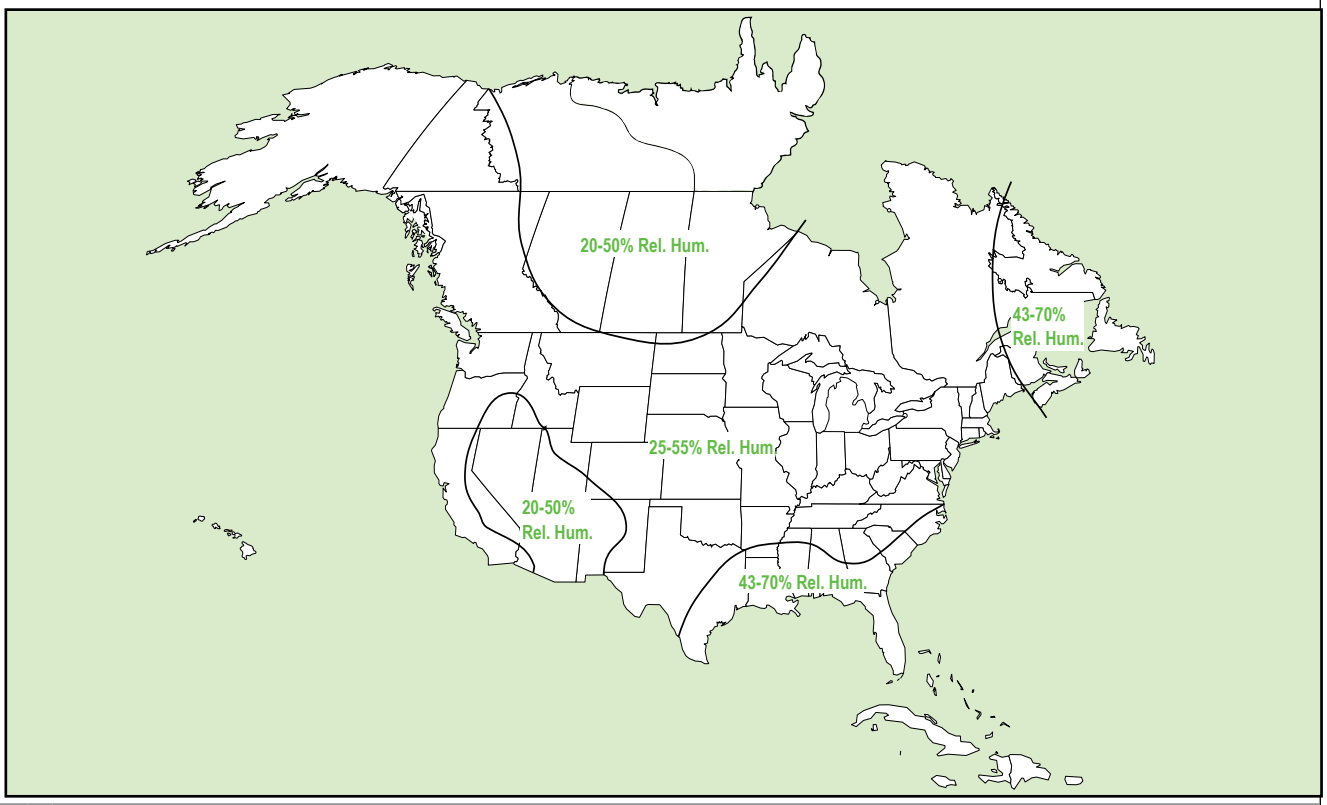

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13.5 CARE / STORAGE REQUIREMENTS

Continued from previous page

1	**THESE REQUIREMENTS GOVERN** (continued)			
1	2			**DELIVERY** will be made in accordance with a progress schedule furnished by the contractor, and in an area in which wet work is dry, overhead work is complete, and area is broom clean.
1	3			**HANDLING** will be with clean hands or gloves and include protection from marks or damage.
1	4			**STORAGE** will be flat on a level, clean surface; off the floor or ground; protected from sunlight, wide swings in relative humidity, abnormal heat or cold, and/or moisture.
1	5			**INSTALLATION** will only occur after materials have been acclimatized for a minimum of 72 hours in climate-controlled site condition between 60 - 90 degrees Fahrenheit (15.5 - 32 degrees Celsius) inclusive that meet the optimum moisture content and relative humidity requirements of this Section.
1	6			**AFTER INSTALLATION,** woodwork will be maintained in the same environmental conditions as during its storage and/or installation, and temperature and humidity in a building or area of a building will not be raised or lowered for a sustained period (more than 24 hours) for any reason as it may negatively affect the appearance and performance of architectural woodwork.
1	7			**SEVERE DAMAGE**, such as warpage, open joints, raised grain, checking, cracking, swelling, dimensional change and delamination of laminated wood products can result from variable rates of expansion and contraction when not adhering to the above requirements, Fabricator / Installer will not be held responsible for the damage caused by not adhering to above.
1	8			**SUBSEQUENT DIMENSIONAL CHANGE** and/or **MOISTURE DAMAGE** in wood products is not the responsibility of the manufacturer and/or installer, specifically:
1	8	1		Responsibility for dimensional change or moisture damage problems in wood products resulting from design rests with the designer / architect / specifier.
1	8	2		Responsibility for dimensional change or moisture damage problems in wood products resulting from improper relative humidity exposure during site storage and installation rests with the general contractor.
1	8	3		Responsibility for dimensional change or moisture damage problems in wood products resulting from humidity extremes after occupancy rests with engineering and maintenance.

END OF SECTION 13

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

INSTALLATION

SECTION-14

INCLUDING: **Installation of all architectural woodwork**

14.1 SCOPE

1 Installation of Architectural woodwork, Stairwork and Rails, Wall / Ceiling Surfacing and Partitions, Wood Passage Doors, Casework, Countertops, and Historic Restoration Work covered under the scope of these standards.

14.2 SURFACE DEFINITIONS

1 n/a

14.3 DEFAULT STIPULATION

1 n/a

14.4 GENERAL REQUIREMENTS

1 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with specific requirements within Product Sections 06 through 12, unless a project's contract documents require otherwise.

2 **LUMBER** & **SHEET PRODUCT COMPONENT REQUIREMENTS** used within the woodwork product sections are established by Sections 03 and 04, unless otherwise modified herein.

3 **FINISHING** requirements for the woodwork product sections are established by Sections 05, unless otherwise modified herein, and:

3.1 **PRIMING** or **SEALING** is not the responsibility of the manufacturer and/or installer, unless the material is furnished pre-finished.

3.2 **FACTORY FINISHING** when specified, requires backs of panels and trim to be factory sealed.

4 **CARE** and **STORAGE REQUIREMENTS** are covered under Section 13.

5 **TOLERANCE REQUIREMENTS** are covered under Section 15.

6 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

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14.4 GENERAL REQUIREMENTS (continued)

7 **CONTRACTOR IS RESPONSIBLE FOR:**

7.1 **STRUCTURAL MEMBERS**, grounds, in wall blocking, backing, furring, brackets, or other anchorage required for architectural woodwork installation that becomes an integral part of walls, floors, or ceilings to which architectural woodwork will be installed, and:

7.1.1 In the absence of contract documents calling for the contractor to supply the necessary in wall blocking / backing in the wall or ceilings, either through inadvertence or otherwise, the architectural woodwork installer will not proceed with the installation until such time as the in wall blocking / backing is installed by others.

7.2 **PREPARATORY WORK** done by others (subject to inspection by the architectural woodwork installer), will be accepted or rejected for cause prior to installation, and:

7.2.1 **WALL, CEILING**, and/or **OPENING VARIATIONS** in excess of 1/4" (6.4 mm), or **FLOORS** in excess of 1/2" (12.7 mm) in 144" (3658 mm), of being plumb, level, flat, straight, square, or of the correct size are not acceptable for the installation of architectural woodwork, nor is it the responsibility of the installer to scribe or fit to gap tolerances in excess of such.

7.3 **INSTALLATION SITE** being properly ventilated, protected from direct sunlight, excessive heat and/or moisture, and that the HVAC system is functioning and maintaining the appropriate relative humidity and temperature per Section 13.

7.4 **SITE ACCESS** being safe to prevent injury to installers or damage to Architectural Woodwork.

7.5 **PRIMING** of architectural woodwork in accordance with the contract documents prior to its installation; except, if the architectural woodwork is factory finished; priming by the factory finisher is required.

8 **INSTALLER IS RESPONSIBLE FOR:**

8.1 **HAVING ADEQUATE EQUIPMENT** and experienced craftsmen to complete the installation in a first-class manner.

8.2 **CHECKING ARCHITECTURAL WOODWORK** specified and studying the appropriate portions of the contract documents, including these standards and the reviewed shop drawings to familiarize themselves with the requirements of the Grade specified, understanding that appearance requirements of Grades apply only to surfaces visible after installation.

8.3 **COLOR** and **GRAIN COMPLIANCE** of the various transparent finished woodwork pieces to ensure they are installed in compliance with the Grade specified.

8.4 **SITE VERIFICATION** to assure it is properly ventilated; protected from direct sunlight, excessive heat and/or moisture; that the HVAC system is functioning and maintaining the appropriate relative humidity and temperature; and that required priming of woodwork has been completed by others before woodwork is installed, and:

8.4.1 Notify the contractor of any variances or omissions that the contractor is responsible for.

8.5 **WOODWORK ACCLIMATION** to assure that woodwork has been acclimatized to the field conditions for a minimum of 72 hours before installation is commenced.

8.6 **SEQUENCE INSTALLATION** of woodwork specifically built or assembled in sequence for match of color and grain is installed to maintain that same sequence.

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14.4 GENERAL REQUIREMENTS (continued)

9 **AESTHETIC REQUIREMENTS** only apply to surfaces visible after fabrication and installation, under building operational lighting conditions, judged from a normal viewing stance and are considered compliant if inconspicuous when viewed from 48" (1220 mm), except at **PREMIUM GRADE** it shall be viewed from 24" (610 mm).

10 **GLUE** and filler residue is not permitted on exposed faces.

11 **EQUIPMENT CUTOUTS**, including electrical and plumbing, will be cut out by the installer, provided needed templates are furnished prior to installation. They will be neatly cut and properly sized and in **HPL** or **SOLID SURFACE** will have a minimum 1/4" (6.4 mm) radius at inside corners. Specific equipment cutouts will be located and marked out by the third-party supplier.

12 **HARDWARE** will be installed per material supplier's instructions and adjusted for smooth operation within limits of the specified hardware, using all required fasteners and fasteners' provisions including appropriate countersunk fasteners suited to hardware preparations.

13 **PRODUCTS** will be installed per specifications and/or manufacturer's instructions, and be:

13.1 Securely fastened and tightly fitted with flush joints, installed plumb, level, square, and flat within 1/8" (3.2 mm) in 96" (2440 mm), including grounds and hanging system, and as applicable, joinery will be consistent throughout the project, trim of maximum available and/or practical lengths and trimmed equally from both sides when fitted for width.

13.2 Free of Warp, twisting, cupping, and/or bowing (that cannot be held true), open joints, visible machine marks, cross sanding, tear outs, nicks, chips, and/or scratches, natural defects exceeding the quantity and/or size limits defined in Sections 03 & 04.

13.3 In conformance to Section 15's **KCPI** and **SANDED SMOOTHNESS** tests.

14 **FASTENING** and **FASTENERS** will include the use of construction adhesive, finish nails, trim screws, pins and/or staples (provided staple crown does not exceed 3/16" (4.8 mm)), prohibits use of drywall or bugle head screws, and, et:

14.1 Exposed fastening at HPL and TFL, Solid Surface, CGS (Compact Laminate) or Natural / Manufactured Stone is prohibited, except at removable panels or where decorative fasteners are specified.

14.2 Allowable fastener holes, at:

14.2.1 Pre-finished materials to be filled by the installer with matching filler furnished by the manufacturer.

14.2.2 Unfinished or primed materials to be filled by the paint contractor or others.

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14.4 GENERAL REQUIREMENTS (continued)

15 **FIELD JOINERY** and their workmanship, such as smoothness, gaps, flushness, flatness, etc. will be judged by the tests methods and allowable tolerances for the applicable grade established within Section 15 (Tolerances):

15.1 **GAPS** at field joints will not be considered a defect or the responsibility of the installer if caused by excessive deviations in the building's walls and ceilings being in excess of 1/4" (6.4 mm) in 144" (3658 mm) of being plumb, level, flat, straight, square, or of the correct size, or 1/2" (12.7 mm) for floors.

15.2 A Chip Out

15.3 B Overlap

15.4 C Over Machined

15.5 D Show-Through / Telegraphing

15.6 E Squareness of Panel

15.7 F Flatness of Panel / Door

15.8 G Flushness, Fabrication

15.9 H Flushness, Installation

15.10 I Flushness at Butted Edges

15.11 J-1 Flushness at Adjoining Fixed Panels

15.12 J-2 Flushness at Adjoining Casework Doors, Drawers and False Fronts

15.13 K Reveals at Adjoining Panels / Doors

15.14 L Gaps at Butted Surface Edges in Same Core Member

15.15 M Gaps at Mitered or Butted Surfaces

15.16 N Gaps at Mitered or Butted Edges

15.17 O Gaps at Parallel Members

15.18 P Gaps at Installation

15.19 Q Gaps / Reveals at Cabinet Door / Drawers

15.20 R Edge Alignment at Cabinet Door / Drawers

16 **FABRICATION** and **MODIFICATIONS** will comply to the general, material, machining, and assembly requirements within the **PRODUCT** portion of each applicable section and, if applicable, the finishing requirements in Section 05.

17 **AREAS** of **INSTALLATION** will be left broom clean, with debris removed and dumped in containers provided by the contractor. Items installed will be cleaned of pencil or ink marks, tape or adhesive residue.

18 **FIRST CLASS WORKMANSHIP COMPLIANCE IS ALWAYS REQUIRED WITHIN THESE STANDARDS.**

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Important:
Section 02 (Fundamental Requirements), Section 13 (Care & Storage), and Section 15 (Tolerances) are primary to and work in conjunction with the requirements within this Section.

14.5 SECTION 05 (Finishing) - APPLICATION REQUIREMENTS

1	**TOUCH UP** of:	
1	**1**	**FACTORY FINISHED** materials are the responsibility of the installation contractor.
1	**2**	**JOBSITE FINISHED** materials are the responsibility of the finishing contractor.

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14.6 SECTION 06 (Millwork) - INSTALLATION REQUIREMENTS

1	**EXPOSED FASTENERS** to be countersunk, set in quirks and reliefs where possible and be inconspicuous when viewed at 48" (1220 mm), except at"			
1	P	**Premium Grade**	Fasteners will be inconspicuous when viewed at 24" (610 mm)	
2	**JOINERY** requires S4S trim to be mitered, and profiled at:			
2	1	Inside corners be mitered and glued, except at:		
2	1	P	**Premium Grade**	They will be coped and glued.
2	2	Outside corners will be mitered and glued.		
2	3	Ends when exposed be profiled or self-mitered and glued, except at:		
2	3	P	**Premium Grade**	They will be self-mitered and glued.
3	**STANDING** and **RUNNING TRIM** requires:			
3	1	Running joints be scarf or butted; if butted must use a dowel, biscuit spline or spline.		
3	2	Running joints on multimember trim will be staggered a minimum of 24" (610 mm) from adjacent members.		
3	3	Base be scribed to the floor, only if so specified; however, if not scribed it will be caulked.		
3	4	Multiple joints in running trim will not be within 36" (914 mm) of each other (including ends or corners), except at:		
3	4	P	**Premium Grade**	They will not be within 48" (1220 mm).
3	5	Scribing at flat surfaces, and at:		
3	5	P	**Premium Grade**	Profiled surfaces will also be scribed.
4	**CLOSET RODS** will be supported at a maximum of 48" (1220 mm) on center.			
5	**DOOR** and **WINDOW FRAMES** will have rough wood bucks secured at openings, allow horns to be removed before installation, be installed per the manufacturers' basic instructions, seated on the floor, set plumb, and securely fastened through shims into the framing, and:			
5	1	Not permit pre-hung and pre-cased door / jamb assemblies that are fastened only through the casing.		
5	2	Have Legs set square with header and parallel to each other within 1/8" (3.2 mm), except at:		
5	2	P	**Premium Grade**	They will be within 1/16" (1.6 mm).
6	**ORNAMENTAL MILLWORK** requires exposed surface scribed to the wall with 1/8" (3.2 mm) maximum gap, except at:			
6	P	**Premium Grade**	Will be 1/16" (1.6 mm) maximum gap.	

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14.7 SECTION 07 (Stairwork & Rails) - INSTALLATION REQUIREMENTS

1	**EXPOSED FASTENERS** to be countersunk, set in quirks and reliefs where possible and be inconspicuous when viewed at 48" (1220 mm), except at:		
1	P	**Premium Grade**	They will be inconspicuous when viewed at 24" (610 mm)
2	**JOINERY** requires trim be coped at inside corners, except S4S will be mitered, profiled or self-mitered when trim ends are exposed, and scribed at flat surfaces, except at:		
2	P	**Premium Grade**	Joinery will be self-mitered when trim ends are exposed, scribed at both flat and shaped surfaces, and splined, doweled or biscuited when miters are over 4" (102 mm) long.

14.8 SECTION 08 (Wall/Ceiling Surfacing & Partitions) - INSTALLATION REQUIREMENTS

1	**MECHANICAL FASTENERS** are required at wall panels installed at 108" (2743 mm) or more above finished floor, and ceiling panels regardless of height.		
2	**CONCEALED FASTENING** is required wherever possible at wall / Ceiling surfacing and partitions. Use of **FURRING / HANGING SYSTEMS** (which are in accordance with applicable codes and regulations) are acceptable for blind installation and a maximum of 3/4" (19.0 mm) reveal is permitted at the top of panels to allow installation clearance for the panel.		
3	**EXPOSED FASTENERS** to be countersunk, set in quirks and reliefs where possible, be inconspicuous when viewed at 48" (1220 mm), and permits use of finish nails, except at:		
3	P	**Premium Grade**	They will be inconspicuous when viewed at 24" (610 mm), and permit use of pins and/or construction adhesive.
4	**JOINERY** requires trim be coped at inside corners, except S4S will be mitered, profiled or self-mitered when trim ends are exposed, and scribed at flat surfaces, except at:		
4	P	**Premium Grade**	Joinery will be self-mitered when trim ends are exposed, scribed at both flat and shaped surfaces, and splined, doweled or biscuited when miters are over 4" (102 mm) long.
5	**REVEAL STRIPS** that are grooved into paneling are to be allowed to expand and contract in reaction to changing relative humidity.		
6	**EXPANSION JOINTS** will be provided equivalent to 1/8" (3.2 mm) per 48" (1220 mm) of linear elevation, and:		
6	1	The minimum reveal gap between panels will be calculated as the length of the panel times 0.002 for particleboard core and 0.0015 for medium density fiberboard (MDF) core.	
7	**PANELING** will be furred and installed plumb within 1/16" (1.6 mm) in 96" (2440 mm), in such a way as to avoid deflection when normal pressure is applied, while free of warp exceeding at 3/64" (1.2 mm) per linear 12" (305 mm),except at:		
7	P	**Premium Grade**	It will be free of warp exceeding 1/32" (0.8 mm) per linear 12" (305 mm).

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14.8 SECTION 08 (Wall/Ceiling Surfacing & Partitions) - INSTALLATION REQUIREMENTS

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8	**VENEER** surfacing requires edges of core that are not veneer edged have one of coat sealer applied before installation, and veneer **JOINTS** will be plumb within 3/16" (4.8 mm) **LOSS** at side, between sequenced adjacent panels will not exceed: 1-1/2" (38.1 mm) **LOSS** at end, between sequenced adjacent panels at end match will not exceed: 2" (50.8 mm) **END MATCH ALIGNMENT,** between sequenced adjacent panels will not exceed: 3/8" (9.5 mm) Except at:				
8	**P**	**Premium Grade**		**JOINTS** will be plumb within 1/8" (3.2 mm) **LOSS** at side, will not exceed 1" (25.4 mm) **LOSS** at end, will not exceed 1-1/2" (38.1 mm). **END MATCH ALIGNMENT,** will not exceed 3/16" (4.8 mm).
8	**1**	**FIGURE** and/or **HEART PROGRESSION** will be uniform and natural between adjacent sequenced panels and not exceed 1" (25.4 mm), except at:		
8	1	**P**	**Premium Grade**	It will not exceed 1/2" (12.7 mm).
8	1	**1**	Doors and other components that adjoin at blueprint panels, where progression will not exceed 2" (50.8 mm), except at:	
8	1	1	**P** **Premium Grade**	It will not exceed 1-1/2" (38.1 mm).
9	**SOLID WOOD** surfacing requires field joints to be factory prepared to the greatest extent possible with feature strips and joint trim furnished oversize, where possible.			
10	**HPL and TFL** surfacing requires:			
10	**1**	**EDGES** of core that are not HPL edged have one coat sealer applied before installation.		
10	**2**	**PATTERN LINES** be plumb, within 3/16" (4.8 mm), except at:		
10	2	**P**	**Premium Grade**	They will be within 1/8" (3.2 mm).

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14.8 SECTION 08 (Wall/Ceiling Surfacing & Partitions) - INSTALLATION REQUIREMENTS

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11	**SOLID SURFACE** surfacing requires installation over suitable cores based on the material supplier's recommendations, and:				
11	**1**	**SEALANTS** and **ADHESIVES** compatible with the individual material supplier's recommendations or sealants specially developed to achieve the best color match.			
11	**2**	**EXPANSION** joints will be furnished where required by building design or material supplier recommendations.			
11	**3**	**FIELD SEAMS** between panels and at outside corners will be hard seamed with the material supplier's hard seaming material or equal, watertight and gap free. Joints may be butt-jointed, lapped or V-grooved per material supplier's instructions. There may be a visual break at patterned or veined materials. Soft seaming is permitted at building expansion joints, inside corners, and when abutting other materials, using color-coordinated 100% Silicone sealant with minimum 50% movement capability. Soft seams with or without battens are also permitted where required by material suppliers maximum wall length limitations for the installation environment. Soft seams shall not exceed ⅛" (3.2 mm) in width (¼" (6.4 mm) at building expansion joints). Thermoformed, V-Coved, or other corner details must be so specified. Gaps at ceiling transitions shall be minimum ⅛" (3.2 mm) using color-coordinated silicone, and:			
11	3	1	Hard seams shall not be visibly noticeable when viewed from 48" (1220 mm), except at:		
11	3	1	**P**	**Premium Grade**	Hard Seams will be inconspicuous when viewed at 24" (610 mm).
11	**4**	**VEINED / SWIRLED** solid surface may have random patterns that cannot be matched at seams. Pattern breaks, changes and color variations may occur, and will not be considered a defect in materials or workmanship.			
12	**CGS** (Compact Laminate) surfacing requires:				
12	**1**	**SEALANTS** and **ADHESIVES** compatible with the individual material supplier's recommendations or sealants specially developed to achieve the best color match.			
12	**2**	**VERTICAL SURFACING** will be installed over suitable cores based on the material supplier's recommendations.			
12	**3**	**EXPANSION CLEARANCE** is required of at least 3/32" (2.4 mm) for every 120" (3048 mm) in length.			
12	**4**	**CAULKED JOINTS** will be approximately 1/8" (3.2 mm) wide to allow satisfactory caulking penetration and expansion.			
12	**5**	**CONCEALED FASTENING,** approved by material supplier and design authority, will be used and a maximum 3/4" (19.0 mm) reveal is permitted at the top of panels either under casework or at ceiling to facilitate such.			

14.9 SECTION 09 (Passage Doors)- INSTALLATION REQUIREMENTS

1		**INSTALLERS** will be furnished with approved hardware schedule and required templates, and metal frame shop drawings, including the locations of the hardware preparations.
2		**PRE-FIT** and **PRE-MACHINED** doors are to be installed in accordance with the material supplier's data.
3		**UTILITY** or **STRUCTURAL STRENGTH** of doors will not be impaired in fitting them to the opening, applying hardware, preparing for lights, louvers, plant-ons, or other detailing.
4		**FIRE DOOR ASSEMBLIES**, including 20, 30, 45, 60, and 90 minute rated, will be prepared for locks, latches, hinges, remotely operated or monitored hardware, concealed closers, glass lights, vision panels, louvers, astragals, HPL and TFL in conformance to the material supplier's Label Service requirements, and labels are prohibited from being removed.
5		**DOORS** and their **ACCESSORIES** will be hung plumb and level within 1/16" (1.6 mm) of the height and width of the door assembly.
6		**WHEN INSTALLED**, doors will operate smoothly and easily without binding, and pairs of doors, when closed, will be within 1/16" (1.6 mm) of flush at the meeting edge.
7		Door **FACES** will not extend more than 1/16" (1.6 mm) beyond the face of the jamb or 1/8" (3.2 mm) behind the face of the jamb of the jamb unless utilizing pivot or offset hinges.
8		**FITTING** for:
8	1	**WIDTH** requires the door to be trimmed equally from both sides; however, on **FIRE RATED DOORS**, in order to preserve the label, they will be trimmed per the material supplier's requirements.
8	2	**HEIGHT** prohibits trimming top or bottom rails more than 3/4" (19.0 mm), and **FIRE RATED DOORS** will be trimmed on the bottom rail only.
8	3	Doors which are trimmed will maintain bevel of 3 degrees unless otherwise indicated by hardware requirements.
9		**CLEARANCE** between the door and frame members (except at fire rated doors where applicable codes apply) will be a maximum of 1/8" (3.2 mm) on the hinge and lock sides, the top of the door, and between the meeting edges of doors in pairs, and:
9	1	Installer will not be responsible for clearances in excess of these dimensions if the door manufacturer made an error on pre-fit widths or locations for mortise hardware.
9	2	Clearance at the bottom of fire rated doors will conform to NFPA 80 and at non-rated doors will be a minimum of 1/4" and a maximum of 5/8" measured from the bottom of the door to the highest point of the finish floor that the door swings over.
10		**HARDWARE** will be installed in the locations and by methods of attachment appropriate for the specific door construction so that it operates as intended, and:
10	1	Templates for specific hardware preparation and installation are typically available from the material supplier.
10	2	Installed using pilot holes and furnished fasteners or fastener provisions and when fastener provisions are countersunk, fasteners will be countersunk.
10	3	With appropriate provided fasteners (fully threaded) on non-rated and fire rated doors.

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14.9 SECTION 09 (Passage Doors)- INSTALLATION REQUIREMENTS

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11	**LEAF HINGES** on:			
11	**1**	**SOLID CORE** doors require:		
11	1	**1**	A minimum of two hinges for doors up to 60" (1524 mm) in height with an additional hinge for each additional 30" (762 mm) or portion thereof in door height, and space between hinges will be equal.	
11	**2**	**HOLLOW CORE** doors weighing less than 50 lbs. (22.7 kg) and not exceeding 90" (2286 mm) in height only require two hinges.		
12	**CUTOUTS** for lights or louvers, if applicable, will be protected from water entering the door core by a satisfactory method such as metal flashing at the bottom of the cutout.			
13	**APPLIED TRIM** will:			
13	**1**	Be **MITERED** at outside corners, and **EXPOSED ENDS** will be profiled or self-mitered **INSIDE CORNERS** will be mitered except at:		
13	1	**P**	**Premium Grade**	**EXPOSED ENDS** will be self-mitered. **INSIDE CORNERS** will be coped.

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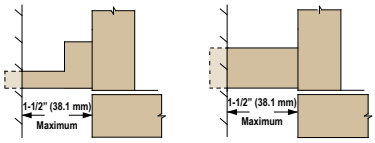
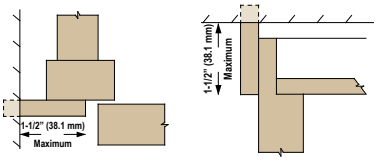
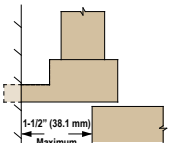
14.10 SECTION 10 (Casework) - INSTALLATION REQUIREMENTS

1				**GAPS, EDGE ALIGNMENT** and **FLUSHNESS** of doors and drawers will be uniform and within the tolerances set forth in the Product portion of Section 10, and:
1	1			Door and drawer fronts will align vertically and horizontally, and:
1	1	1		Be flush (on the same plane) to one another.
1	1	2		Adjustments within manufacturers hardware tolerances are the responsibility of the installer.
2				**FREESTANDING** end panels will be securely installed, and at:
2	P		**Premium Grade**	They will be installed with concealed fasteners / hardware.
3				**SCRIBE MATERIAL** will be **FURNISHED** by the manufacturer where cabinets contact finished walls or ceiling, matching the exposed surfaces, and:
3	1			Where scribing is required at both ends of a cabinet run, it will utilize the same type of scribing at each end and be uniform in scribing width not to exceed 20% in variance.
3	2			Be furnished in maximum available lengths, joints not allowed in material less than 96" (2440 mm).
3	3			Allow **COLOR COMPATIBLE CAULKING** not to exceed 1/8" (3.2 mm).
3	4			**SCRIBE FILLERS** will not exceed 1-1/2" (38.1 mm) in width, except Inside corners where two elevations of casework meet will be equal in width, and not to exceed a maximum of 3" in width unless required for hardware clearance during operation. 
3	5			**SCRIBE MOLDS** will not exceed 1-1/2" (38.1 mm) in width, with end joints beveled and exposed corners mitered or coped, except at: 
3	5	P	**Premium Grade**	Scribe molds are not allowed.
3	6			**SCRIBE ALLOWANCE** will not exceed 1-1/2" (38.1 mm) in width. 
3	7			**SOFFIT** or **FASCIA PANELS are** to be furnished in maximum available lengths, joints are not allowed in material less than 95-1/2" (2426 mm) at horizontal grain or directional pattern and 47-1/2" (1207 mm) at vertical grain or directional pattern, and will:
3	7	1		Be a minimum of 3/4" (19.0 mm) in thickness.
3	7	2		Have grain direction (if any) run vertically, or be of manufacturer's choice if less than, 12" (305 mm) tall, except at:
3	7	2	P **Premium Grade**	Larger than 1-1/2" (38.1 mm) tall.
3	8			At tall and wall hung cabinets, closure panels will be provided at top and bottom voids.
3	9			Allowable gap at the back-bottom edge of wall hung cabinets will not exceed 1/4" (6.4 mm) and, when scribing is necessary, the use of a separate scribe mold is permitted:

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14.10 SECTION 10 (Casework) - INSTALLATION REQUIREMENTS

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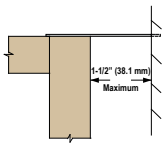
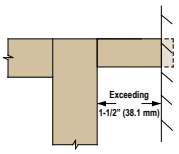
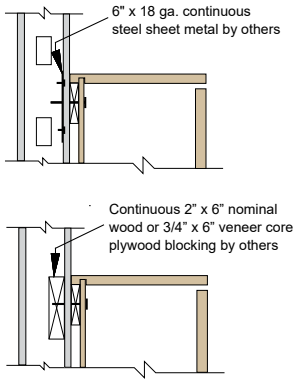
4		**CLOSURE** provision is required at voids or open spaces between cabinets and walls, such as at the top of tall and upper cabinets and the bottom of upper cabinets caused by scribing or angle turns, and:
4	1	At non-visible voids, 1-1/2" (38.1 mm) or less in width, a piece of VGP-HPL may be used as a closure cap. 
4	2	At non-visible voids, exceeding 1-1/2" (38.1 mm) in width, a minimum 3/4" (19.0 mm) closure filler will be provided of manufacturer's choice. 
4	3	At visible voids, a minimum 3/4" (19.0 mm) closure filler will be provided matching the adjacent surface.
5		**CASEWORK WALL ANCHORAGE**, except for peninsula / island or base casework with mechanical spacing allowances (because of the need to be engineered on an individual basis), requires:
5	1	**CONTINUOUS IN WALL BLOCKING** or **BACKING** of at least 2" x 6" (50.8 mm x 152 mm) nominal wood, 3/4" x 6" (19 mm x 152 mm) veneer core plywood or 6" x 18-gauge (152 mm x 1.2 mm) steel sheet metal, installed by others, be located in all wood or metal stud walls as shown below: 

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14.10 SECTION 10 (Casework) - INSTALLATION REQUIREMENTS

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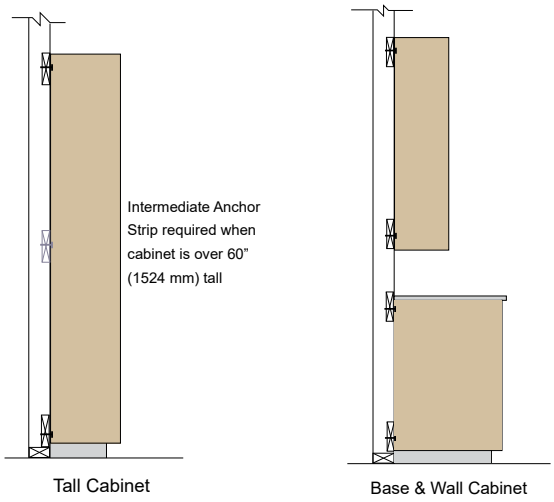
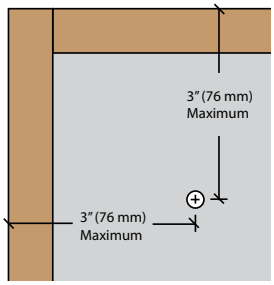
5	**CASEWORK WALL ANCHORAGE** (continued)			
5	2	**MANUFACTURER** to provide appropriate location layouts on their shop drawings for in wall blocking or backing for all tall, base, and wall hung casework for both top and bottom runs of fasteners, as shown below:		
5	3	**ADJACENT** cabinet units are to be fastened together at the front with a minimum of two # 8 (0.164" (4.1 mm)) x 1-1/4" (31.8 mm) flat, oval, pan head screws or binder head sex bolts, a maximum of 30" (762 mm) on center, and at exposed interior surfaces, cover caps of compatible color to interior are required.		
5	4	**ANCHORAGE FASTENERS** (at **NON-SEISMIC** installations) are to be neatly installed through the back and anchor strip (if applicable), at the top and bottom at each cabinet body, and at the intermediate height of cabinets over 60" (1524 mm) tall, and:		
5	4	1	**EACH CABINET UNIT** or undivided span will have a minimum of four anchorage fasteners; two at the top and two at the bottom, subject to them being horizontally and vertically within 3" (76 mm) of the outside end, top or bottom of the cabinet unit and equally spaced, at a maximum horizontal spacing of 16" (406 mm) on center, except at wall cabinet units over 48" (1220 mm) in height it will be 12" (305 mm) on center.	
5	4	2	Fasteners will be a minimum of 3" (76 mm) x #10 (0.190" (4.8 mm)) diameter screw with a surface bearing head, and:	
5	4	2	1	Will achieve a minimum penetration of 1" (25.4 mm) into solid wood wall studs and/or solid wood / plywood in wall blocking.
5	4	2	2	Will achieve a minimum penetration of three full screw threads extending beyond steel wall studs and minimum 18-gauge steel in wall blocking.
5	4	2	3	**CONCRETE** or **MASONRY BLOCK WALL** (CMU) grouted solid **WALLS** fasteners will be minimum #10 concrete screw with surface bearing head, with minimum 2" (50.8 mm) embedment.





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SUGGESTION

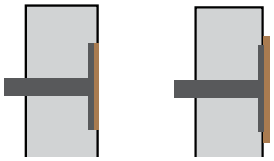
RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

14.10 SECTION 10 (Casework) - INSTALLATION REQUIREMENTS

Continued from previous page

5	**CASEWORK WALL ANCHORAGE** (continued)				
5	4	**ANCHORAGE FASTENERS** (at **NON-SEISMIC** installations) (continued)			
5	4	3	At Exposed Interior surfaces, exposed screw heads will be painted or covered with caps / covers of compatible color to interior surface, and:		
5	4	3	1	Use of specialty installation screws intended for flush or recessed set with matching adhesive backed covers may be used at:	
5	4	3	1	1	Minimum 1/4" (6.4 mm) thick backs when the head is drawn tight to the back surface; however, not recessed into the back. 
5	4	3	1	2	Minimum 1/2' (12.7 mm) thick backs with the head recessed a maximum of 1/8" (3.2 mm) into the back surface to facilitate surface or flush mounting of the cover. 
5	4	4	Does **NOT** allow use of drywall, tapered or bugle head screws.		
5	4	5	Locking hanging cleats, or other concealed method of installation may be used, provided it has been independently tested to show compliance to the NAAWS Casework Evaluation Tests 10.01 (Fabrication Joinery) as shown and qualified in the **APPENDIX**.		
5	5	Bases or toes are not required to be anchored to the floor; however:			
5	5	1	Separate bases or toes are required to be mechanically fastened in the field to the cabinet bottom with flat head screws set flush or slightly recessed, to prevent their movement, and screw heads in cabinet bottoms, where exposed, will be covered with color compatible adhesive caps.		

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14.10 - A - ADDITIONAL GENERAL SEISMIC REQUIREMENTS

1 **CAUTION** - It is the user's responsibility to confirm compatibility, acceptability and scope of these seismic engineered installation standards. The Sponsor Associations will not be responsible to anyone for the use of or reliance upon these standards, nor will they incur any obligation nor liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon these standards.

2 These engineered seismic casework installation standards are based on the Woodwork Institutes Pre-Approvals of 2010 (for base, peninsula and mechanical chase base cabinets) and 2020 (for tall storage and wall cabinets) California Building Code (CBC) requirements for use in California (approved by the California Office of Statewide Health Planning and Development (OSHPD) and/or accepted by California Division of State Architecture (DSA)); however, may also be adequate for use in other areas that base their requirements on the International Building Code (IBC). This engineering is applicable for the installation of casework in building structures:

2.1 At any height within the building where z/h <= 1.0.

2.2 Where the S_{DS} is not greater than 1.93 for base, peninsula and mechanical chase cabinets or 2.0 for wall and tall storage cabinets, and includes:

2.3 At concrete or concrete masonry unit (CMU) wall construction when grouted solid.

2.4 At wood or metal stud wall construction with either continuous 3 x 6 (76 mm x 152 mm) or 16 gauge in wall blocking respectively, with one or two layers of 5/8" (15.9 mm) sheetrock.

2.5 Where Casework construction is of plywood, particleboard, MDF or CGS (Compact Laminate) core and in compliance with the minimum requirements of the North American Architectural Woodwork Standards (NAAWS), including:

2.5.1 Base cabinets, up to 36" (914 mm) tall x 24" (610 mm) body depth x 48" (1220 mm) wide, including peninsula and those with mechanical chase.

2.5.2 Wall cabinets up to 48" (1220 mm) tall x 18" (457 mm) body depth x 48" (1220 mm) wide.

2.5.3 Tall storage cabinets up to 96" (2440 mm) tall x 24" (610 mm) body depth x 48" (1220 mm) wide.

2.5.4 Peninsula base cabinets up to 36" (914 mm) tall x 36" (914 mm) body depth x 48" (1220 mm) wide.

2.5.5 Mechanical chase base cabinets up to 42" (1067 mm) tall x 36" (914 mm) body depth and 48" (1220 mm) wide.

3 **CONTRACTOR IS RESPONSIBLE FOR:**

3.1 **FURNISHING** and **INSTALLING** in wall blocking and backing anchorage required for seismic casework installation, in accordance with these standards, that becomes an integral part of the walls to which architectural woodwork will be installed, and:

3.1.1 In the absence of contract documents calling for the contractor to supply the necessary in wall blocking / backing in the wall, either through inadvertence or otherwise, the architectural woodwork installer will not proceed with the installation until such time as the in wall blocking / backing is installed by others.

3.1.2 In wall blocking / backing installed by others will be subject to inspection by the architectural woodwork installer prior to being covered by wall finish and may be accepted or rejected for cause prior to installation.

14.10 - A - ADDITIONAL GENERAL SEISMIC REQUIREMENTS (continued)

4 **INSTALLER IS RESPONSIBLE FOR:**

4.1 Ensuring that the casework shop drawings:

4.1.1 Are in compliance with the NAAWS's minimum requirements as established in Section 01, including:

4.1.1.1 Casework elevations showing the center-line height and horizontal locations of all required, continuous, internal wall blocking furnished by others.

4.1.1.2 A casework fastener schedule, clearly showing the type, size, location and maximum spacing of the installation fasteners.

4.2 At wood or metal stud walls, prior to application of wall surfacing, examine, approve and acknowledge blocking compliance.

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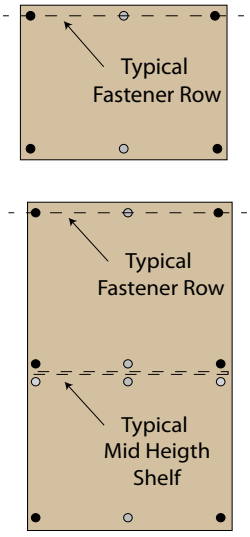
14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

1				Nailers will be minimum ¾" (19.0 mm) in thickness, of veneer core plywood (Struct. 1), MDF Grade 155 or Douglas Fir with a specific gravity of 0.5 or higher.
2				Tall storage cabinets will have a fixed shelf approximately mid height securely attached to the cabinet back and nailers.
3				**WALL BLOCKING / BACKING** will be at:
3	1			**WOOD STUD WALLS**, a minimum 3 x 6 nominal Douglas Fir (#2 or better) or 16 gauge x 6" (152 mm) , 50 KSI steel sheet metal.
3	2			**METAL STUD WALLS**, a minimum 16 gauge x 6" (152 mm), 50 KSI steel sheet metal.
4				**FASTENERS** will be at
4	1			**WOOD STUD WALLS** with:
4	1	1		**WOOD BLOCKING**, a minimum 3" (76 mm) x #14 (0.242" (6.1 mm)) washer head wood screw (WS) or Sheet Metal Screws (SMS) with minimum 2-1/2" (63.5 mm) penetration.
4	1	2		**SHEET METAL BACKING**, a minimum 3" (76 mm) x #14 washer head Sheet Metal Screws (SMS) with minimum of three threads extending beyond sheet metal backing.
4	2			**METAL STUD WALLS** with sheet metal backing, a minimum #14 washer head Sheet Metal Screws (SMS) with minimum of three threads extending beyond sheet metal backing.
4	3			**CONCRETE WALLS** of minimum 4" (102 mm) in thickness, a 3/8" Hilti KWIK Bolt TZ, ICC ESR-1917 (or equal) with minimum 2" (50.8 mm) embedment and minimum 6" (152 mm) clearance from any wall edge.
4	4			**CONCRETE MASONRY BLOCK WALL** (CMU), grouted solid, a 3/8" HILTI KWIK Bolt – 3 (or equal) with minimum 2-1/2" (63.5 mm) embedment and minimum 4" (102 mm) clearance from any wall edge.
5				**FASTENER PLACEMENT** requires:
5	1			Minimum of 4 fasteners, one each in the four corners of each cabinet box, **EXCEPT TALL STORAGE CABINETS** require a minimum of 6 fasteners with the additional requirement of one or two rows of fasteners at the mid-height fixed shelf.



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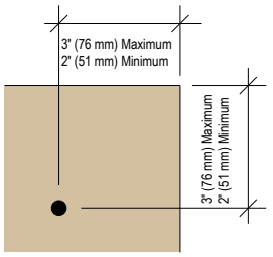
14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

Continued from previous page

5 **FASTENER PLACEMENT** (continued)

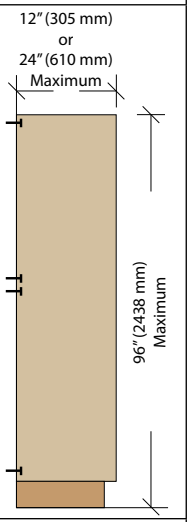
5 2 Each corner fastener will be centered a maximum of 3" (76 mm) and minimum of 2" (50.8 mm) from the outside edge, top and/or bottom of the cabinet box.



5 3 All additional fastener requirements outlined for specific cabinet types will be maximum of 3" (76 mm) and minimum of 2" (50.8 mm) from the top and/or bottom of the cabinet box.

6 **FASTENER QUANTITY** and **SPACING** requires at:

6 1 **TALL STORAGE CABINETS** not exceeding 48" (1220 mm) in width, 96" (2440 mm) in height,



and:

6 1 1 12" (305 mm) or less in depth, excluding doors or drawer fronts at:

6 1 1 1 **WOOD** or **METAL STUD** walls requires two additional horizontal rows of fasteners, approximately 2" (50.8 mm) apart split vertical above and below the fixed mid-height shelf and with up to:

6 1 1 1 1 **1 LAYER** of 5/8" (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 12" (305 mm) on center.

6 1 1 1 2 **2 LAYERS** of 5/8" (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 10-1/2" (267 mm) on center.

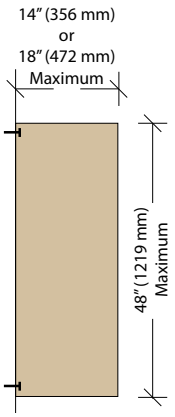
6 1 1 2 **CONCRETE** or **CONCRETE BLOCK** walls requires one additional horizontal row of fasteners below the fixed mid-height shelf with the maximum horizontal spacing between fasteners in the top, bottom or middle rows not exceeding 14" (356 mm) on center.

Continued on next page

14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

Continued from previous page

6	**FASTENER QUANTITY** and **SPACING** (continued)				
6	1	**TALL STORAGE CABINETS** (continued)			
6	1	2	24” (610 mm) or less in depth, excluding doors or drawer fronts at:		
6	1	2	1	**WOOD** or **METAL STUD** walls requires two additional horizontal rows of fasteners, approximately 2” (50.8 mm) apart split vertical above and below the fixed mid-height shelf with up to:	
6	1	2	1	1	1 layer of 5/8” (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 6” (152 mm) on center.
6	1	2	1	2	2 layers of 5/8” (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 5-1/4” (133 mm) on center.
6	1	2	2	**CONCRETE** or **CONCRETE BLOCK** walls requires one additional horizontal row of fasteners below the fixed mid-height shelf and at:	
6	1	2	2	1	**CONCRETE** walls the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 14” (356 mm) on center.
6	1	2	2	2	**CONCRETE BLOCK** walls the maximum horizontal spacing between fasteners in the top, bottom or middle rows will not exceed 21” (533 mm) on center.
6	2	**WALL HUNG CABINETS** not to exceed 48” (1220 mm) in width or height, and:			
6	2	1	14” (356 mm) or less in depth, excluding doors or drawer fronts at:		
6	2	1	1	**WOOD** or **METAL STUD** walls with up to:	
6	2	1	1	1	1 layer of 5/8” (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top or bottom will not exceed 8” (203 mm) on center.
6	2	1	1	2	2 layers of 5/8” (15.9 mm) drywall the maximum horizontal spacing between fasteners in the top or bottom rows will not exceed 6” (152 mm) on center.
6	2	1	2	**CONCRETE** or **CONCRETE BLOCK** walls the maximum horizontal spacing between fasteners in the top or bottom rows will not exceed 14” (356 mm) on center.	



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14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

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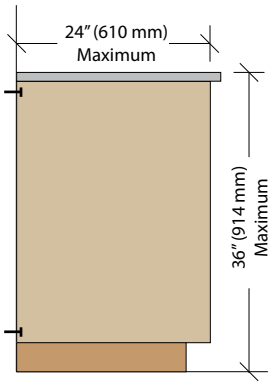
6	**FASTENER QUANTITY** and **SPACING** (continued)					
6	2	**WALL HUNG CABINETS** (continued)				
6	2	2	18" (457 mm) or less in depth, excluding doors or drawer fronts at:			
6	2	2	1	**WOOD** or **METAL STUD** walls requires two horizontal rows of fasteners at the top and bottom, approximately 2" (50.8 mm) apart vertically, with up to:		
6	2	2	1	1	1 layer of 5/8" (15.9 mm) drywall, and the maximum horizontal spacing between fasteners in the top or bottom rows will not exceed 12" (305 mm) on center.	
6	2	2	1	2	2 layers of 5/8" (15.9 mm) drywall, and the maximum horizontal spacing between fasteners in the top or bottom rows will not exceed 10" (254) on center.	
6	2	2	2	**CONCRETE** or **CONCRETE BLOCK** walls and the maximum horizontal spacing between fasteners in the top or bottom rows will not exceed 10-1/2" (267 mm) on center.		
6	3	**BASE CABINETS** not to exceed 36" (914 mm) in height (including countertop) and 24" (610 mm) in depth (excluding doors or drawer fronts), and **INCLUDING** the two fasteners in each corner of the top and bottom rows of fasteners, the total number of fasteners per row will be at:				
6	3	1	**WOOD** or **METAL STUD** walls with up to 2 layer of 5/8" (15.9 mm) drywall, 2 for cabinets 12" (305 mm) or less in width, 3 for cabinets 24" (610 mm) or less in width, 4 for cabinets 36" (914 mm) or less in width and 5 for cabinets 48" (1220 mm) or less in width.			
6	3	2	C**ONCRETE** walls, 2 for cabinets 24" (610 mm) or less in width and 3 for cabinets 48" (1220 mm) or less in width.			
6	3	3	**CONCRETE BLOCK** walls, 2 for cabinets 24" (610 mm) or less in width, 3 for cabinets 36" (914 mm) or less in width and 4 for cabinets 48" (1220 mm) or less in width.			



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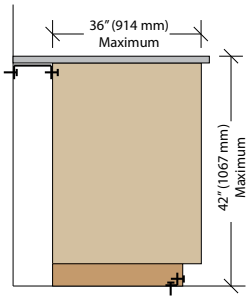
14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

Continued from previous page

6	**FASTENER QUANTITY** and **SPACING** (continued)			
6	4			**BASE CABINETS** with **UTILITY CHASE** not to exceed 42" (1067 mm) in height (including countertop), 36" (914 mm) in depth (excluding doors, drawer fronts and utility chase) and 48" (1220 mm) in width requires:  Integral toe base construction, and anchorage of the:
6	4	1		**TOE BASE** to the floor at front only, requires a continuous (for each cabinet unit) bent 16 gauge sheet metal 2.5" x 2.5" (63.5 mm x 63.5 mm) angle (FY+50KSI) mounted to the floor with 3/8" diameter Simpson Strong Bolt 2 (or equal) with minimum 2" (50.8 mm) embedment within 2" (50.8 mm) of each end and a maximum of 11" (279 mm) on center and fastened to the front left / right toe base member with # 12 sheet metal screws, driven through the toe base member into the metal angle within 4" (102 mm) of each end and a maximum of 12" (305 mm) on center.
6	4	2		**CABINET BACK** to the wall requires a continuous bent 16 gauge sheet metal channel (FY=50KSI) with 2" (50.8 mm) legs be mounted just below the countertop to bridge between the cabinet back and wall and will be fastened to the wall with a uniformly spaced, continuous horizontal row of fasteners at a maximum of 11" (279 mm) on center with the end fasteners within 2" (50.8 mm) of each end of the channel, and cabinet backs will be fastened to the continuous metal channel, including the two fasteners in each corner of the top row of fasteners, the total number of fasteners at cabinets:
6	4	2	1	12" (305 mm) or less in width, will be 2.
6	4	2	2	24" (610 mm) or less in width, will be 3.
6	4	2	3	36" (914 mm) or less in width, will be 4.
6	4	2	4	48" (1220 mm) or less in width, will be 5.

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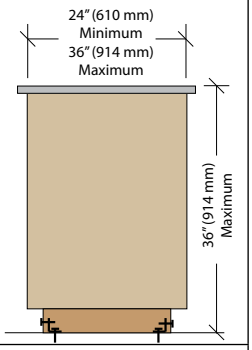
14.10 - A SECTION 10 (Casework) - ADDITIONAL SEISMIC INSTALLATION REQUIREMENTS

Continued from previous page

6 **FASTENER QUANTITY** and **SPACING** (continued)

6 5 **PENINSULA CABINETS** of single row double faced casework not to exceed 36" (914 mm) in height (including countertop), a minimum of 24" (610 mm) or a maximum of 36" (914 mm) in depth (excluding doors and drawer fronts) and 48" (1220 mm) in width requires



integral toe base construction and:

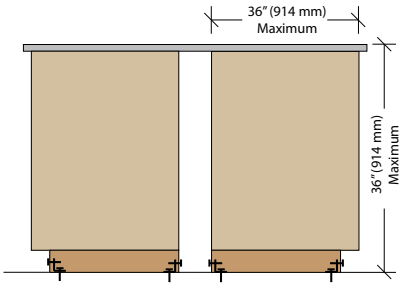
6 5 1 Anchorage of the toe base to the floor at front with a continuous (for each cabinet unit), a bent 16 gauge sheet metal 2.5" x 2.5" (63.5 mm x 63.5 mm) angle (FY+50KSI) will be mounted to the floor with 3/8" diameter Simpson Strong Bolt 2 (or equal) with minimum 2" (50.8 mm) embedment within 2" (50.8 mm) of each end and a maximum of 11" (279 mm) on center, with a minimum of:

6 5 1 1 13.5" (343 mm) on center between front and back anchors at cabinets 24" (610 mm) in depth.

6 5 1 2 25.5" (648 mm) on center between front and back anchors at cabinets 36" (914 mm) in depth.

6 5 1 3 Fastened to the left / right toe base member with # 12 (0.216" (5.9 mm)) sheet metal screws, driven through the front of the toe base member into the metal angle within 4" (102 mm) of each end and a maximum of 12" (305 mm) on center.

6 6 **PENINSULA CABINETS** of double row casework with **UTILITY CHASE**, each row of casework will not exceed 36" (914 mm) in height (including countertop), 36" (914 mm) in depth (excluding doors and drawer fronts) and 48" (1220 mm) in width requires same case fastening as single row, double faced peninsula casework.



14.11 SECTION 11 (Countertops & Horizontal Surfaces) - INSTALLATION REQUIREMENTS

1					**SPACING / SUPPORT MATERIALS** required for installation of a countertop are the responsibility of the countertop manufacturer.
2					**HORIZONTAL REVEAL** between the lower edge of the countertop and the upper edge of the adjacent door or drawer front at base cabinets with countertops will be a consistent 1/4" (6.4 mm) +/- 1/8" (3.2 mm), except:
2	1				At laboratory casework, will be 1/4" (6.4 mm) to 1" (25.4 mm) and be consistent across elevations, except at sink locations.
2	2				Coordination of such is the responsibility of the cabinet manufacturer.
3					**COUNTERTOPS** will be of maximum available and/or practical lengths, and:
3	1				Installed within 1/4" (6.4 mm) plus or minus the industry standard for height specified (see Section 10), except where ADA compliance is required.
3	2				**SECURELY FASTENED** and tightly fitted with flush joints and consistent joinery throughout the project, and:
3	2	1			Material supplier's recommended, water resistant, clear or color compatible **CAULK** and **SEALANTS** will be furnished and used by the installer to achieve the best performance.
3	2	2			At wall mounted splash, joint between splash and countertop will be caulked so as to leave a visible bead not exceeding 1/8" (3.2 mm) measured vertically or horizontally.
3	2	3			Flat countertops, except those of epoxy resin or natural / engineered stone, will be fit to the vertical surfaces and caulked so that the bead does not exceed 3/16" (4.7 mm) when measured vertically or horizontally, except at:
3	2	3	P	**Premium Grade**	It shall not exceed 1/8" (3.2 mm).
3	2	4			Flat countertops, of epoxy resin or natural / engineered stone, will be caulked to the vertical surfaces with a bead not to exceed 5/16" (7.9 mm) when measured vertically or horizontally.
3	2	5			Splash, except those of CGS Compact Laminate, epoxy resin or natural / engineered stone, will be fit to the vertical surfaces and caulked so that the bead does not exceed 3/16" (4.7 mm) when measured vertically or horizontally, except at:
3	2	5	P	**Premium Grade**	It shall not exceed 1/8" (3.2 mm).
3	2	6			Splash, of CGS Compact Laminate, epoxy resin or natural / engineered stone, will be caulked to the vertical surfaces with a bead not to exceed 5/16" (7.9 mm) when measured vertically or horizontally.
3	3				**CUTOUTS** in countertops, sub-tops or supports subject to moisture will have edges sealed with a color toned (for verification), water resistant sealer, except:
3	3	1			Materials of Solid surface, CGS (compact laminate), Epoxy, Natural and Engineered Stone.
4					**EDGE OVERHANGS** will be consistent, within a minimum of 1/2" (12.7 mm) and a maximum of 1-1/4" (31.8 mm) over the outer most cabinet face and finished end, parallel with the cabinet face or end within +/- 1/8" (3.2 mm) in any 96" (2440 mm) run of countertop, and:
4	1				At appliance ends, be flush to a maximum of 1/4" (6.4 mm) over the cabinet end.
4	2				If specified, a continuous drip groove 1/8" x 1/8" (3.2 mm x 3.2 mm), approximately 3/8" (9.5 mm) back from the front edge, will be provided.
4	3				If specified flush, will not exceed 1/8" (3.2 mm) over the outer most cabinet face and finished end, and be parallel with the cabinet face or end within +/- 1/16" (1.6 mm) in any 96" (2440 mm) run of countertop.

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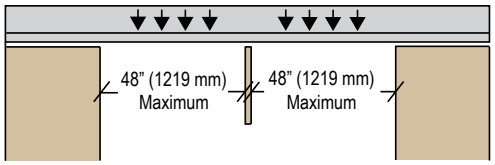
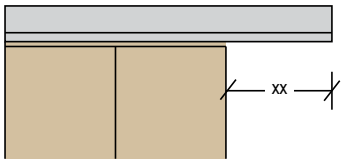
14.11 SECTION 11 (Countertops & Horizontal Surfaces) - INSTALLATION REQUIREMENTS

Continued from previous page

5			**SPANS** and **CANTILEVERS** of countertops will be reinforced to prevent deflection, and:
5	1		**SPANS** will be reinforced to prevent deflection under a 50 lb. (22.7 kg) per square foot (kgs. per 305 mm square) load in any 48" (1220 mm) span or portion thereof, at:
5	1	1	**WOOD, HPL** and **CGS** (Compact Laminate) in excess of 1/4" (6.4 mm).
5	1	2	**SOLID SURFACE, EPOXY RESIN** and **NATURAL** or **ENGINEERED STONE in excess of 1/16" (1.6 mm).**
5	2		SPANS such as,  will not exceed 48" (1220 mm) in width unsupported by cabinets or brackets/support, and:
5	2	1	Brackets / support will prevent defection under a 50 lbs. (22.7 kg) per square foot (kgs. per 305 mm square) load in any 48" (1220 mm) span or portion thereof in excess of 1/16" (1.6 mm).
5	3		**CANTILEVERS**, with or without a sub-top, such as,  will not exceed from a support, whether in the front, back, or end at: Wood or HPL, 12" (305 mm) Solid Surface 6" (152 mm) for 1/2" (12.7 mm) or 12" (305 mm) for 3/4" (19.0 mm) material thickness. CGS (Compact Laminate) 6" (152 mm) for 1/2" (12.7 mm), 12" (305 mm) for 3/4" (19.0 mm) or 18" (457 mm) for 1" (25.4 mm) material thickness. Epoxy Resin, 6" (152 mm) for 3/4" (19.0 mm) or 12" (305 mm) for 1" (25.4 mm) material thickness. Natural or Engineered Stone, 6" (152 mm) for 2CM (13/16" (20 mm) or 10" (254 mm) for 3CM (1-3/16" (30.2 mm)) material thickness.
6			**SOLID** or **VENEERED WOOD COUNTERTOPS** requires:
6	1		**INSTALLER ASSEMBLED JOINTS** will be glued and fastened together with a mechanical tightening system either routed into or mounted on the bottom side of the countertop.
6	2		**PERIMETER** of countertop to withstand a 75 lb. (34 kg) pull up pressure.
6	3		Sink cutouts will not fall within 18" (457 mm) of discretionary installer joints.
7			**HPL COUNTERTOPS** will be properly aligned with uniform front edge overhang, scribed to walls and securely anchored to base cabinets with proper length screws, and requires:
7	1		**INSTALLER ASSEMBLED JOINTS** will be glued and fastened together with a mechanical tightening system either routed into or surface mounted on the bottom side of the countertop.
7	2		Perimeter of countertop to withstand a 75 lb. (34 kg) pull up pressure.
7	3		Sink cutouts will not fall within 18" (457 mm) of discretionary installer joints.

Continued on next page

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

14.11 SECTION 11 (Countertops & Horizontal Surfaces) - INSTALLATION REQUIREMENTS

Continued from previous page

8	**SOLID SURFACE** will conform to the material supplier's recommendations, and requires:			
8	1	**SEALANTS** and **ADHESIVES** will be compatible with the individual material supplier's recommendations or specially developed sealants to achieve the best color match.		
8	2	**EXPANSION** joints will be furnished where required by building design or material supplier recommendations.		
8	3	**SUPPORT** will be adequately furnished to minimize stresses, and:		
8	3	1	Minimum full perimeter and joint support is required on horizontal applications, with:	
8	3	1	1	Maximum on center separation between supports of 30" (750 mm) for acrylic and 24" (610 mm) for non-acrylic materials.
8	3	1	2	A maximum unsupported and unloaded overhang of 12" (305 mm) for 3/4" (19.0 mm) and 6" (152 mm) for 1/2" (12.7 mm) sheet thickness.
8	4	**FIELD JOINTS** will be precision-machined, reinforced and glued with the material supplier's hard seaming material or equal, fully supported, joined straight, smooth, gap free and clean, and:		
8	4	1	**"L"** and **"U"** shaped inside corners will be rounded / radiused and smooth.	
8	5	**CUTOUTS** at heat producing areas, will have corners reinforced per the material supplier's requirements and protected with approved heat reflective tape.		
8	6	**BACK** and **END SPLASHES,** will be securely adhered to the wall, butt joined to the countertop, and coved splashes, when specified, will be hard seamed and integral to the countertop.		
8	7	**COUNTERTOP ADHESION** will be made using a clear silicone sealant placed a maximum of 12" (12.7 mm) on center.		
9	**CGS** (Compact Laminate), requires:			
9	1	**COUNTERTOP** will be secured to supports with silicone adhesive or appropriately sized machine screws applied to each corner and along the perimeter edge at not more than 48" (1220 mm) on center.		
9	2	**JOINTS** will be precision machined with tight joint fasteners and sealed with a biocide silicone prior to tightening.		
9	3	**SINKS** will be stainless steel, polypropylene, or epoxy resin; either lipped or under mount, and:		
9	3	1	**LIPPED** will be set in a rabbeted cutout in the countertop.	
9	3	2	**UNDER MOUNT** will be installed using adjustable metal sink supports for underside installation or fastened directly to the underside of the countertop using machine screws and silicone adhesive.	
9	3	3	A biocide silicone adhesive will be used at the juncture of the sink and countertop to produce a leak proof joint.	
9	4	**BACK** and **END SPLASHES** will be securely adhered to the wall, butt joined to the countertop.		

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14.11 SECTION 11 (Countertops & Horizontal Surfaces) - INSTALLATION REQUIREMENTS

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10	**EPOXY RESIN, NATURAL / ENGINEERED STONE,** requires:				
10	1	**COUNTERTOP** will be secured to supports with epoxy cement applied to each corner and along the perimeter edge at not more than 48" (1220 mm) on center, and joints will be butted and filled with a color matched epoxy cement.			
10	2	**EDGE OVERHANG** will be provided on the front and ends of 1" (25.4 mm) nominal.			
10	3	**BACK** and **END SPLASHES** will be securely adhered to the wall, butt-joined to the countertop.			
10	4	**HARD SEAMS** will be water-tight and gap free.			
10	5	**SCRIBING** is not required.			
10	6	**SINKS** will be either lipped or under mounted, and:			
10	6	1	At **EPOXY RESIN,** lipped sinks will be set in a rabbeted cutout in the countertop.		
10	6	2	**UNDER MOUNT** will be installed using adjustable metal sink supports, and:		
10	6	2	1	An epoxy cement is required at the juncture of the sink and countertop to produce a leak proof joint.	
10	6	2	2	The maximum gap between the countertop edge of the sink and underside of the countertop will not exceed 3/16" (4.8 mm).	
10	7	**CANTILEVERED OVERHANGS**, with or without a sub top, will not exceed at:			
10	7	1	**EPOXY RESIN:** 6" (152 mm) for 3/4" (19.0 mm) thick, 12" (305 mm) for 1" (25.4 mm) thick, or 16" (406 mm) for 1-1/4" (31.8 mm) material thickness, whether in the front, back or end.		
10	7	2	**NATURAL / ENGINEERED STONE:** 6" (152 mm) for 2CM (3/16" (20 mm)) thick material or 10" (254 mm) for 3CM (1-1/8" (28.6 mm) material thickness, whether in the front, back or end.		

14.12 SECTION 12 (Historic Restoration Work) - INSTALLATION REQUIREMENTS

1	**MATCH** of **EXISTING** installation methods is required, in compliance with Sections 03 - 11, as applicable.
2	Where new materials are required to be distressed to blend seamlessly with original, mock-ups will be approved by the design professional or conservator before proceeding.

END OF SECTION 14

NAAWS

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

TOLERANCES

SECTION - 15

INCLUDING: Tolerances for all fabricated and installed architectural woodwork

15.1 SCOPE

1 All Tolerances for fabricated and installed architectural woodwork covered under the scope of these standards.

15.2 SURFACE DEFINITIONS

1 **EXPOSED, EXPOSED-EXTERIOR, EXPOSED-INTERIOR** and/or **SEMI-EXPOSED** finished surfaces include all surfaces visible after fabrication or installation.

15.3 DEFAULT STIPULATION

1 **IF NOT OTHERWISE SPECIFIED OR INDICATED** all work under this section will meet Custom Grade.

15.4 GENERAL REQUIREMENTS

1 **FUNDAMENTAL GENERAL / PRODUCT REQUIREMENTS** within **Section 02** are primary to and work in conjunction with the following specific requirements unless a project's contract documents require otherwise.

2 **CARE** and **STORAGE REQUIREMENTS** are covered under **Section 13.**

3 **INSTALLATION REQUIREMENTS** are covered under **Section 14**

4 **ERRATA**, published at naaws.com, will take precedence over these requirements, subject to their date of posting and a project's bid date.

5 **TOLERANCES**:

5.1 **WITHIN NAAWS** fall into two categories:

5.1.1 **FACTORY FABRICATED** joinery, assembly and construction found in Product Sections 06 - 12.

5.1.2 **FIELD INSTALLATION** joinery, assembly and construction found in Section 14.

5.2 **TESTS** are applicable to**:**

5.2.1 Flatness of wood-based panel products.

5.2.2 Solid wood to solid wood joints and assemblies.

5.2.3 Solid wood to wood veneer joints and assemblies.

5.2.4 Wood veneer to wood veneer joints and assemblies.

5.2.5 Solid wood to wood-based product (HPL. TFL, CGS (Compact Laminate) and panel products) joints and assemblies.

5.2.6 HPL or TFL to HPL or TFL joints and assemblies.

5.2.7 Solid surface to solid surface joints and assemblies.

5.2.8 However, because of expansion and contraction differences of non-wood products compared to solid wood and wood-based products, are not applicable for flatness or joinery to**:**

5.2.8.1 Solid wood to non-wood-based products (such as drywall, glass, metal, stone, acrylics, etc.).

5.2.8.2 Non-wood to non-wood joints.

15.4 GENERAL REQUIREMENTS (continued)

6 **FABRICATED** and **INSTALLED** woodwork will be tested for compliance to these standards as follows.

6.1 **SEQUENCED** and **BLUEPRINT-MATCHED PANELS, COMPONENTS,** and **RELATED DOORS:**

6.1.1 **TESTS** do not apply to stand alone flush doors specified under Section 09 or specified using other standards.

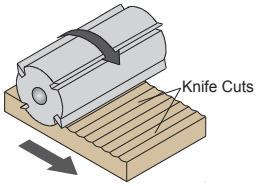
6.1.2 **END-MATCHED JOINTS** by separating end-matched panels and visually testing grain void for continuity.

6.1.3 **SIDE-MATCHED JOINTS** by separating side-matched panels and visually testing grain void for continuity.

6.1.4 **HEART FIGURE PROGRESSION**, the full heart figure of plain-sliced veneer will develop in uniform and natural progression, and:

6.1.4.1 Split or cut hearts are permitted, provided they are used to maintain sequence or to achieve special effects.

6.2 **KCPI SMOOTHNESS TEST** of surfaces by observation of the Knife Cuts Per Inch on the top flat surfaces, (those that can be sanded with a drum or wide belt sander) or profiled / shaped surfaces. Compliance is determined by holding the surfaced board at an angle to a strong light source and counting the visible ridges per inch, usually perpendicular to the profile. Acceptable compliance allows a minimum of 20 KCPI at profiled / shaped surfaces, except:



Premium Grade	Prohibits any KCPI

6.3 **SANDING SMOOTHNESS TEST** of surfaces by observance the sanding on the top flat surfaces, (those that can be sanded with a drum or wide belt sander) or profiled / shaped surfaces. Compliance is determined by sanding a sample piece of the same species with the required grit of abrasive and observing the scratch marks of the abrasive grit with a hand lens compared to a prepared sample. Acceptable compliance requires minimum 120 grit sanding at flat, profiled / shaped, or turned surfaces, except:

Premium Grade	Requires minimum 150 grit sanding at flat surfaces, 120 grit at profiled / shaped surfaces, and 180 grit at turned surfaces.

6.3.1 Reasonable assessment of the performance of the finished product will be weighed against absolute compliance with the standard.

6.3.2 A product is sanded sufficiently smooth when knife cuts are removed and remaining sanding marks are or will be concealed by applied finishing coats.

6.3.3 Grain raise at unfinished wood, due to moisture or humidity in excess of the ranges set forth in this standard, will not be considered a defect and must be sanded prior to finishing.

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15.4 GENERAL REQUIREMENTS (continued)

7 **FINISHED WOODWORK:**

7.1 **VISUAL TESTING** is only applicable to exposed surfaces:

7.1.1 View finished surfaces in the ambient conditions in which they will be installed and used, perception of color varies with the light source and between individuals.

7.1.2 Tests apply only to new work at the time of installation, they **will** not be applied to refinishing conditions, except as agreed in advance between buyer and seller.

7.2 **COMPLIANCE TESTING** for **CONSISTENCY** of **GRAIN** and **COLOR** can be highly subjective, each person's perception of color is unique, and:

7.2.1 The apparent color of a finished wood species is affected by many variables, such as ambient lighting, cellular structure of the individual piece of wood, cutting or slicing of the wood, machining and sanding of the surface, and orientation of the surface to the viewer.

7.2.2 **COMPLIANCE WILL BE EVALUATED** (by comparison to an approved panel, minimum 8" x 12" (203 mm x 305 mm), that has been signed and dated and protected from light) based on the following conditions:

7.2.2.1 Viewing of the surfaces in the lighting and orientation in which they will be installed.

7.2.2.2 Observing a color and tone blending that is not significantly lighter than the lightest of the range, nor darker than the darkest of the range.

7.2.2.3 Because of natural variations in color and grain, it cannot be expected that all panels will match one particular sample exactly; however, **will** match within the sample range submitted.

7.3 **SHEEN TEST** compliance **will** be evaluated by comparison to the approved range of sample panels, that has been signed and dated and protected from light, based on testing of the surfaces with a gloss meter, parallel to the grain, in identical lighting conditions, and:

7.3.1 When comparisons of sheen tests between the approved sample panels and the installed work show sheen readings within 10 points of each other they **will** be considered to be in compliance.

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15.4 GENERAL REQUIREMENTS (continued)

8 **GAPS, FLUSHNESS, FLATNESS** and **ALIGNMENT** by observance. Compliance is determined by measuring the maximum gaps between exposed components with a feeler gauge at points designed to join, where members contact or touch, and:

8.1 Measuring the questioned joint length with a ruler, with minimum 1/16" (1.6 mm) divisions, and making the calculations accordingly.

8.2 Reasonable assessment of the performance of the finished product weighed against absolute compliance with the standards.

8.3 Evaluation against their allowable tolerances by the following tests that are covered within the Tolerance Test Requirements table:

8.3.1 A Chip Out

8.3.2 B Overlap

8.3.3 C Over Machined

8.3.4 D Show-Through / Telegraphing

8.3.5 E Squareness of Panel

8.3.6 F Flatness of Panel / Door

8.3.7 G Flushness, Fabrication

8.3.8 H Flushness, Installation

8.3.9 I Flushness at Butted Edges

8.3.10 J-1 Flushness at Adjoining Fixed Panels

8.3.11 J-2 Flushness at Adjoining Casework Doors, Drawers and False Fronts

8.3.12 K Reveals at Adjoining Panels / Doors

8.3.13 L Gaps at Butted Surface Edges in Same Core Member

8.3.14 M Gaps at Mitered or Butted Surfaces

8.3.15 N Gaps at Mitered or Butted Edges

8.3.16 O Gaps at Parallel Members

8.3.17 P Gaps at Installation

8.3.18 Q Gaps / Reveals at Cabinet Door / Drawers

8.3.19 R Edge Alignment at Cabinet Door / Drawers

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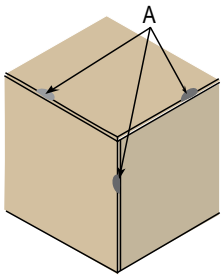
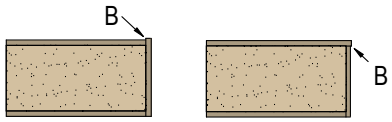
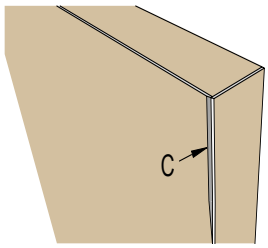
Important:
Section 02 (Fundamental Requirements) and Section 13 (Care & Storage),are primary to and work in conjunction with the requirements within this Section.

15.5 TOLERANCE REQUIREMENTS

1			**FACTORY** and **FIELD JOINERY** and their workmanship, such as gaps, flushness, flatness, etc. will be judged by the following allowable tolerances for the applicable grade established herein; however:
1	1		**GAPS** at field joints will not be considered a defect or the responsibility of the installer if caused by excessive deviations in the building's walls and ceilings being in excess of 1/4" (6.4 mm]) in 144" (3658 mm) of being plumb, level, flat, straight, square, or of the correct size. Or floor deviations in excess of 1/2" (12.7 mm) in 144" (3658 mm).
2			**TEST A** - **CHIP OUT** will be inconspicuous when viewed at 48" (1220 mm), except at:
2	P	**Premium Grade**	When viewed at 24" (610 mm).
2	1		**EXAMPLES** of observation / test points may include: 
3			**TEST B** - **OVERLAP** will not exceed 0.005" (0.13 mm) for a maximum length of 1" (25.4 mm) in any 24" (610 mm) run, except at:
3	P	**Premium Grade**	Will not exceed 0.003" (0.08 mm) for a maximum length of 1" (25.4 mm) in any 48" (1220 mm) run.
3	1		**EXAMPLES** of observation / test points may include: 
4			**TEST C** - **OVER MACHINED** (removal of color or pattern of face material) will be limited to 1/32" x 4" (0.8 mm x 102 mm) and may not occur within 60" (1524 mm) of a similar occurrence, except at:
4	P	**Premium Grade**	Limited to 1/32" x 1-1/2" (0.8 mm x 38.1 mm) and may not occur within 72" (1829 mm) of a similar occurrence.
4	1		**EXAMPLES** of observation / test points may include: 

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15.5 TOLERANCE REQUIREMENTS

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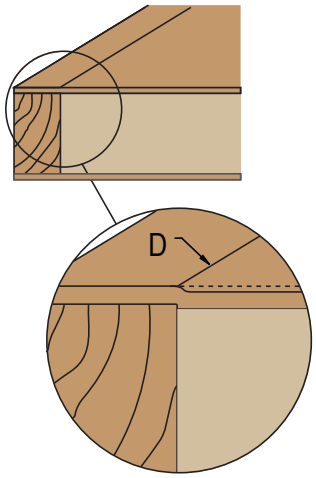
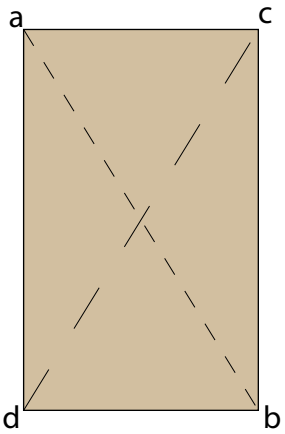
5		**TEST D - SHOW-THROUGH / TELEGRAPHING** will not exceed 0.010" (0.25 mm) in any 3" (76 mm) span, except at:	
5	P	**Premium Grade**	Excluding passage doors, it will not exceed 0.005" (0.125 mm) in any 1-1/2" (38 mm) span.
5	1	**EXAMPLES** of observation / test points may include:	
6		**TEST E - SQUARENESS OF PANEL** variance (the difference between the measurement of a/b versus c/d) will not exceed:	
6	1	1/16" (1.6 mm) for any panels 48" x 48" (1220 mm x 1220 mm) or smaller.	
6	2	3/32" (2.4 mm) for any panels larger than 48" x 48" (1220 mm x 1220 mm).	
6	3	1/8" (3.2 mm) at any passage door.	
6	4	**EXAMPLES** of observation / test points may include:	

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15.5 TOLERANCE REQUIREMENTS

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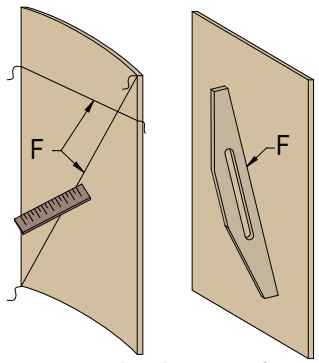
7		**TEST F - FLATNESS** of **an INSTALLED COMPONENT** (not subject to a load) will not exceed 0.020" (0.5 mm), for any 12" (305 mm) length or portion there of in diagonal, width and/or length or as lineal ratio (not geometric ratio) thereof. Example, twice the grade tolerance listed for 24" (610 mm), three times the tolerance for 36" (914 mm), except:
7	1	**PASSAGE DOORS** will not exceed 0.032" (0.8 mm), subject to maximum 0.25" per 3'6" x 7'0" (6.4 mm in any 1067 mm x 2134 mm) door section.
7	2	**EXAMPLES** of observation / test points may include:



Measured on the concave face

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15.5 TOLERANCE REQUIREMENTS

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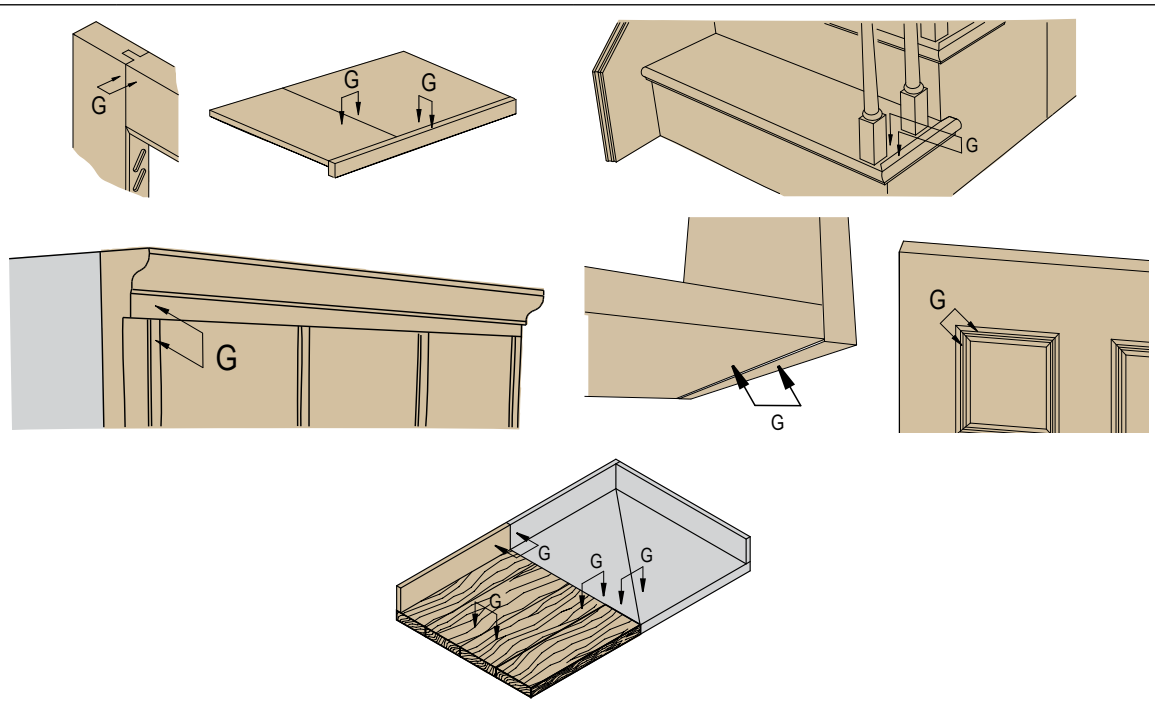
8			**TEST G - FLUSHNESS, FABRICATION** between two surfaces, will not exceed at:	
8	1		**WOOD** to **WOOD** 0.007" (0.2 mm), except at:	
8	1	P	**Premium Grade**	It will not exceed 0.005" (0.1 mm)
8	2		**NON-WOOD** to **NON-WOOD** 0.015" (0.4 mm), except at:	
8	2	P	**Premium Grade**	It will not exceed 0.010" (0.3 mm)
8	3		**SOLID SURFACE** to **SOLID SURFACE** will be flush.	
8	4		**CGS** (Compact Laminate) to **CGS** (Compact Laminate) 0.001" (0.03 mm).	
8	5		**EPOXY RESIN** to **EPOXY RESIN** 0.050" (0.8 mm).	
8	6		**NATURAL / ENGINEERED STONE** to **NATURAL / ENGINEERED STONE, INCLUDING LIPPAGE VARIATIONS** 1/32" (0.8 mm) at the center of the joint.	
8	7		 **EXAMPLES** of observation / test points may include:	

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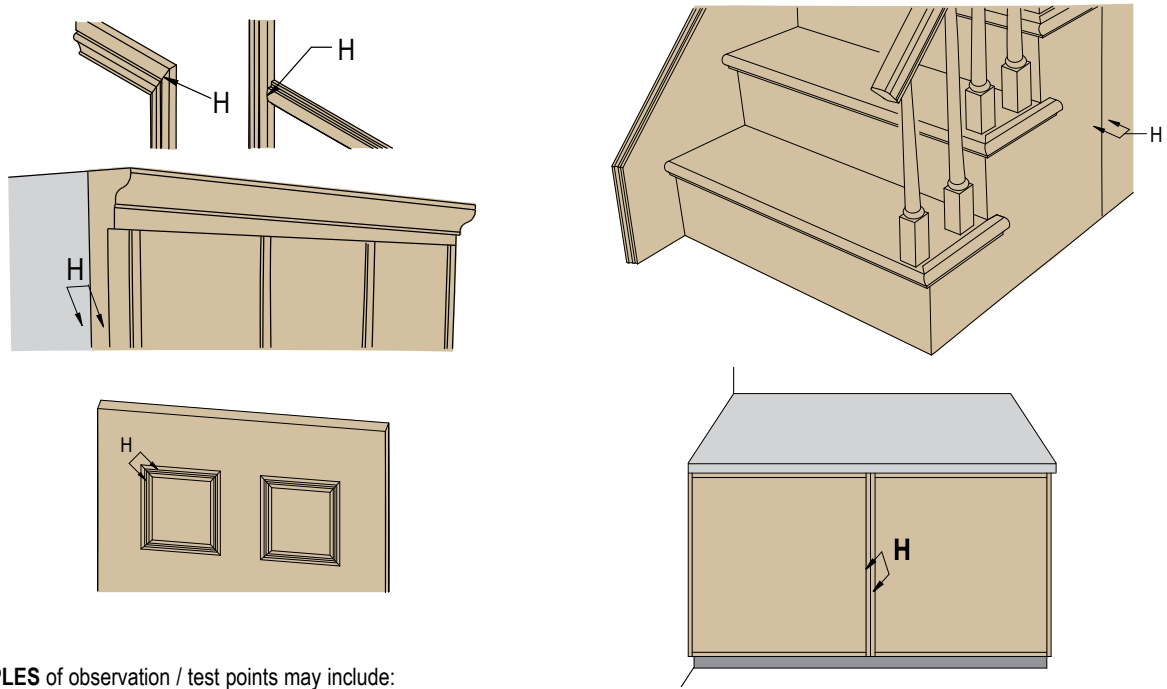
15.5 TOLERANCE REQUIREMENTS

Continued from previous page

9			**TEST H - FLUSHNESS, INSTALLATION** will not exceed at:	
9	1		**WOOD** to **WOOD**, **FLAT** surfaces 0.015" (0.38 mm), except at:	
9	1	P	**Premium Grade**	It will not exceed 0.010" (0.25 mm).
9	2		**WOOD** to **WOOD**, **SHAPED** surfaces 0.025" (0.65 mm), except at:	
9	2	P	**Premium Grade**	It will not exceed 0.020" (0.51 mm).
9	3		**WOOD** to **NON-WOOD**, **FLAT** and **SHAPED** surfaces 0.050" (1.27 mm), except at:	
9	3	P	**Premium Grade**	It will not exceed 0.035" (0.89 mm).
9	4		**NON-WOOD** to **NON-WOOD** and/or all **ELEMENTS**, **FLAT** surfaces 0.050" (1.27 mm), except at:	
9	4	P	**Premium Grade**	It will not exceed 0.035" (0.89 mm).
9	5		**NON-WOOD** to **NON-WOOD** and/or all **ELEMENTS**, **SHAPED** surfaces 0.075" (1.91 mm), except at:	
9	5	P	**Premium Grade**	It will not exceed 0.050" (1.27 mm).
9	6		 **EXAMPLES** of observation / test points may include:	

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15.5 TOLERANCE REQUIREMENTS

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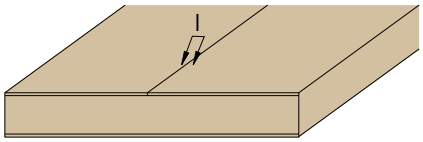
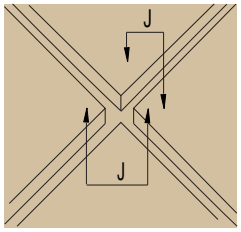
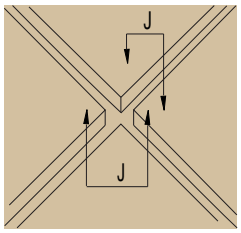
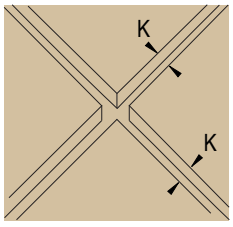
10	**TEST I - FLUSHNESS at BUTTED EDGES** within a panel will not exceed 0.006" (0.15 mm), except at:		
10	P	**Premium Grade**	It will not exceed 0.003" (0.08 mm).
10	1	**EXAMPLES** of observation / test points may include: 	
11	**TEST J-1 - FLUSHNESS at ADJOINING FIXED PANELS** (parallel or diagonal) will not exceed a maximum variance of 0.025" (0.65 mm), except at:		
11	P	**Premium Grade**	The maximum variance will be 0.015" (0.38 mm).
11	1	**EXAMPLES** of observation / test points may include: 	
12	**TEST J-2 - FLUSHNESS at ADJOINING CASEWORK DOORS, DRAWERS or FALSE FRONTS** (parallel or diagonal) will not exceed a maximum variance of 3/64" (1.2 mm), except at:		
12	P	**Premium Grade**	The maximum variance will be 1/32" (0.8 mm).
12	1	**EXAMPLES** of observation / test points may include: 	
13	**TEST K - REVEALS at ADJOINING PANELS / DOORS** will not exceed a maximum variance of 0.050" (1.27 mm), except at:		
13	P	**Premium Grade**	The maximum variance will be 0.030" (0.76 mm).
13	1	**EXAMPLES** of observation / test points may include: 	

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15.5 TOLERANCE REQUIREMENTS

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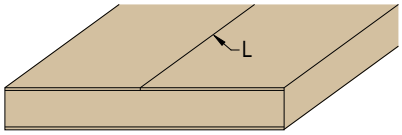
14 **TEST L - GAPS** at **BUTTED SURFACE EDGES** in **SAME CORE MEMBER** will not exceed 2 occurrences of 0.015" x 5" (0.38 mm x 127 mm) in any panel, except at:

14	P	**Premium Grade**	It will not exceed 1 occurrence of 0.007" x 3" (0.18 mm x 76 mm) in any panel.

14 1

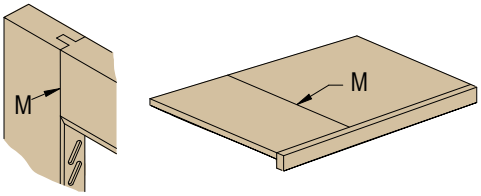


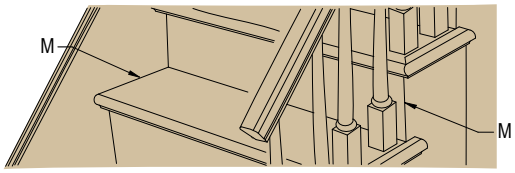
EXAMPLES of observation / test points may include:

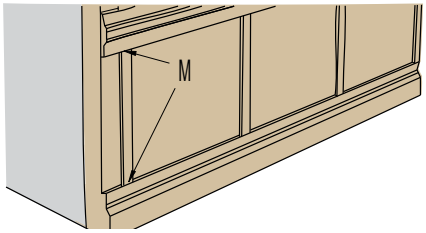
15 **TEST M - GAPS** at **MITERED** or **BUTTED SURFACES** will not exceed 0.015" (0.38 mm) wide by 20% of the joint length, except Solid Surface, CGS (Compact Laminate), Epoxy Resin or Natural / Engineered Stone will be gap free, except at:

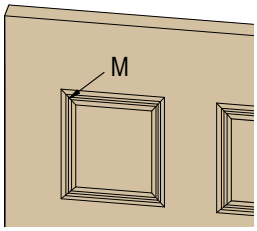
15	P	**Premium Grade**	It will not exceed 0.010" (0.25 mm) wide by 20% of the joint length.

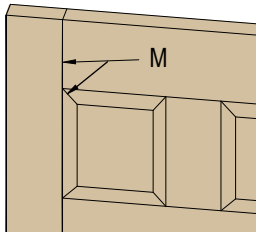
15 1

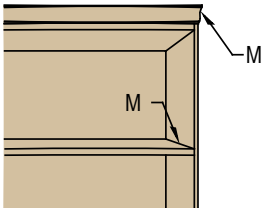


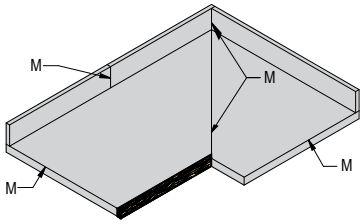












EXAMPLES of observation / test points may include:

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15.5 TOLERANCE REQUIREMENTS

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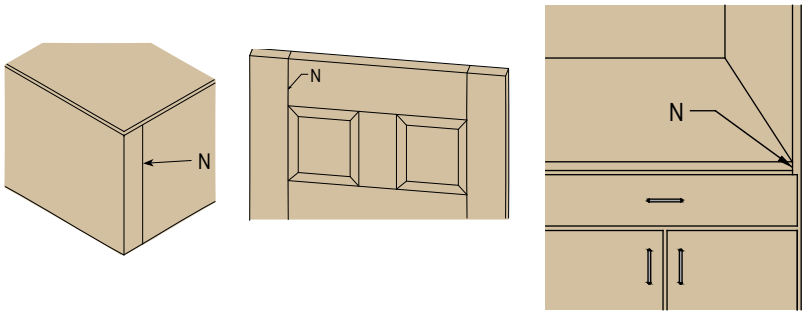
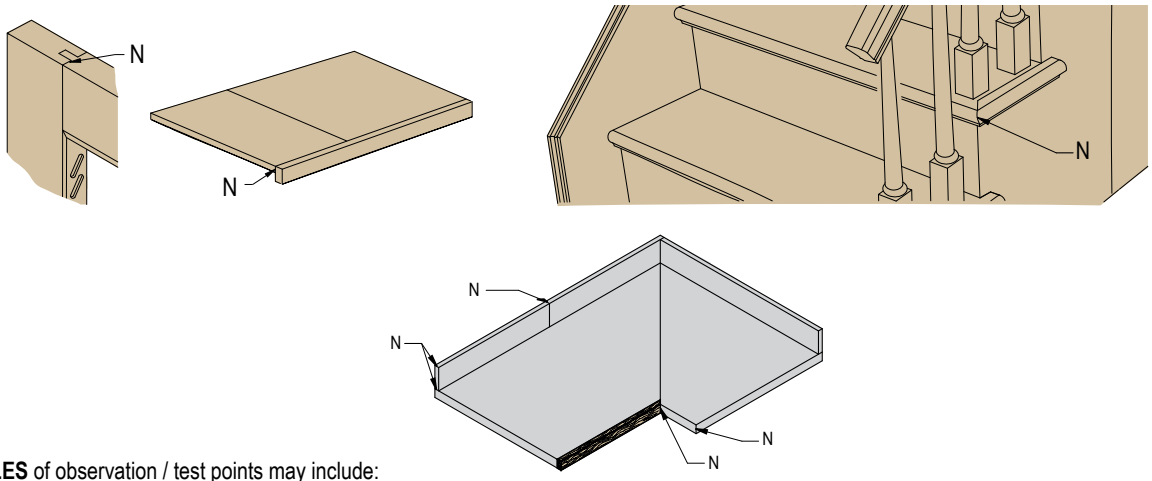
16		**TEST N - GAPS** at **MITERED** or **BUTTED EDGES** will not exceed 0.015" (0.38 mm), except Solid Surface will be gap free, or at:	
16	**P**	**Premium Grade**	It will not exceed 0.010" (0.25 mm), except Solid Surface and Epoxy Resin will be gap free.
16	**1**	**CGS** (Compact Laminate) to **CGS** (Compact Laminate) or **NATURAL / ENGINEERED STONE** to **NATURAL / ENGINEERED STONE** 0.015" (0.38 mm).	



16 **2**



EXAMPLES of observation / test points may include:

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15.5 TOLERANCE REQUIREMENTS

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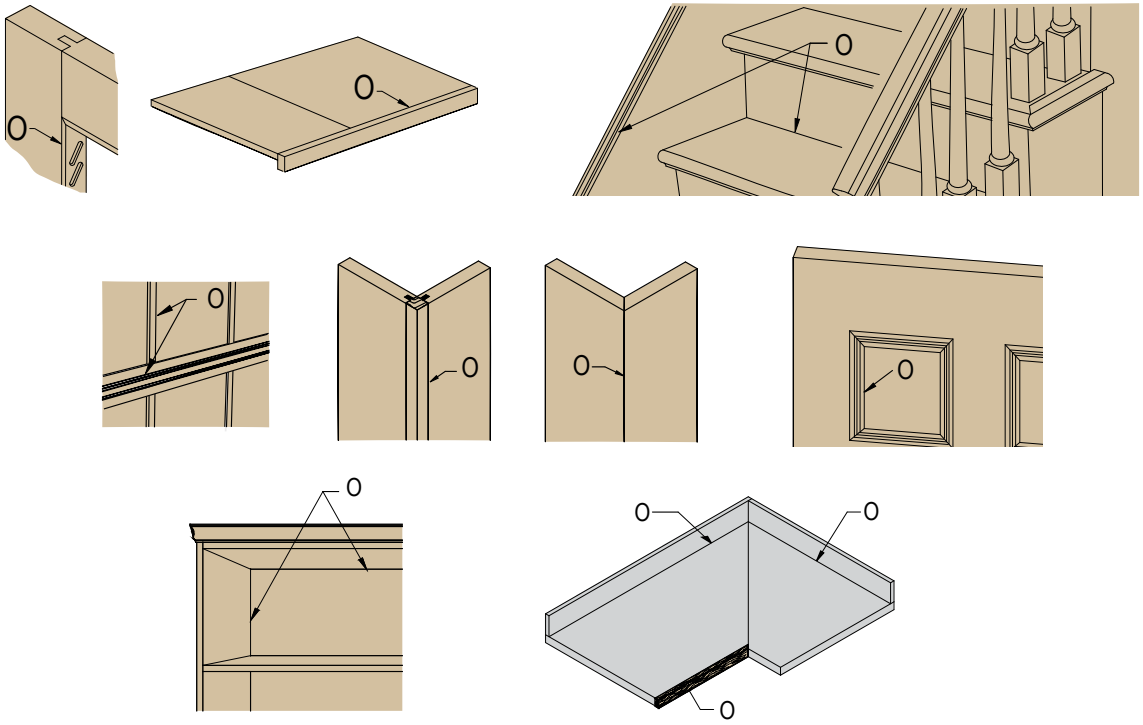
17		**TEST O - GAPS** at **PARALLEL MEMBERS**, will not exceed 0.015" x 6" (0.38 mm x 152 mm) and will not occur within 60" (1524 mm) of a similar gap in the same joint, except Solid Surface will be gap free, except at:	
17	P	**Premium Grade**	It will not exceed 0.010" x 4" (0.25 mm x 102 mm) and will not occur within 72" (1829 mm) of a similar gap in the same joint, except Solid Surface and Epoxy Resin will be gap free.
17	1	**CGS** (Compact Laminate) to **CGS** (Compact Laminate) or **NATURAL / ENGINEERED STONE** to **NATURAL / ENGINEERED STONE** 0.015" x 3" (0.4 mm x 76 mm) and will not occur within 12" (1829 mm) of a similar gap.	
17	2	 **EXAMPLES** of observation / test points may include:	

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15.5 TOLERANCE REQUIREMENTS

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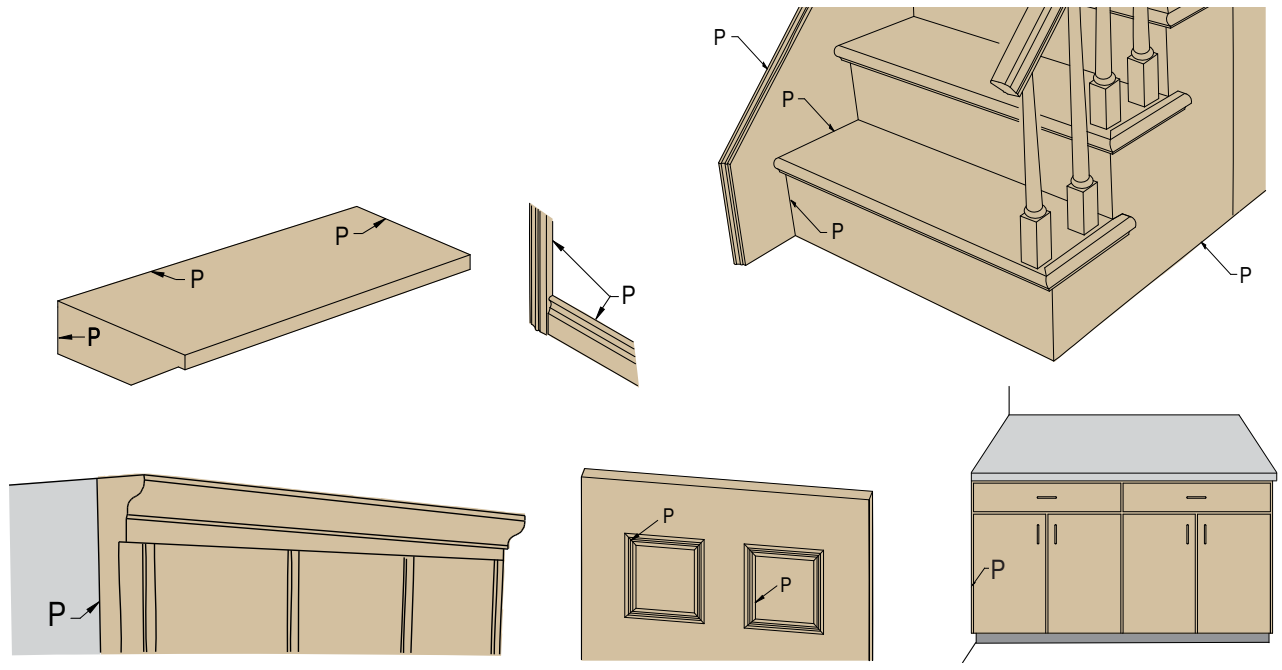
18		**TEST P - GAPS** at **INSTALLATION** will not exceed 30% of a joint's length and will not exceed in width at:	
18	1	**WOOD** to **WOOD**, **FLAT** surfaces 0.020" (0.51 mm), except at:	
18	P	**Premium Grade**	It will not exceed 0.015" (0.38 mm).
18	2	**WOOD** to **WOOD**, **SHAPED** surfaces 0.025" (0.64 mm), except at:	
18	P	**Premium Grade**	It will not exceed 0.015" (0.38 mm).
18	3	**WOOD** to **NON-WOOD**, **FLAT** and **SHAPED** surfaces 0.050" (1.27 mm), except at:	
18	P	**Premium Grade**	It will not exceed 0.035" (0.89 mm).
18	4	**NON-WOOD** to **NON-WOOD** and/or all **ELEMENTS**, **FLAT** surfaces 0.050" (1.27 mm), except at:	
18	P	**Premium Grade**	It will not exceed 0.035" (0.89 mm).
18	5	**NON-WOOD** to **NON-WOOD** and/or all **ELEMENTS**, **SHAPED** surfaces 0.075" (1.91 mm), except at:	
18	P	**Premium Grade**	It will not exceed 0.050" (1.27 mm).

18 6



EXAMPLES of observation / test points may include:

Continued on next page

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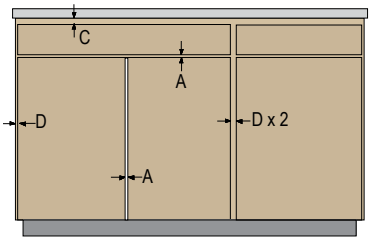
15.5 TOLERANCE REQUIREMENTS

Continued from previous page

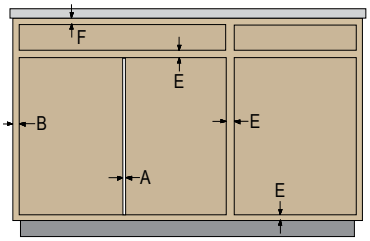
19 TEST Q - GAP / REVEAL at CABINET DOOR / DRAWERS:

19 1 The **MAXIMUM GAP / REVEAL** variance within a cabinet elevation, between any edge of a door and/or drawer and another door and/or drawer or finished end, cabinet member and doors hung in pairs, will be based on the following elevations for:

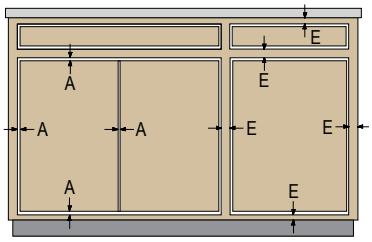
19 1 1 **FLUSH OVERLAY FRAMELESS** construction.



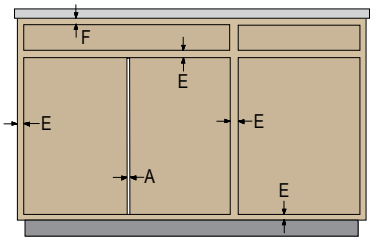
REVEAL OVERLAY FRAMELESS construction.



19 1 2 **INSET FACE FRAME** construction.



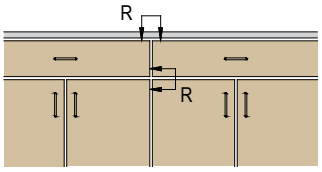
REVEAL OVERLAY FACE FRAME construction.



19	1	2	1	"**A**" - a minimum of 1/16" (1.6 mm) and maximum of 1/8" (3.2 mm) and variance will not exceed 1/32" (0.8 mm).
19	1	2	2	"**B**" - a minimum of 0.0" (0.0 mm) and maximum of 1/16" (1.6 mm) and variance will not exceed 1/32" (0.8 mm).
19	1	2	3	"**C**" - a minimum of 1/8" (3.2 mm) to a maximum of 1/4" (6.4 mm), consistent across each elevation and variance will not exceed 1/32" (0.8 mm).
19	1	2	4	"**D**" - shall be determined by hinge overlay and variance will not exceed 1/32" (0.8 mm).
19	1	2	5	"**E**" - shall be as specified, indicated or agreed and variance will not exceed 1/32" (0.8 mm).
19	1	2	6	"**F**" - a minimum of 1/4" (6.2 mm) to a maximum of 1" (25.4 mm), consistent across each elevation and variance will not exceed 1/32" (0.8 mm).

20 TEST R - EDGE ALIGNMENT at CABINET DOOR / DRAWERS.

20 1 **EDGE ALIGNMENT** of doors and drawers (see Test I illustrations in Tolerances) in both the vertical and horizontal plane, such as, will not exceed 1/32" (0.8 mm).



END OF SECTION 15

NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

APPENDIX

GENERAL

- Introduction
- Adhesive Usage Guide
- Chemical / Stain Resistance / Testing (SEFA)
- Casework Integrity Testing
- Cabinet Design Series (CDS)

INTRODUCTION

INTRODUCTION

This **APPENDIX** provides additional resources to the manufacturer, design professional, educator, user, or certifying organization. When referenced, the Appendix forms part of the standards (Compliance Requirements).

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ADHESIVE USAGE GUIDE

BASIC REQUIREMENTS:

ADHESIVE used shall be for the intended purpose, applied in accordance with the material suppliers' instructions, and **DELAMINATION** or **SEPARATION** shall not occur, and:

- **LUMBER** shall conform to the requirements established in Section 03.
- **SHEET PRODUCTS** shall conform to the requirements established in Section 04.
- When intended for:
  - **NON-CLIMATE CONTROLLED INTERIOR USE**, it will be **Fully Waterproof.**
  - **CLIMATE CONTROLLED USE**, it will be **Water Resistant:**
  - **CLIMATE CONTROLLED USE** at **DRY AREAS**, it will be manufacturers choice.

GENERIC NAME	MANUFACTURING					INSTALLATION					RIGID GLUE LINE
	Wood to Wood	HPL to Wood		Glass to Wood & HPL	Metal to Wood	Wood to Wood	HPL to Wood		Glass to Wood & HPL	Metal to Wood	
	All Work	Flat Work	Curved Work	All Work	All Work	All Work	Flat Work	Curved Work	All Work	All Work	
NON WATER RESISTANT											
PVA (Polyvinyl Acetate)	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes
Aliphatic Resin	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes
WATER RESISTANT											
CONTACT ADHESIVE	**No**	Yes	Yes	**No**	**No**	**No**	Yes	Yes	**No**	**No**	**No**
	NOTE: curved reception walls or panel work shall incorporate a minimum 1-1/2" (38 mm) wide rigid glue line at spring line and all perimeter borders. ⚠										
HOT MELT *, **	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	NOTE: HPL edgebanding shall be primed before application. ⚠										
POLYURETHANE Reactive (PUR) *, **	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	NOTE: HPL edgebanding shall be primed before application. ⚠										
PVA (Polyvinyl Acetate Crosslinked) *	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes
UREA RESIN	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes
PANEL / CONSTRUCTION ADHESIVE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SILICONE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**No**
FULLY WATERPROOF											
EPOXY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
POLYURETHANE Reactive *, **	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PVA (Polyvinyl Acetate Proprietary) *	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes
RESORCINOL RESIN	Yes	Yes	Yes	**No**	**No**	Yes	Yes	Yes	**No**	**No**	Yes

* Check adhesive material suppliers' listings for water resistant or water-proof ratings.
** Check with adhesive material supplier for specific compatibility when bonding dissimilar materials.

SUGGESTION
RESOURCE GUIDE
CG TC

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CHEMICAL / STAIN RESISTANCE / TESTING

CHEMICAL and/or STAIN RESISTANCE

If chemical and/or stain resistance is a concern, users should consider the chemical and staining agents that might be used on or near casework or countertop surfaces. Common guidelines can be found in:

- **CHEMICAL RESISTANCE** - ISO-4586 (latest edition), iso.org
- **STAIN RESISTANCE** - ASTM D3023 and C1378 (latest editions), astm.org

Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping, and other factors, it is recommended that actual samples are tested in a similar environment with those agents that are of concern.

IN LIEU OF TESTING

To evaluate the resistance a finish has to chemical spills, the SEFA 8-1999 (Scientific Equipment and Fixture Association sefalabs.com), standard list of 49 chemicals / concentrations, their required methods of testing, and their minimum acceptable results have been adapted for use in these standards as the means of establishing a minimum acceptable chemical resistance for exposed and semi-exposed surfaces where required by contract documents.

REQUIREMENT:
Exposed horizontal surfaces, such as countertops, are required to pass a 24-hour exposure test, whereas exposed vertical surfaces and semi-exposed surfaces are required to pass a 1 hour exposure test.

TEST PROCEDURE:
Obtain one sample panel measuring 14" x 24" (356 mm x 610 mm) and test for chemical resistance as described herein:

Place the panel on a flat surface, clean with soap and water, and blot dry. Condition the panel for 48 hours at 73 ±3 °F (20 ±2 °C) and 50% ±5% relative humidity. Test the panel for chemical resistance using the following 49 different chemical reagents by one of the following methods:

- **METHOD A** - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1 oz. (29.574 cc) bottle and inverting the bottle on the surface of the panel.
- **METHOD B** - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 0.945" (24 mm) watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of:

- **ONE (1) HOUR** for exposed vertical surfaces and semi-exposed surfaces.
- **TWENTY-FOUR (24) HOURS** for exposed horizontal surfaces such as countertops.

Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24 hours at 73 ± 3 °F (20 ± 2 °C) and 50% ±5% relative humidity using the following rating system:

TEST RESULT CLASSIFICATIONS:
- **LEVEL 0** - No detectable change.
- **LEVEL 1** - Slight change in color or gloss.
- **LEVEL 2** - Slight surface etching or severe staining.
- **LEVEL 3** - Pitting, cratering, swelling, or erosion of coating; obvious and significant deterioration.

ACCEPTANCE LEVEL:
Results will vary from product to product, and suitability for a given application is dependent upon the chemicals used in each laboratory setting. Without contract documents requiring otherwise, an acceptable level of chemical and stain resistance for products requiring such in accordance with these standards and a project's contract documents shall be finishes with test results **SHOWING NO MORE THAN** four of the Level 3 Result Classifications.

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CHEMICAL / STAIN RESISTANCE / TESTING (continued)

STANDARD LIST OF 49 CHEMICALS / CONCENTRATIONS

	CHEMICAL REAGENT	TEST METHOD
1	Acetate, Amyl	A
2	Acetate, Ethyl	A
3	Acetic Acid, 98%	B
4	Acetone	A
5	Acid Dichromate, 5%	B
6	Alcohol, Butyl	A
7	Alcohol, Ethyl	A
8	Alcohol, Methyl	A
9	Ammonium Hydroxide, 28%	B
10	Benzene	A
11	Carbon Tetrachloride	A
12	Chloroform	A
13	Chromic Acid, 60%	B
14	Cresol	A
15	Dichloroacetic Acid	A
16	Dimethylformamide	A
17	Dioxane	A
18	Ethyl Ether	A
19	Formaldehyde, 37%	A
20	Formic Acid, 90%	B
21	Furfural	A
22	Gasoline	A
22	Hydrochloric Acid, 37%	B
24	Hydrofluoric Acid, 48%	B
25	Hydrogen Peroxide, 3%	B
	CHEMICAL REAGENT	TEST METHOD

	CHEMICAL REAGENT	TEST METHOD
26	Iodine, Tincture of	B
27	Methyl Ethyl Ketone	A
28	Methylene Chloride	A
29	Mono Chlorobenzene	A
30	Naphthalene	A
31	Nitric Acid, 20%	B
32	Nitric Acid, 30%	B
33	Nitric Acid, 70%	B
34	Phenol, 90%	A
35	Phosphoric Acid, 85%	B
36	Silver Nitrate, Saturated	B
37	Sodium Hydroxide, 10%	B
38	Sodium Hydroxide, 20%	B
39	Sodium Hydroxide, 40%	B
40	Sodium Hydroxide, Flake	B
41	Sodium Sulfide, Saturated	B
42	Sulfuric Acid, 33%	B
43	Sulfuric Acid, 77%	B
44	Sulfuric Acid, 96%	B
45	Sulfuric Acid, 77% and Nitric Acid, 70% - equal parts	B
46	Toluene	A
47	Trichloroethylene	A
48	Xylene	A
49	Zinc Chloride, Saturated	B
	CHEMICAL REAGENT	TEST METHOD

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CASEWORK INTEGRITY TESTING

IN GENERAL

These test procedures and their success establishes the minimum acceptable level of integrity and performance for casework / drawer joinery incorporated within NAAWS 4.0.

These tests are unique to NAAWS and were created specifically for the needs of architectural wood casework, and drawers. They replace the SEFA and BIFMA testing previously referenced in NAAWS 3.0 & 3.1.

All of the casework and drawer box joinery listed within NAAWS 4.0 has been successfully tested to these performance requirements by a NAAWS Committee approved facility.

JOINERY, other than that provided for within NAAWS is permitted provided it is fully documented by text / illustration explanation, has been independently tested to show compliance to the performance requirements herein and has been approved by the NAAWS Committee.

- **REQUESTS FOR APPROVAL** of other **CASEWORK** and/or **DRAWER BOX JOINERY** shall be submitted to the NAAWS Committee in accordance with the requirements spelled out at naaws.com.
- **INDEPENDENT TESTING** shall include that conducted by a Federal or Provincial / State regulated university, college or technical (post high school) school, licensed testing facility, or a NAAWS approved testing facility, see naaws.com.
- **DISCLAIMER**
  - **THE SPONSOR ASSOCIATIONS** shall not be responsible to anyone for the use of or reliance upon this testing. The Sponsor Associations shall not incur any obligation nor liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this testing.
  - Illustrations and photographs are intended to assist in understanding the tests and may not include all requirements for a specific product or unit, nor do they show the only methods of fabrication.

- **DEFINITIONS:**
  - **CASEWORK JOINERY TEST:**
    - **FUNCTIONAL** load is 90 lbs. (40.8 kg) / square foot of the bottom, adjustable shelf and top horizontal surface area, rounded up to the nearest 5 lbs. (2.0 kg) and 120 lbs. (54.4 kg) hung on the top of each door edge centered 14" (356 mm) out from the cabinet face. Total test load is 1,050 lbs. (476.3 kg).
    - **PROOF** load is 140 lbs. (63.5 kg) / square foot of the bottom's interior horizontal surface area, rounded up to the nearest 5 lbs. Total test load is 420 lbs. (190.5 kg).
  - **CASEWORK SIDE STRESS TEST:**
    - **PROOF** load is 100 lbs. (40.5 kg) / square foot, rounded to the nearest 5 lbs. (2.0 kg) applied to the cabinet side of a rotated test unit (cabinet is hung with top and bottom vertical to floor). Total test load is 300 lbs. (136.1 kg).
  - **DRAWER JOINERY TEST:**
    - **FUNCTIONAL** load is 300 lbs. (136.1 kg) applied to the drawer box bottom surface.
    - **PROOF load is 200% of the drawer slides minimum load requirement on the back and combined (sub- / finish front) members.**
- **NAAWS EVALUATION TESTS include:**
  - NAAWS Test 10.01 - Casework Joinery (Functional & Proof Loads)
  - NAAWS Test 10.02 - Casework Side Stress (Proof Load)
  - NAAWS Test 10.03 - Drawer Box Joinery (Functional & Proof Loads)

NOTE:

- **EXTREME AMOUNTS OF WEIGHT** have been used in these tests; however, this shall not endorse or imply that similar cabinet or drawer loading is acceptable - the load restrictions within Section 10 of these standards shall govern maximum acceptable loading.

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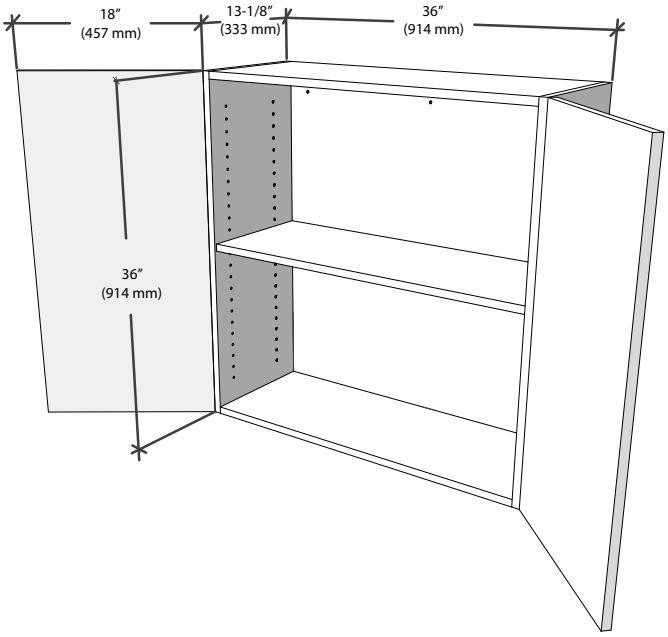
CASEWORK INTEGRITY TESTING (continued)

CASEWORK EVALUATION TEST - 10.01 - Fabrication Joinery - Functional & Proof Loads

TEST UNIT - Will be a single wall hung cabinet 36" (914 mm) x 36" (914 mm) x 13.125" (333 mm) (excluding doors), with one adjustable shelf and a pair of doors. Construction shall be of particleboard with TFL applied to both surfaces with either a plowed in ¼" (6.4 mm) thick or surface applied ½" (12.7 mm) thick back, all in compliance with NAAWS 4.0 minimum Custom Grade fabrication requirements.



NOTE: for weight calculation purposes, the square footage of the test units bottom, adjustable shelf and top shall each be 3.0 square foot, regardless of back thickness and/or fabrication configuration.

TEST PROCEDURES:

- Test unit will be attached to a test wall with appropriate in wall blocking and attachment fasteners all in accordance with NAAWS 4.0 minimum Custom Grade installation requirements.

  Shelf will be installed approximately mid height. Doors will be installed. Installed test unit will be examined and documented as to compliance with NAAWS 4.0 Custom Grade for joinery, shelf side clearance, door alignment / operation and gap tolerance conformance.

- Cabinet components will be uniformly loaded with weight as follows:

FUNCTIONAL LOAD TEST – facilitates a load of 90 lbs. (40.8 kg) per square foot of horizontal surface area, plus an additional 120 lbs. per door for a total test cabinet load of 1,050 lbs. (476.3 kg) distributed as follows:

- **TOP** loaded to 270 lbs. (122.5 kg)
- **SHELF** loaded to 270 lbs. (122.5 kg)
- **BOTTOM** loaded to 270 lbs. (122.5 kg)
- **DOORS** rotated and restrained in a 90° open position, with each loaded with 120 lbs. (54.4 kg) of uniformly applied weight by means of a 2" (50.8 mm) wide web strap centered on the top door edge 14" (356 mm) out from the cabinet body.

ONCE LOADED, cabinet will set for at least 24 hours, load will be removed and then be re-examined and documented as to any signs of joinery failure, shelf side clearance, door alignment / operation or gap tolerances issues.

TEST SUCCESS will show no sign of joinery failure, improper door operation or unacceptable gap tolerances.

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CASEWORK INTEGRITY TESTING (continued)

CASEWORK EVALUATION TEST - 10.01
Fabrication Joinery - Functional & Proof Loads (continued)

PROOF LOAD TEST - facilitates, with doors and shelf removed, a load of 420 lbs. (190.5 kg) uniformly applied to the bottom only.

ONCE LOADED, cabinet will set for at least 24 hours, load will be removed and then be re-examined and documented as to any signs of joinery failure, shelf side clearance, door alignment / operation or gap tolerances issues.

TEST SUCCESS will show no sign of joinery failure.

CASEWORK EVALUATION TEST - 10.02
Cabinet Side Stress

TEST UNIT - Will be the same as used for Test 10.01, with shelf and doors removed.

TEST PROCEDURE:

- Test unit will be rotated (so that the top and bottom are vertical to the floor) and attached to the test wall in accordance with NAAWS 4.0 minimum installation requirements.
- Cabinet side (bottom) will be uniformly loaded with 300 lbs. (136.1 kg)

ONCE LOADED, cabinet will set for at least 30 minutes and then be re-examined for any signs of joinery failure.

TEST SUCCESS will show no sign of joinery failure.

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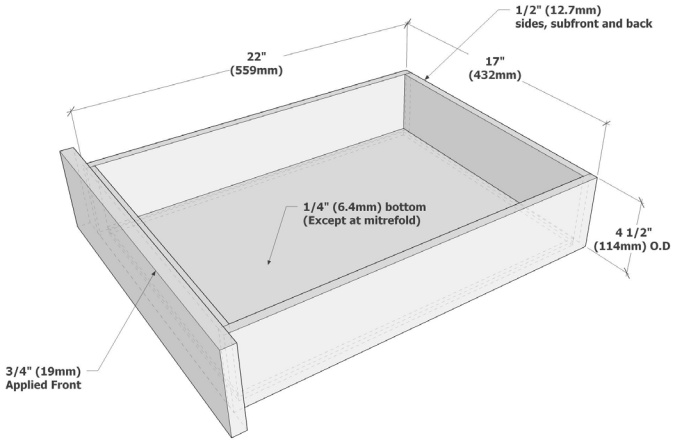
CASEWORK INTEGRITY TESTING (continued)

CASEWORK EVALUATION TEST - 10.03
Drawer Box Joinery

TEST UNIT - Will be construction of particleboard and/or MDF with TFL applied to both surfaces. All construction shall be in compliance with NAAWS 4.0 minimum fabrication requirements.

Test unit consists of a **GENERAL PURPOSE DRAWER** box 17" (432 mm) wide x 22" (559 mm) deep x 4.5" (114 mm) tall with 1/2" (12.7 mm) thick sides, sub-front and back, and 1/4" (6.4 mm) bottom (except at integral miter-fold construction). With a 3/4" (19 mm) x 6" (152 mm) x 16-7/8" (429 mm) HPL faced front attached.

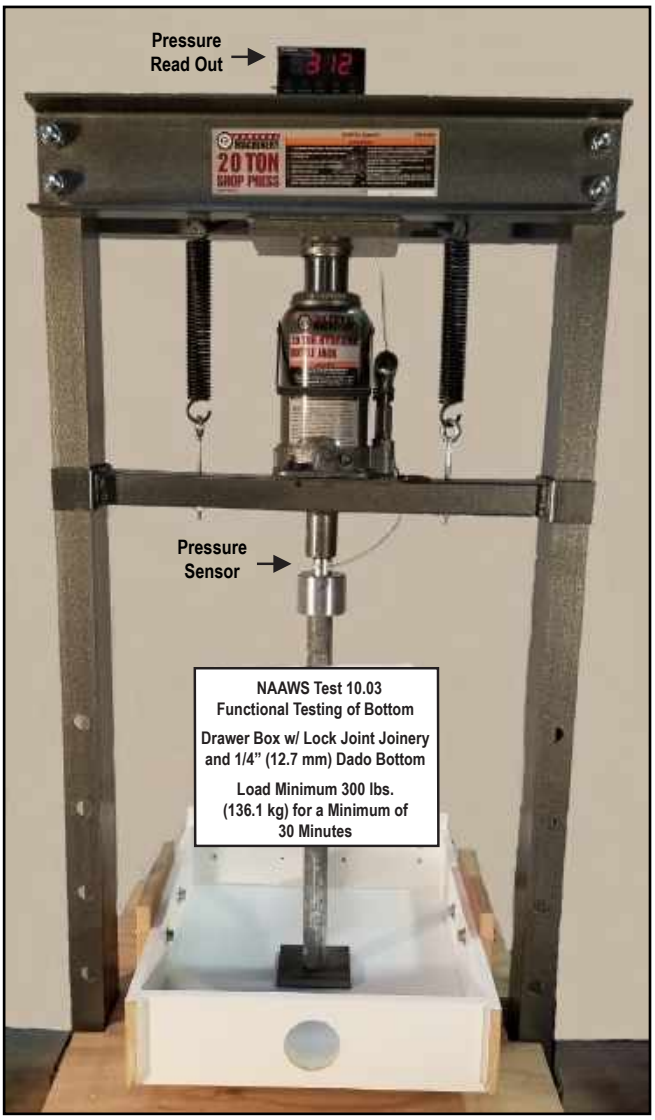


TEST PROCEDURE:

- Test unit **BOTTOM** and **SUB-FRONT / FRONT** components shall be secured in place, facing down, by attachment of side supports with a minimum of 2" of free space below the bottom or sub-front / fronts lower surface.

  Installed test unit will be examined and documented as to compliance with NAAWS 4.0 Custom Grade for joinery. The following minimum bearing surfaces loads will be applied from above:

FUNCTIONAL LOAD TEST – Facilitates a load of 300 lbs. (136.1 kg) on the horizontal drawer bottom surface by means of a 1/2" (12.7 mm) x 4" (102 mm) x 4" (102 mm) steel bearing plate centered on the drawer box bottoms interior surface.



ONCE LOADED, test unit will set for at least 30 minutes and then be examined for any signs of joinery failure.

TEST SUCCESS will show no sign of joinery failure.

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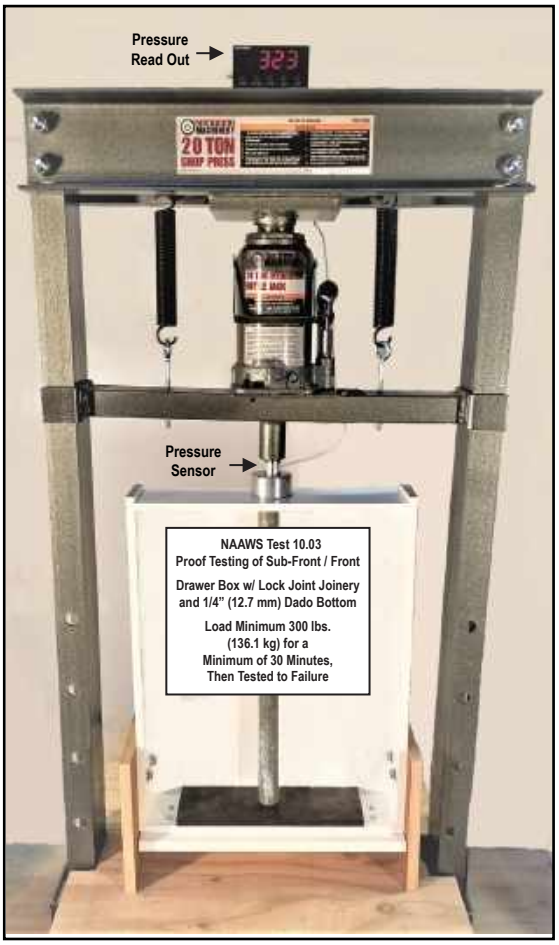
CASEWORK INTEGRITY TESTING (continued)

CASEWORK EVALUATION TEST - 10.03
Drawer Box Joinery (continued)

PROOF LOAD TEST – Facilitates a load equal to 300 lbs. (136.1 kg) on the combined sub-/finish front members surface by means of a 1/2" (12.7 mm) x 4" (102 mm) x 12" (305 mm) steel bearing plate centered on the drawer box sub-front interior surface.



ONCE LOADED, test unit will set for at least 30 minutes and then be examined for any signs of joinery failure.

TEST SUCCESS will show no sign of joinery failure.

DRAWER SUB-FRONT / FRONT will then be tested to failure, by slowly increasing the pressure until any sign of joint failure. The maximum pressure achieved before failure shall be recorded.

NOTE: THE FOLLOWING TYPES OF DRAWER JOINERY listed in Section 10 exceeded weight of 400 lbs. (181.5 kg) prior to joinery failure:

- Lock Joint
- Miter Fold
- Dowel
- Push Pocket

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CABINET DESIGN SERIES (CDS)

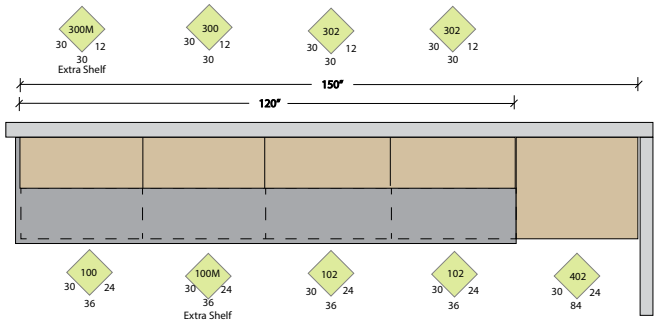
IN GENERAL

CABINET DESIGN SERIES (CDS) casework illustrations are provided to assist design professionals and casework users in selecting typical designs. These illustrations are not intended to limit or restrict creativity, or to be all inclusive. CDS files are available at: naaws.com

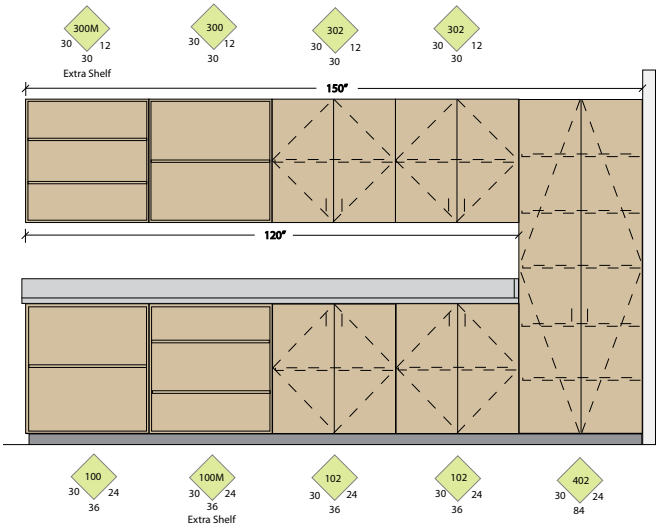
CDS cabinets are intended for **FRAMELESS CONSTRUCTION** with integral finished ends and scribes at wall to wall installations not exceeding 1-1/2" (38.1 mm) in width. Hardware and accessories shall be as provided for in these standards.

UTILIZING THE CDS NUMBERING SYSTEM:

- It is not necessary to show casework elevations in your contract documents. However, it is necessary to show a plan view with each CDS number indicated along with the width, height, and depth in inches or millimeters (example: 102-36"x 30"x 18" [102-914 mm x 762 mm x 457 mm]).
- Cabinet dimensions indicate the nominal outside dimension (floor to top of countertop for height and face of finished wall to face of cabinet door for depth). Manufacturers are permitted a tolerance of plus / minus 1/2" (12.7 mm) in width only.
- If the CDS numbering system is used in conjunction with cabinet elevations on contract documents, the cabinet elevations shall govern on any conflict between the requirements of the elevation and the CDS number.
- When designs other than those provided for in the CDS system are desired, they may be indicated by selecting the CDS number most closely representing the desired design, followed by the letter "M" and a description or illustration of the design modification (example: 102M - 2 shelves - 36"x 30"x 18" [102M - 2 shelves - 914 mm x 762 mm x 457 mm] or 102M - no shelves -36"x 30"x 18" [102M - no shelves -914 mm x 762 mm x 457 mm]).
- It is suggested that a standard number / dimension convention like that shown below in plan view, is used.



Or if so desired, in Elevation



CDS SERIES:

- Base Cabinets w/o Drawers 100 Series
- Base Cabinets w/ Drawers 200 Series
- Wall Hung Cabinets 300 Series
- Tall Storage Cabinets 400 Series
- Tall Wardrobe Cabinets 500 Series

BASE CASEWORK HEIGHTS:

The following cabinet countertop heights are recommended for various school grades, subject to ADA requirements:

- Kindergarten - Grade 1 24" (610 mm)
- Grades 2 - 3 27" (686 mm)
- Grades 4 - 6 30" (762 mm)
- Grades 7 - 9 33" (838 mm)
- Grades 10 and above 36" (914 mm)

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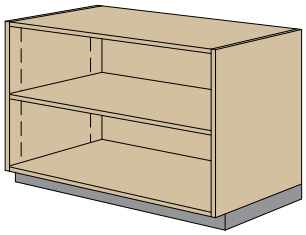
CABINET DESIGN SERIES (CDS) (continued)

100 SERIES - BASE CABINETS without DRAWERS

NOTE:

- **100 Series cabinets may be converted into moveable cabinets (with base removed and casters added) by prefixing a "7" to the CDS number. (Example: 7-102-36"x 30"x 18" [7-102-914 mm x 762 mm x 457 mm]). These cabinets may also be made double sided by indicating such in plan view and noting such requirement.**
- **Moveable cabinets will be equipped with approved casters for the intended load capacity.**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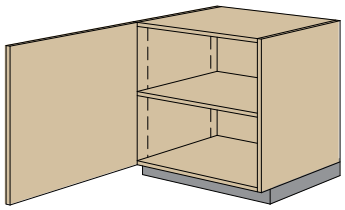
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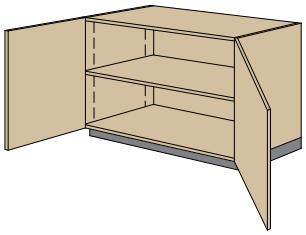
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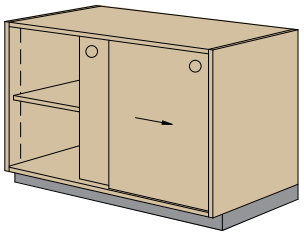
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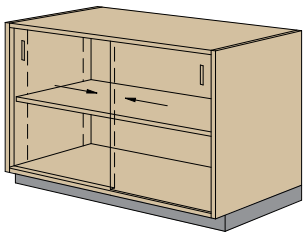
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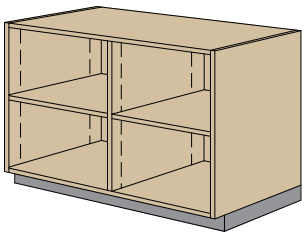
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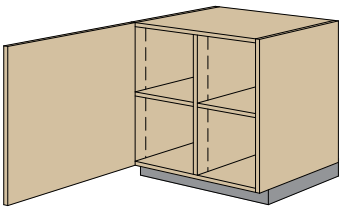
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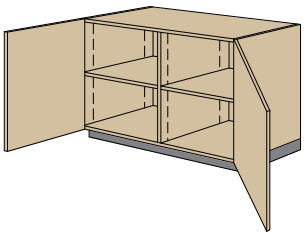
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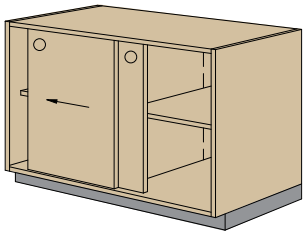
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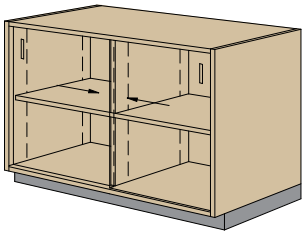
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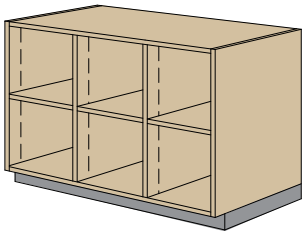
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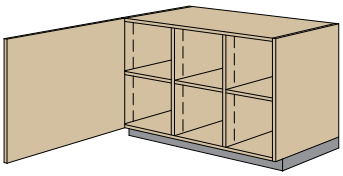
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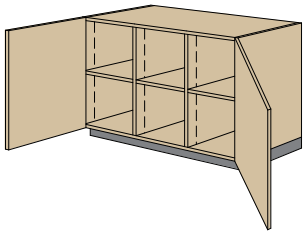
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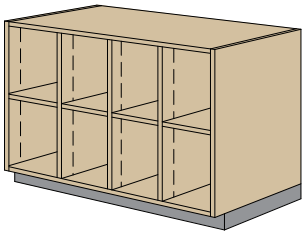
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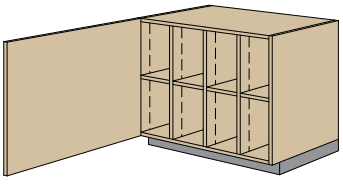
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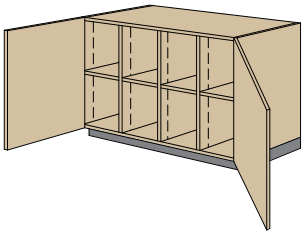
132

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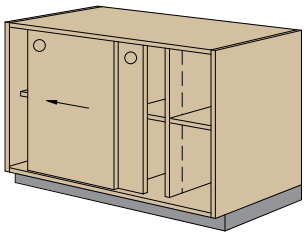
CABINET DESIGN SERIES (CDS) (continued)

100 SERIES - BASE CABINETS without DRAWERS (continued)



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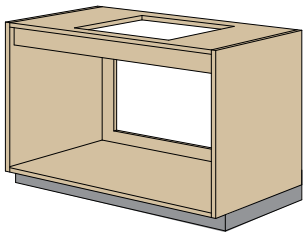

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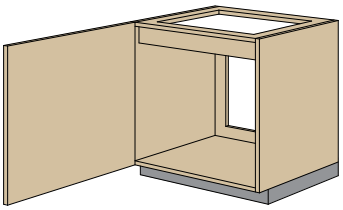
Removable Back



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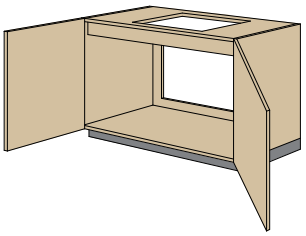

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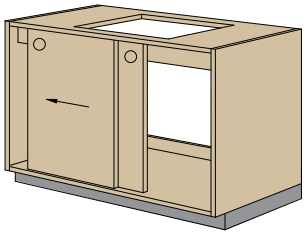

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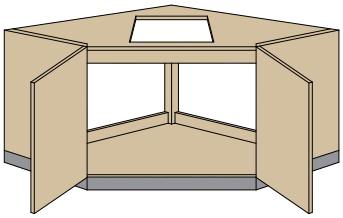

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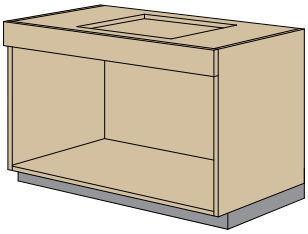

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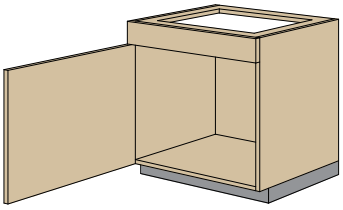

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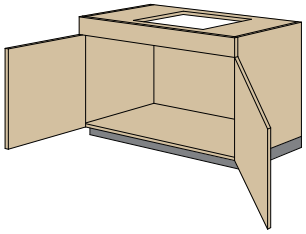

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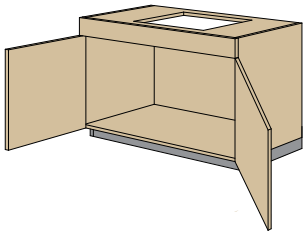

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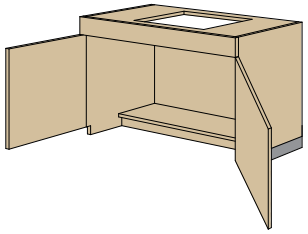
Removable Base / Toe



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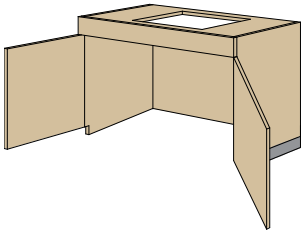

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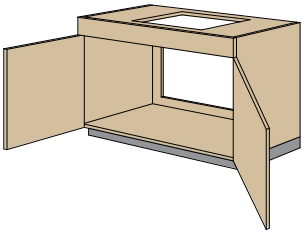
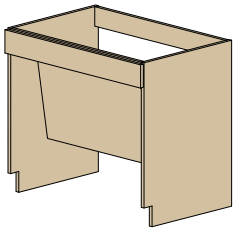
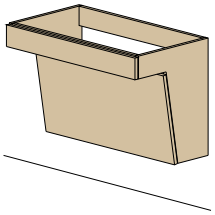


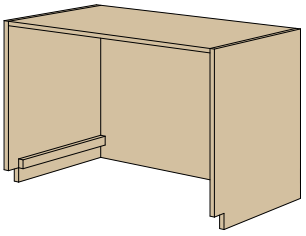
156
Removeable Back



157
Open Back



158
Open Back



160
Cart Storage with Hardwood Guide Rails

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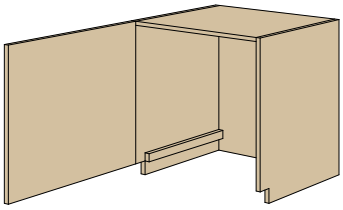
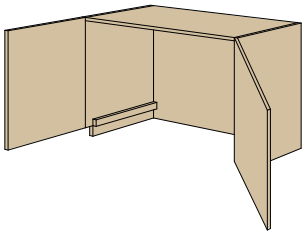
CABINET DESIGN SERIES (CDS) (continued)

100 SERIES - BASE CABINETS without DRAWERS (continued)



161
Cart Storage with Hardwood Side Guides



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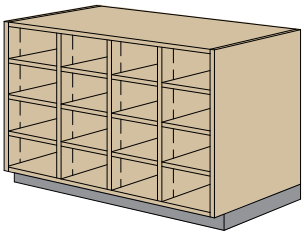
Cart Storage with Hardwood Side Guides



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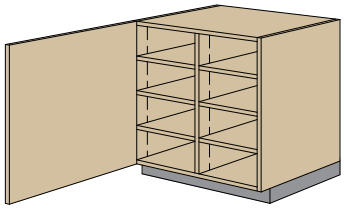

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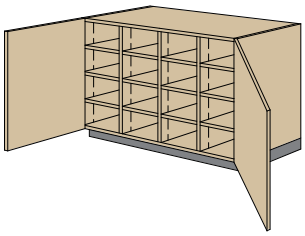

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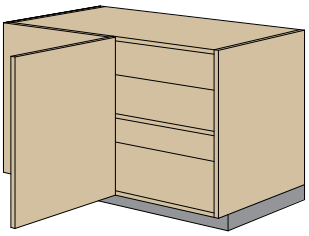
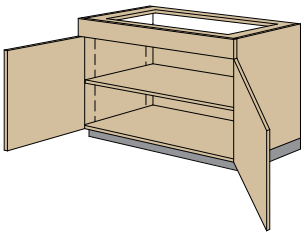


176
Blind Corner



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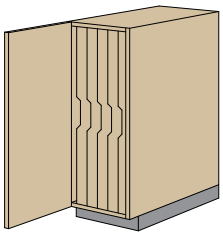

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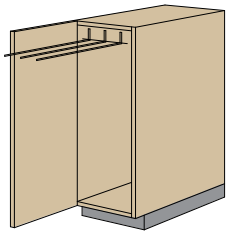
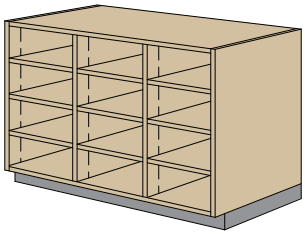


179
Retractable Towel Rack



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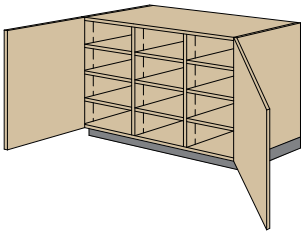

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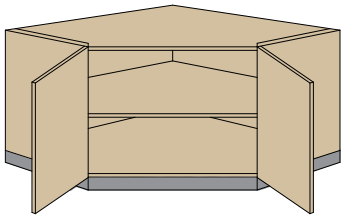
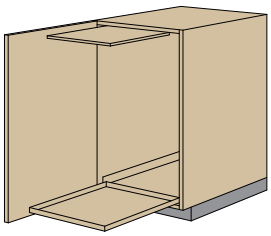
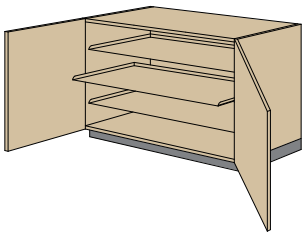


186
Fixed Shelf



187
Sliding Tray & Lift Shelf



188
Slide Out Shelves

SUGGESTION
RESOURCE GUIDE
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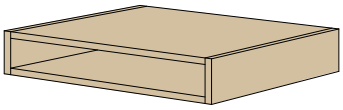
CABINET DESIGN SERIES (CDS) (continued)

100 SERIES - BASE CABINETS without DRAWERS (continued)



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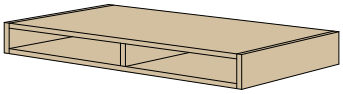

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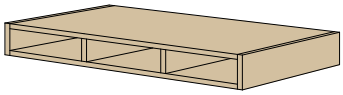

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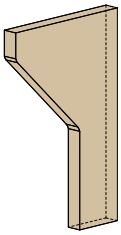

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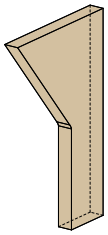

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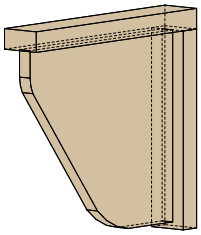

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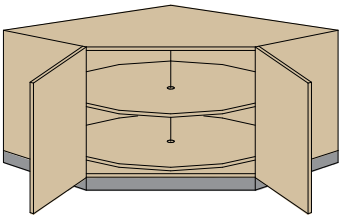
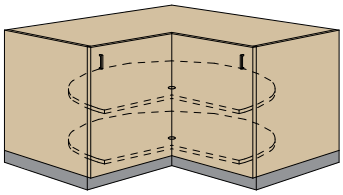


196
Corner Cabinet



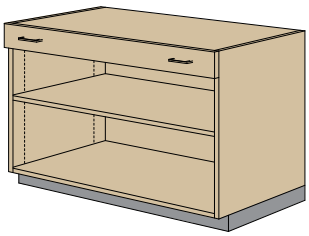
197
Corner Cabinet

CABINET DESIGN SERIES (CDS) (continued)

200 SERIES - BASE CABINETS with DRAWERS

NOTE:

- 200 Series cabinets may be converted into moveable cabinets (with base removed and casters added) by prefixing a "7" to the CDS number. (Example: 7-102-36"x 30"x 18" [7-102-914 mm x 762 mm x 457 mm]). These cabinets may also be made double sided by indicating such in plan view and noting such requirement.
- Moveable cabinets shall be equipped with approved casters for the intended load capacity.



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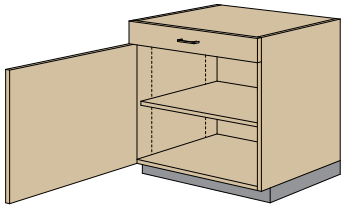

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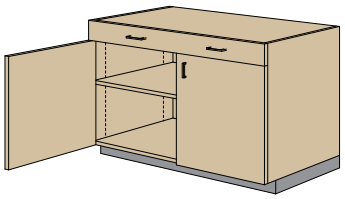

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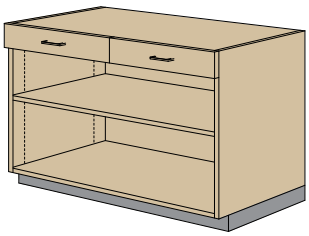

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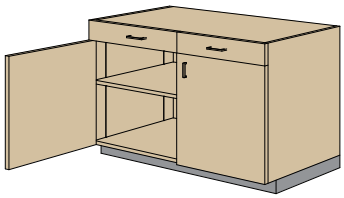

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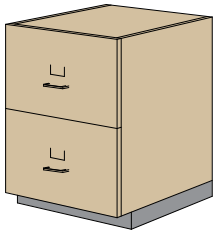
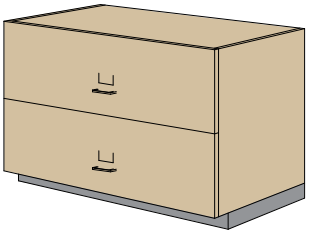


223
File Drawers



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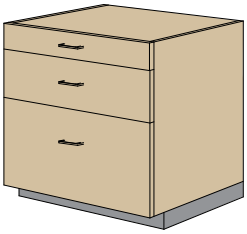
File Drawers



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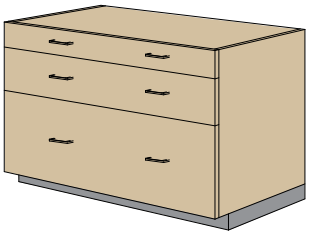
File Drawer



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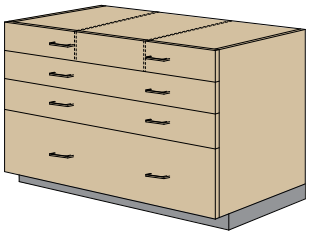
File Drawer



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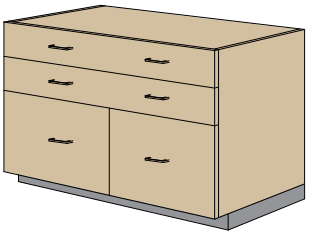
File Drawers



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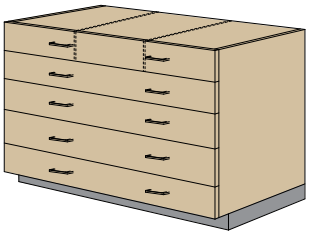
File Drawers



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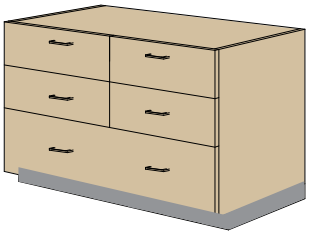

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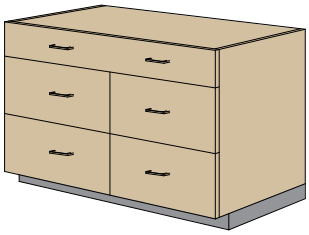

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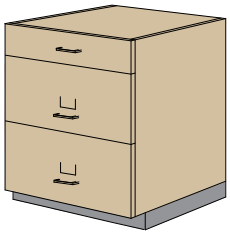

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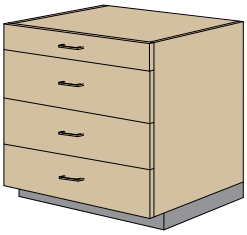
File Drawer



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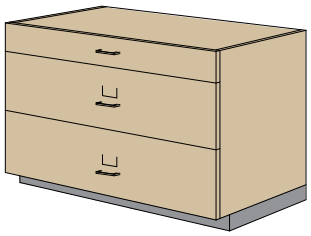
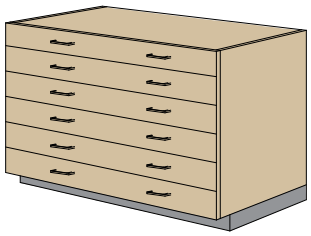
CABINET DESIGN SERIES (CDS) (continued)

200 SERIES - BASE CABINETS with DRAWERS (continued)



255
File Drawers



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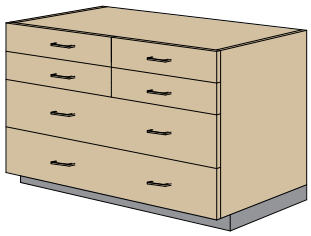

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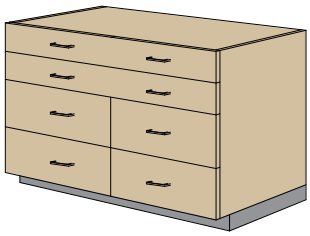

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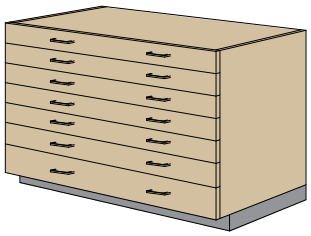

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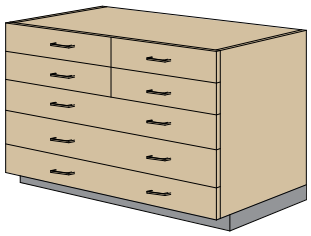

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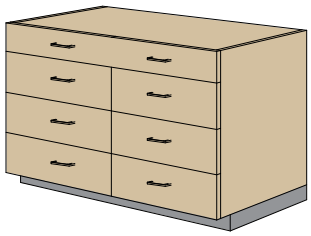

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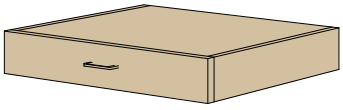

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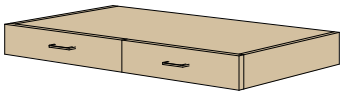

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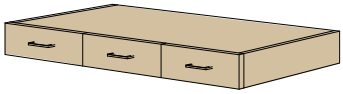

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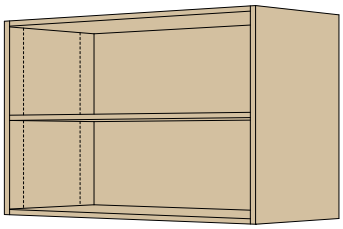
CABINET DESIGN SERIES (CDS) (continued)

300 SERIES - WALL HUNG CABINETS

NOTE:

- Hutch cabinets may be created by stacking 300 Series cabinets on 100 and 200 Series cabinets; however, any exposed top of the 100 or 200 Series cabinet must be finished or covered by a supplemental top. To show such simply list the upper 300 Series cabinet with the appropriate 100 or 200 Series cabinet immediately below it such as: **317-36" x 30" x 12"** / **231-36" x 36" x 24"**



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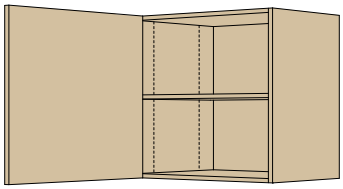

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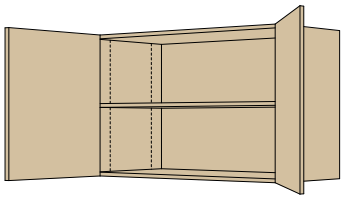

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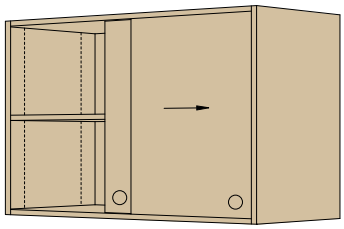
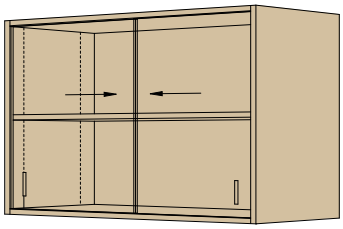
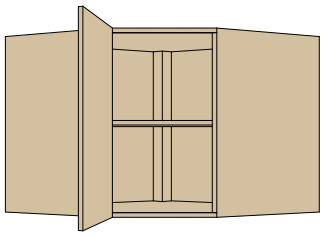


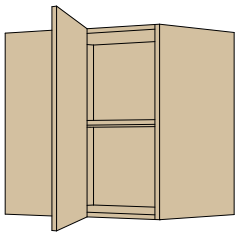
306
Sliding Doors



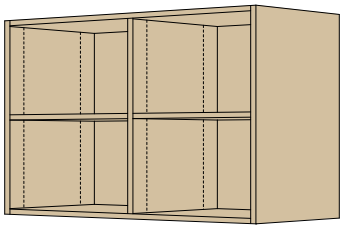
307
Sliding Glass Doors



308
Angle Corner



309
Blind Corner



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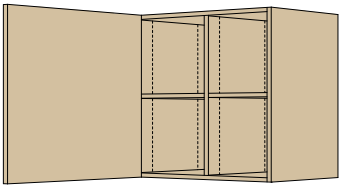

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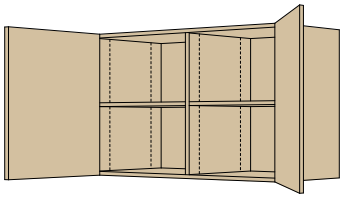
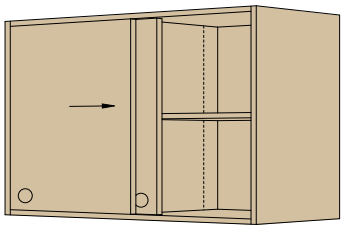
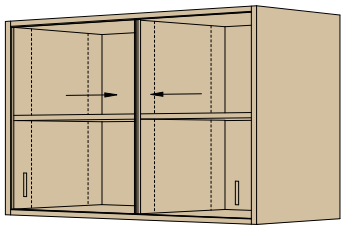


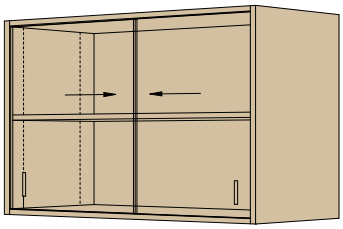
312



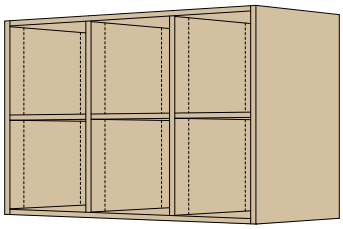
316
Sliding Doors



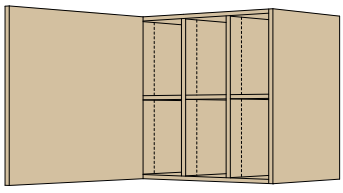
317
Sliding Glass Doors



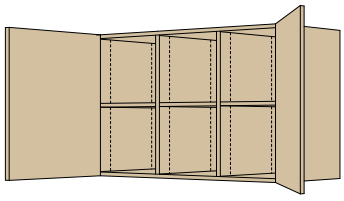
318
Sliding Glass Doors



320



321



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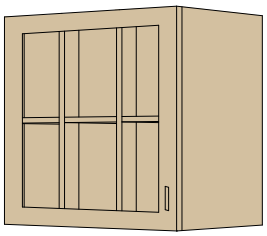
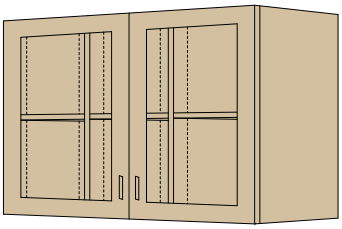
CABINET DESIGN SERIES (CDS) (continued)

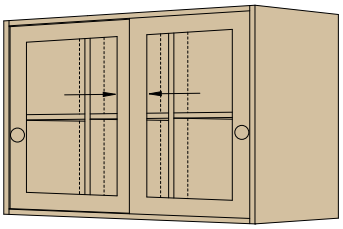
300 SERIES - WALL HUNG CABINETS (continued)



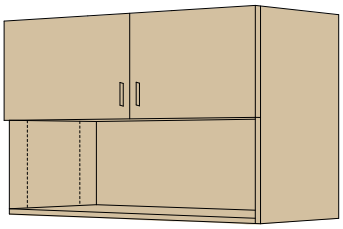
323
Glass Lite Door



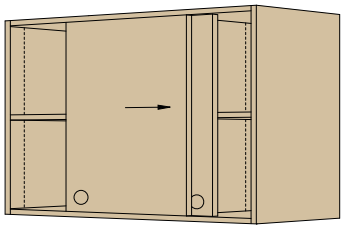
324
Glass Lite Doors



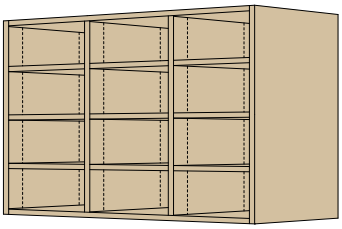
325
Sliding Glass Lite Doors



326



336
Sliding Doors



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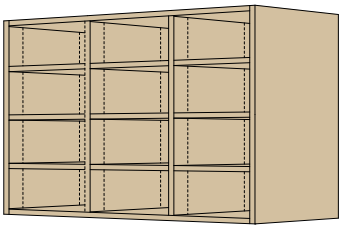
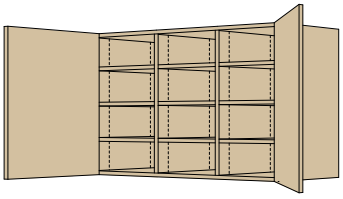


341
Open Back



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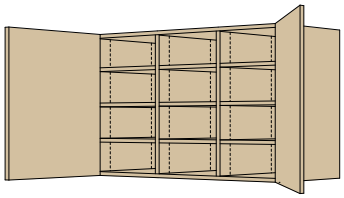

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Open Back

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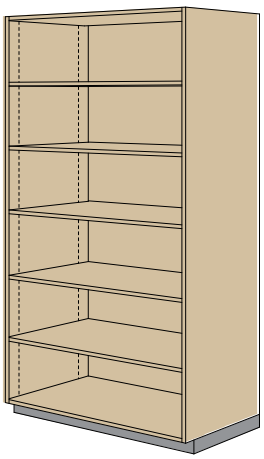
RESOURCE GUIDE

CG TC

CABINET DESIGN SERIES (CDS) (continued)

400 SERIES - TALL STORAGE CABINETS

NOTE:
These cabinets may also be made double sided by indicating such in plan view and noting such requirement.



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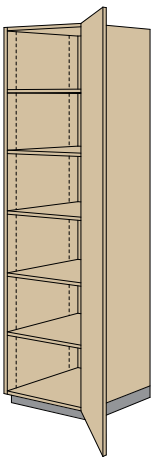
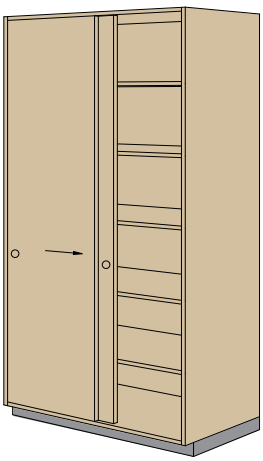
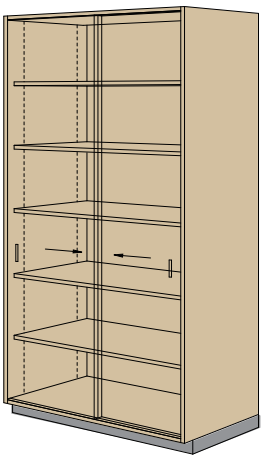


401

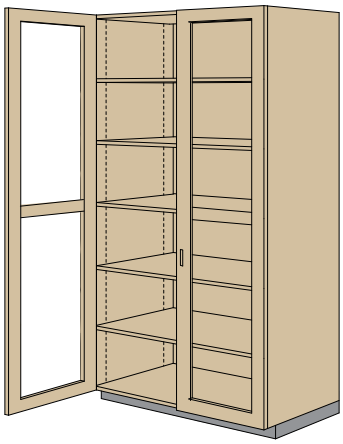
402



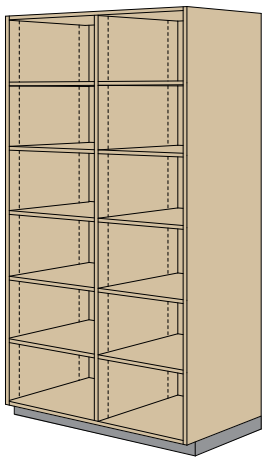
406
Sliding Doors



407
Sliding Glass Doors



408
Two Lite Glass Doors



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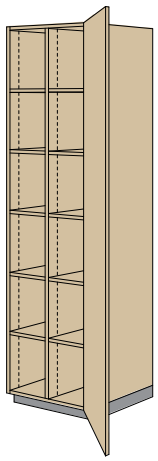

411

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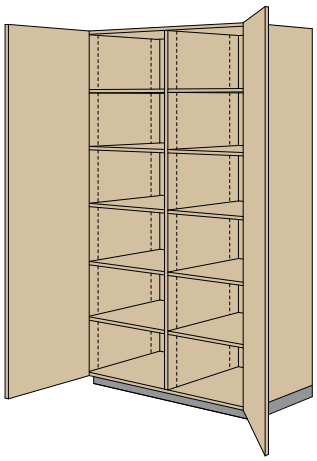
CABINET DESIGN SERIES (CDS) (continued)

400 SERIES - TALL STORAGE CABINETS (continued)



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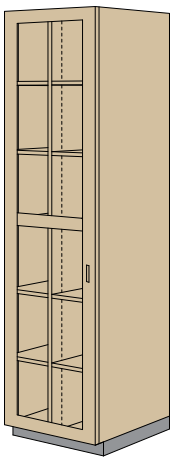
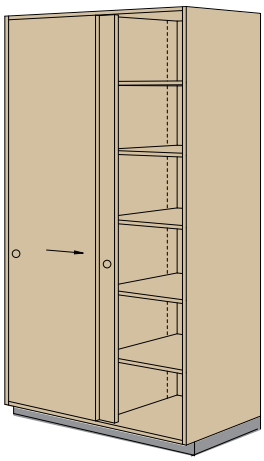
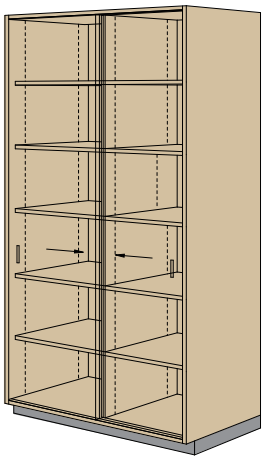


413
Two lite Glass Door

414
Two Lite Glass doors

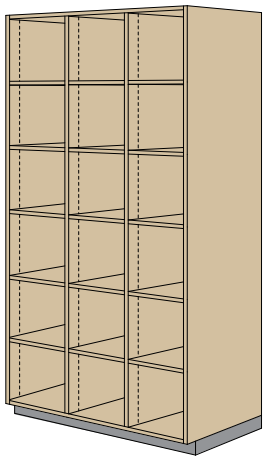


416
Sliding Doors



417
Sliding Glass Doors

419
Sliding Two Lite Glass Doors



420

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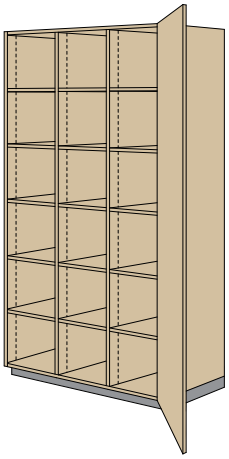
CABINET DESIGN SERIES (CDS) (continued)

400 SERIES - TALL STORAGE CABINETS (continued)



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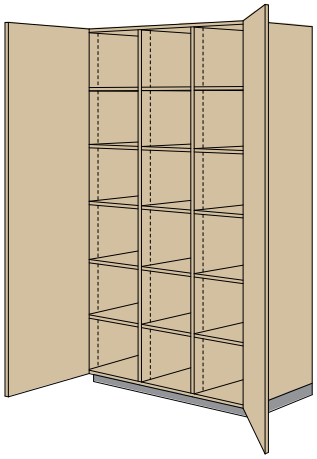

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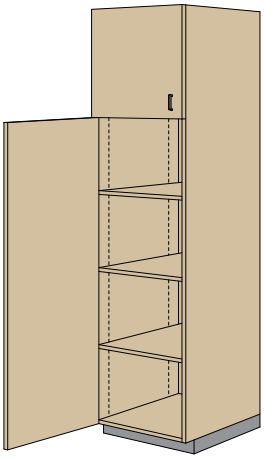
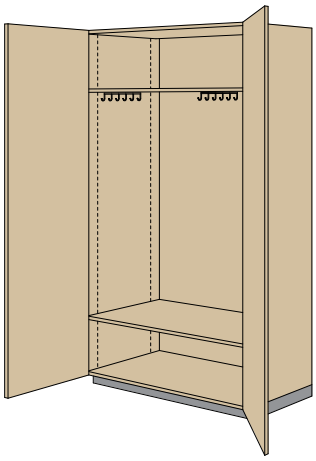
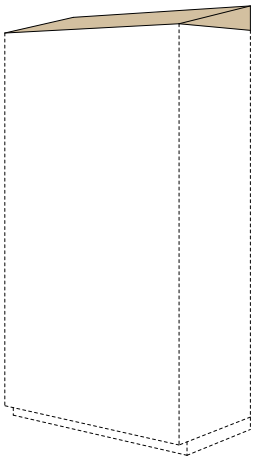


423
Fixed Shelf

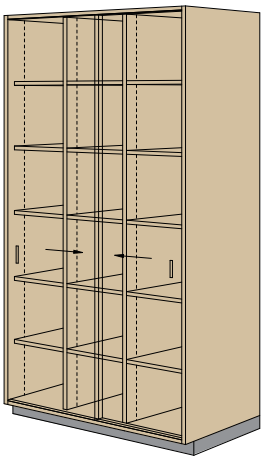
424
Fixed Shelf



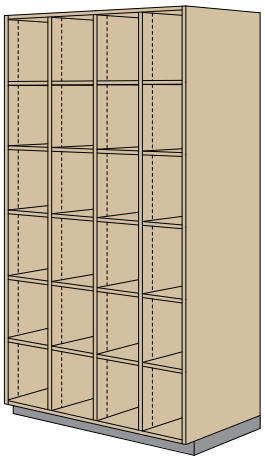
425
Adjustable Shelf w/ Pull out Hooks



426
Sloping Dust Top



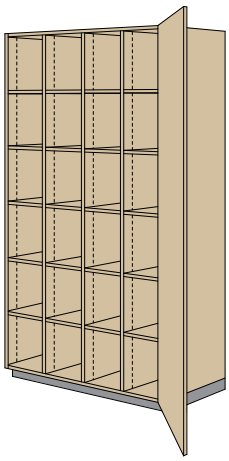
427
Sliding Glass Doors



430

CABINET DESIGN SERIES (CDS) (continued)

400 SERIES - TALL STORAGE CABINETS (continued)



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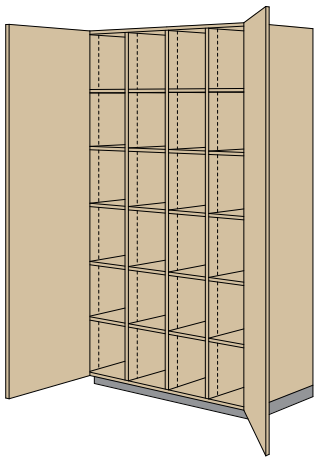

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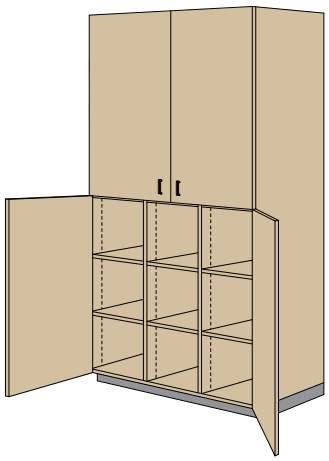

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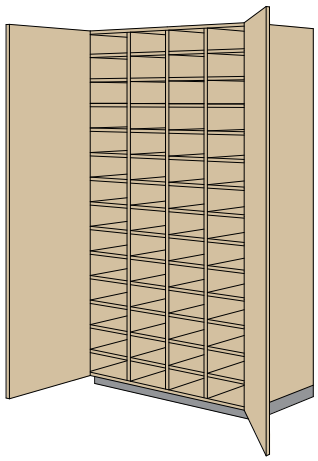

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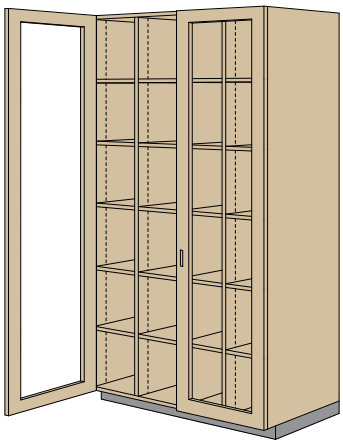
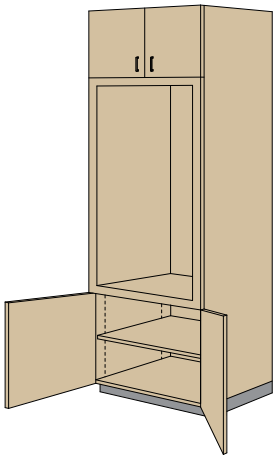
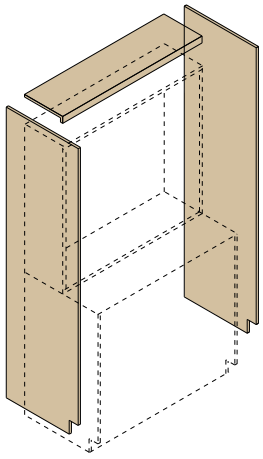


438
Two Lite Glass Doors



454
Appliance Opening



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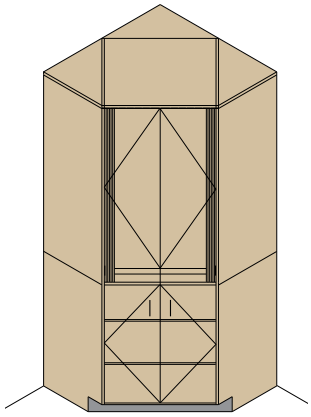

461

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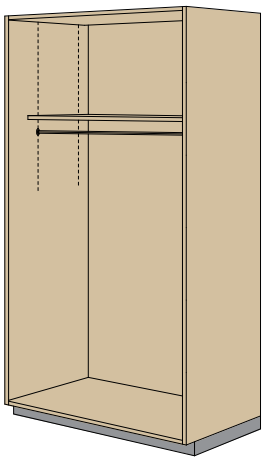
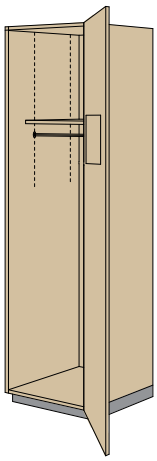
CABINET DESIGN SERIES (CDS) (continued)

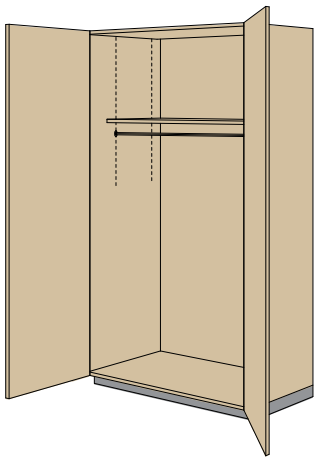
500 SERIES - WARDROBE CABINETS



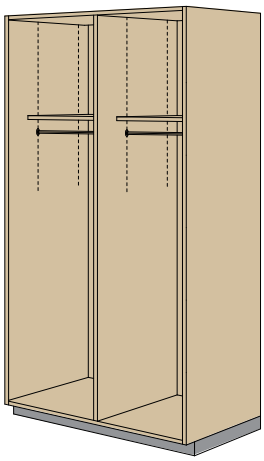
500
Shelf & Pole



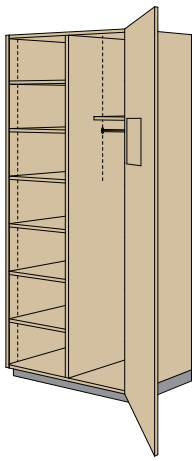
501
Shelf, Pole & Mirror



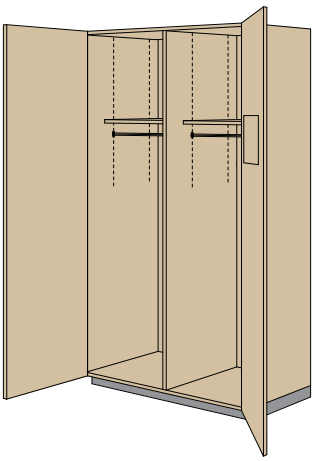
502
Shelf & Pole



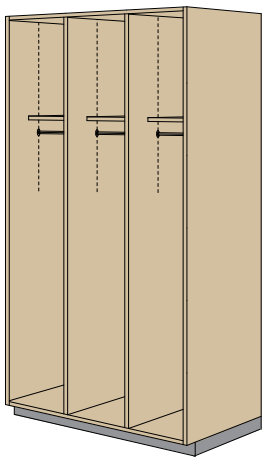
510
Shelves & Poles



511
Shelf, Pole & Mirror



512
Shelves, Poles & Mirror



520
Shelves & Poles

522
Shelves, Pole & Mirror

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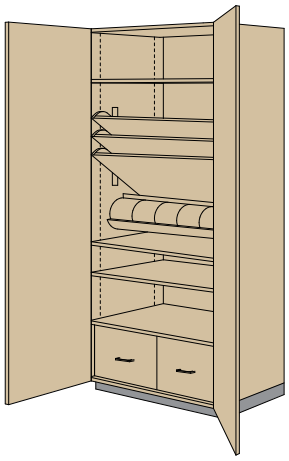
CABINET DESIGN SERIES (CDS) (continued)

500 SERIES - WARDROBE CABINETS (continued)

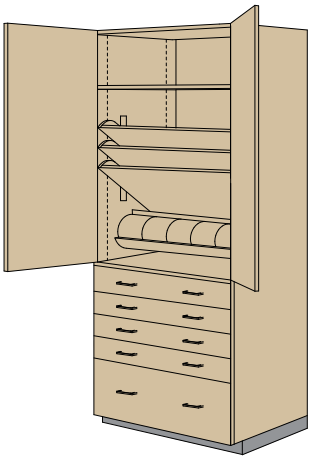
530
Shelf, Pole & Mirror

531
Shelf, Pole & Mirror
File Drawers

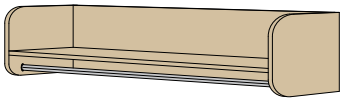
532
Shelf, Pole & Mirror
File Drawers
Vertical Dividers



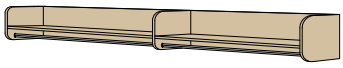
533
File Drawers
Paper Roller / Cutter
Slide Out, Tilting Paper Shelves



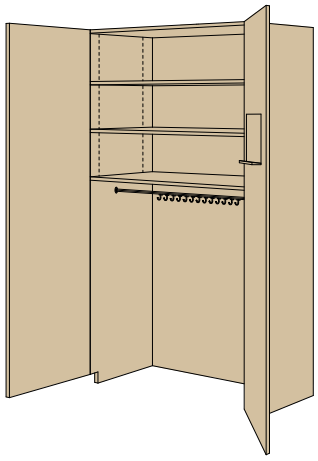
534
Paper Roller / Cutter
Slide Out Tilting Paper Shelves



540
Shelf & Pole



541
Shelf & Pole



552
Pole w/ Wall Hooks
Fixed Shelf

END OF APPENDIX

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A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

GLOSSARY

A | B | C | D | E | F | G | H | I

J | K | L | M | N | O | P | Q | R

S | T | U | V | W | X, Y, Z

INTRODUCTION

The **GLOSSARY** consists of definitions of words used within these standards and is intended to clarify terms and their usage with regard to specific application within the standards.

A

ABRASION RESISTANCE: Resistance to friction wear.

ABS: Abbreviation for "Acrylonitrile butadiene styrene", a synthetic plastic used as a decorative coating or edgebanding.

ACCESS DOOR(s): A panel that allows access to fixtures, ducts, valves, switchboards, pipes, wires, safes, and anything else that's installed or located behind a wall, ceiling, or floor.

ACRYLIC LACQUER: In finishing, a high-quality clear system for finishing furniture.

ADHESION: The degree of attachment between a finish step and the underlying material.

ADHESIVE: A substance capable of bonding materials together by surface attachment. It is a general term and includes all cements and glues.

ADHESIVE, COLD PRESS AND HOT PRESS: "Cold press" means no heat is applied to the press while in operation. "Hot press" means heat is applied at the time the press is in operation.

ADHESIVE, FULLY WATERPROOF: Forms a bond that will retain practically all of its strength when frequently subjected to a thorough wetting and drying; bond shall be of such quality that specimens will withstand shear and the two cycle boil test specified in ANSI/HPVA HP-1 (latest edition) often referred to as Type I.

ADHESIVE, WATER RESISTANT: Forms a bond that will retain practically all of its strength when occasionally subjected to a thorough wetting and drying; bond shall be of such quality that specimens will withstand the three cycle cold soak test specified in ANSI/HPVA HP-1 (latest edition) often referred to as Type II.

ADJACENT: When one surface is directly next to or touching another surface with no other surfaces in between the two.

ADJACENT PANEL: When one panel surface is within 6" (152 mm) of another panel surface on the same plane within a room.

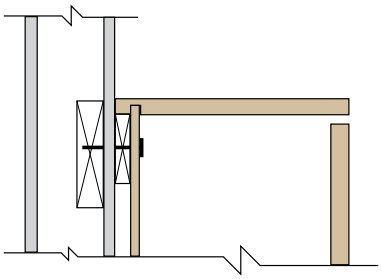
ADJUSTABLE SHELVES: Generally accomplished through the use of multiple holes with either plastic or metal pins to hold the shelves. Some metal or plastic shelf standards are still in use. The adjustment method is the manufacturer's option unless otherwise specified.

AGRIFIBER: Refers to core products made from the residual material from a grain crop similar in composition to particleboard. Shall meet or exceed the performance properties of ANSI A208.1 or 2 compositepanel.org

AIR DRIED: Seasoned by controlled exposure to the atmosphere, in the open or under cover, without artificial heat.

ALL HEART: Of heartwood throughout; free of sapwood.

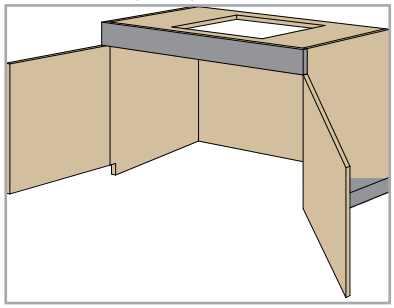
ANCHOR STRIPS: Used to mount woodwork; other names include nailers, mounting cleats, hanging strips, spacers and wall cleats.



ANCHORAGE FASTENER: Installation screws used to attach casework to walls. Screw requirements are as described in section 10.

ANILINE DYE: A synthetic dye often used to impart enhanced clarity of color to wood.

APRON: For purposes of these standards, means a horizontal trim member below the countertop typically at knee spaces or open sink areas.



ARCHITECTURAL WOODWORK: Custom woodworking, so varied in design and complexity that it becomes difficult to define; specified for special applications and functions by design professionals and created by manufacturers. It includes all interior woodwork exposed to view in a finished building (except specialty items of flooring, shingles, structural wood trusses and rafters, and overhead type doors), including all exposed wood, plywood, TFL, HPL, and doors. Items made of other materials are included only if called for in the specifications. Finishing may be included if specified. Site installation may also be included if specified.

ARRIS: In architecture, a sharp edge formed by the meeting of two flat or curved surfaces.

ARTICULATED JOINT: In architectural paneling, joint details that allow for field variations.

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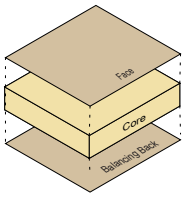
B

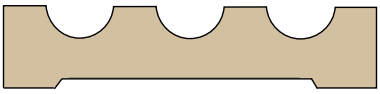
B-STAGE CURING: Is a process that utilizes heat or UV light to remove the majority of solvent from a substance, thereby allowing application to be "staged." In between application, coating and curing can be held for a period of time, without sacrificing performance.

BACK: The side reverse to the face of a panel, or the poorer side of a panel in any Grade of plywood calling for a face and a back.

BACK VENEER: The veneer placed on the semi-exposed or concealed face of a veneered panel construction to balance the construction. Also, the side reverse to the face of a panel, or the poorer side of panel in any Grade calling for a face and a back.

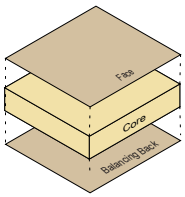


BACKED OUT: Wide, shallow area machined on the back surface of wide solid moldings and some frames. Allows the item to span irregular surfaces.

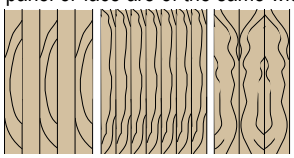


BACKER MATERIAL: A sheet product with performance properties determined by its material composition. Because material composition types vary then backer sheet types accordingly vary in performance properties. Which backer sheet material is used should be based on overall product demands? When used as a balancing sheet a backer must have performance properties equal to an opposing surface with a similar adhesive and application process as the face sheet. (See BALANCING SHEET) Otherwise a backer sheet need not have performance properties equal to an opposing surface.

BALANCED CONSTRUCTION: To achieve balanced construction, panels should be symmetrical from the center line; i.e., use materials on either side that contract or expand, or are moisture permeable, at the same rate. Balanced finishing coats on the back of veneered panels are also highly recommended. Balancing sheet requirements for HPL fabrication vary with the product. Doors and panels should have a balancing sheet on the back side and be applied in the same machine direction. Countertops or cabinet members, on the other hand, require some form of backer material.



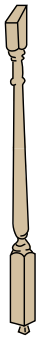
BALANCED MATCH: A common term in book matching that uses two or more leaves of uniform width on the face of a panel, wherein the two outermost leaves in a panel or face are of the same width.



BALANCING SHEET: A sheet product with performance properties equal to an opposing surface. A balancing sheet is laminated to the secondary surface of a core with the same adhesive and application process as the primary surface material (i.e., face material) to maintain the panel's flatness. Typically, a balance sheet is used to balance a panel that will not be captured or restrained (e.g., doors).

BALANCING SPECIES: A species of similar density to achieve balance by equalizing the rate of moisture absorption or emission.

BALUSTER: One of the repetitive vertical members below a handrail or guardrail to provide support and a functional barrier.



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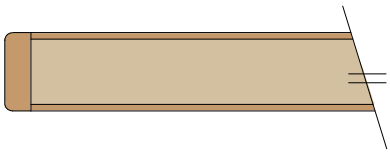
BALUSTRADE: The assembly of newels, balusters, and rails that make up the safety barrier along balconies and open sides of stairways and ramps.

BANDED: Usually refers to the application of material to the edge of a built-up member to cover or hide the otherwise exposed core, such as on plywood.



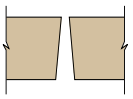
BARBER POLE: An effect in book matching of veneers resulting from tight and loose sides of veneers causing different light reflections when finished.

BARK POCKET: Bark around which normal wood has grown.

BEDDING IN PUTTY: Glazing whereby a thin layer of putty or bedding compound is placed in the glass rabbet, and the glass is inserted and pressed onto this bed.

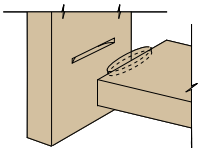
BEVEL: An angle other than a right angle; e.g., a 3-degree bevel, which is equivalent to a 1/8" (3.2 mm) drop in a 2" (50.8 mm) span. Also, in flooring or wall paneling, a V shaped groove between strips, planks, or panels.

BEVELED EDGE: An edge of the door that forms an angle of less than 90 degrees with the wide face of the door, such as a 3-degree beveled edge.



BIRD'S EYE: Decorative figure due to small conical depressions in the outer annual rings, which appear to follow the same contour in subsequent growth rings, probably for many years. Rotary slicing cuts the depressions crosswise, exposing a series of circlets called bird's eyes.

BISCUIT SPLINE: A concealed oblong shaped spline used to join adjacent members.



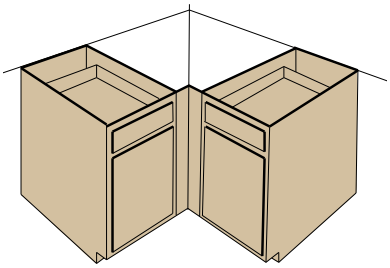
BKL: The HPL acronym for "Backer Laminate".

BLEACHING: The chemical process used to remove color or whiten solid wood or wood veneered panels. This process may be used to lighten an extremely dark wood or to whiten a lighter colored wood. Most woods do not turn completely white when bleached.

BLEEDING: When the color of one coating material migrates up through the finishing layer to the succeeding coat, imparting some of its characteristics.

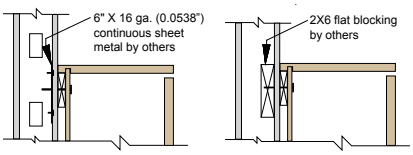
BLENDING: Color change that is detectable but that does not detract from the overall appearance of the panel.

BLIND CORNER: The space created by abutting cabinets at an angle.



BLISTERING: The formation of bubbles on the surface of a coating, caused by trapping air or vapors beneath the surface; an area where veneer does not adhere; a figure resembling an uneven collection of rounded or blister like bulges caused by the uneven contour of annual growth rings.

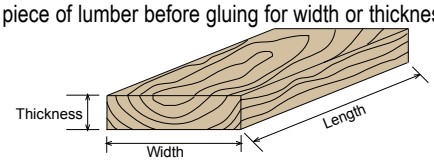
BLOCKING: Commonly understood as the support material placed within or upon gypsum board and plaster walls to support casework.



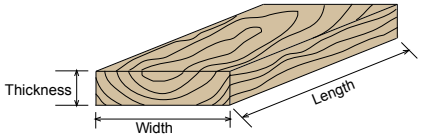
BLUEPRINT SEQUENCED PANELS AND COMPONENTS: Each panel for walls and components (e.g., desk, doors) is custom manufactured to the specific size required. All panels are balance matched and sequenced to the adjacent panels.

BLUSHING: The whitish, cloud like haze that occurs in fast drying finishes, especially lacquer, when they are sprayed in very humid conditions. Blushing is most often due to moisture (water vapor) trapped in the film or to resin precipitating out of solution.

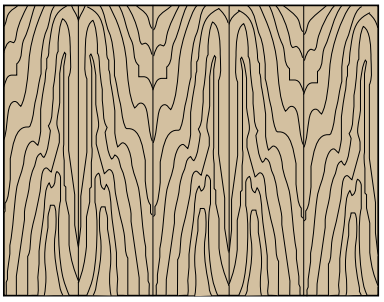
BOARD: A piece of lumber before gluing for width or thickness.



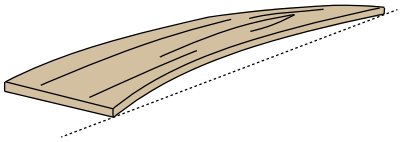
BOARD FOOT: A unit of measurement of lumber represented by a board 12" (305 mm) long, 12" (305 mm) wide, and 1" (25.4 mm) thick when rough sawn and before final milling. Abbreviated BF, Bf, bf. When stock is less than 1" (25.4 mm) thick, it is usually calculated as if it were a full 1" (25.4 mm) thick.



BOOK MATCH: Matching between adjacent veneer leaves on one panel face. Every other piece of veneer is turned over so that the adjacent leaves are "opened" as two pages in a book. The fibers of the wood, slanting in opposite directions in the adjacent leaves, create a characteristic light and dark effect when the surface is seen from an angle.



BOW: A deviation, flat wise, from a straight line drawn from end to end of a piece. It is measured at the point of greatest distance from the straight line.

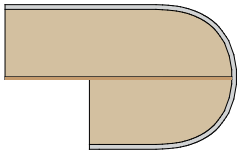


BOX STRINGER: See closed stringer.

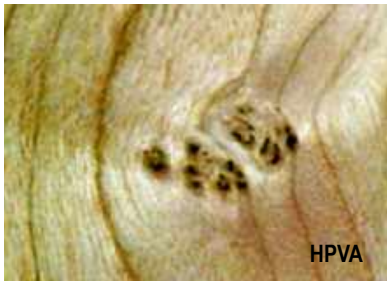
BUCKS (ROUGH BUCKS): In wall blocking used for the installation of door / window jambs and other woodwork in conjunction with metal framing and/or block walls.

BUGLE HEAD SCREW: Is similar to countersunk; however, there is a smooth progression from the shaft to the angle of the head, similar to the bell of a bugle. This term is generally used in referencing drywall screws. They are not allowed in architectural woodwork assembly.

BULLNOSE: A convex, rounded shape such as the front edge of a stair step or countertop.

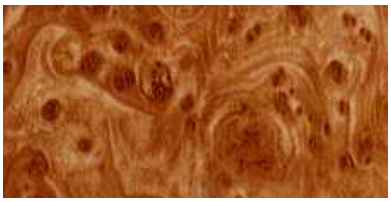


BURL: A figure created by abnormal growth or response to injury that forms an interwoven, contorted, or gnarly mass of dense woody tissue on the trunk or branch of the tree. Burls are usually small and characterized by eye like markings surrounded by swirls and clusters of distorted tissues. The measurement of the burl is the average of the maximum and minimum dimensions of the burl.

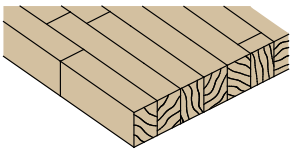


BURL, BLENDING: A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch but does not contain a knot and does not contain abrupt color variation. A blending burl is detectable at 72" (1829 mm) as a swirl or roundel.

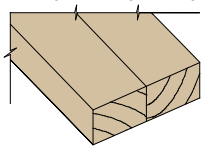
BURL, CONSPICUOUS: A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch. A conspicuous burl is associated with abrupt color variation and/or a cluster of small dark piths caused by a cluster of adventitious buds.



BUTCHER BLOCK: Generally, refers to face laminate hardwoods (usually Maple) forming a work surface in which the edge grain is exposed to wear. End-Grain Butcher Block is not commonly utilized in architectural woodwork.



BUTT JOINT: A joint formed by square edged surfaces (ends, edges, faces) coming together; end butt joint, edge butt joint.



SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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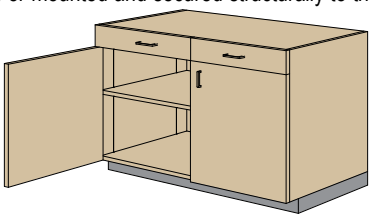
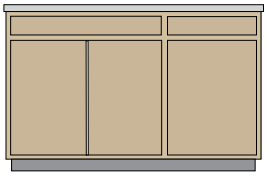
C

CABINET, BASE: A cabinet less than 72" (1829 mm) in height that either rests or is attached to the floor and is either free standing (and finished all sides) or mounted and secured structurally to the wall.



CABINET FACE: The outermost surface of a cabinet unit that allows access to the interior of the cabinet unit, including door faces, drawer faces or false front faces. Does not include ends, sides, top, bottom or back. If the cabinet is an open cabinet, the cabinet face is the outermost front exposed edges of the cabinet box.

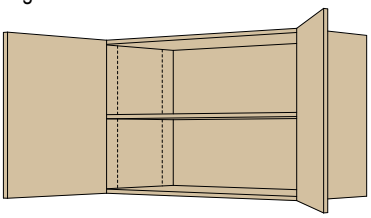


CABINET LINER: See "CLS".

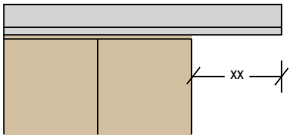
CABINET, TALL STORAGE: A cabinet 72" (1829 mm) or more in height that either rests or is attached to the floor and is either free standing (and finished all sides) or mounted and secured structurally to the wall.

CABINET UNIT: A single manufactured case typically consisting of two ends, a top, a bottom, and may include back, stretchers, anchor strips, shelves, doors, drawer fronts, drawers, dividers, and hardware.

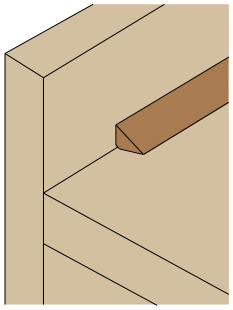
CABINET, WALL: A cabinet that is mounted and secured structurally to a wall without resting on the floor.



CANTILEVER: A projecting structure that is attached or supported at only one end, such as an extended countertop.



CANT STRIP: A triangular shaped or beveled strip of material used to ease the transition from a horizontal plane to a vertical plane.



CAPTURED: A component whose perimeter is mechanically fastened or joined to other components so that it's not allowed to warp independent of those attached components.

CASEWORK: Base and wall cabinets, display fixtures, and storage shelves. The generic term for both "boxes" and special desks, reception counters, nurses' stations, and the like. Generally, includes the countertops and work surfaces. As normalized within NAAWS through:

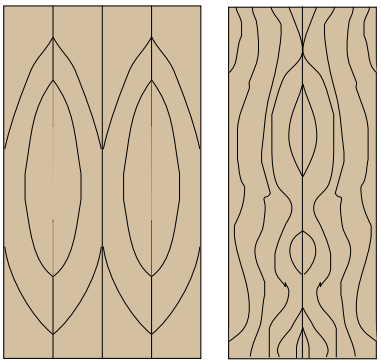
ANSI/KCMA 161.1 - kcma.org
IANSI/BIFMA X5.9 - bifma.org
SEFA 8 - sefalabs.com

CATALYZED: In finishing, a system using a reactive agent (catalyst) to accelerate or enhance drying, adhesion or performance.

CATHEDRAL GRAIN: A grain appearance characterized by a series of stacked and inverted "V" or cathedral type of springwood (early wood) / summerwood (late wood) patterns common in plain sliced (flat cut) veneer.

CAULK: Either the action of making a watertight or airtight seal between two adjacent surfaces by filling the area between the surfaces with a sealant, or the sealant itself.

CENTER MATCHED: A form of veneer matching that uses two or more even numbered leaves, matched with a joint occurring in the center of the panel. A small amount of the figure is lost.



CGS (Compact Laminate)**:** Is constructed with layers of paper, dipped in resin and dried. These layers are then sandwiched between laminated top and bottom sheets, compressed and baked. A process called polymerization melds them all together creating a solid- core panel that is an extra tough durable laminate. Solid Phenolic is a subset of CGS (Compact Laminate) which is produced using phenolic treated Kraft paper or fibers.

CHAIN OF CUSTODY: A method of tracking the handling of a wood product from forest to delivery of a finished product. Each step of transportation and manufacturing is documented for verification of the handling process.

CHAMFER: To cut away the edge where two surfaces meet in an exterior angle, leaving a bevel at the junction.

SUGGESTION

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CG TC

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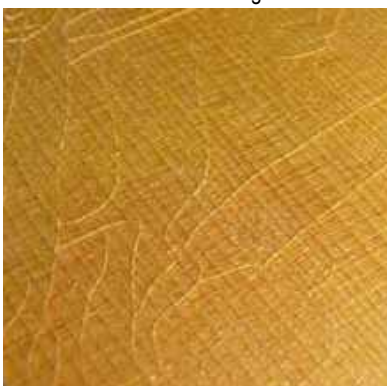
CHARACTER MARK: As an element of nature, a distinctive feature in a hardwood surface produced by minerals and other elements that are absorbed as a tree grows.

CHARACTERISTICS: The natural irregularities found in wood, whether solid or veneered. Their acceptance is a function of each particular Grade.

CHATTER: Lines appearing across the panel or board at right angles to the grain, giving the appearance of one or more corrugations resulting from bad setting of sanding equipment or planing knives.

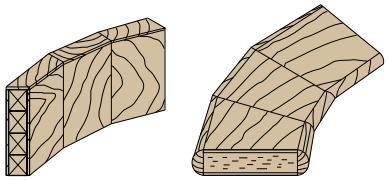
CHECKING: Cracks that appear in a finishing film due to lack of cohesion, often caused by too heavy of a coat being applied or a poor grade of finish being used. Also called cold checking.



CHECKS: Small slits running parallel to the grain of wood, caused chiefly by strains produced while drying and/or seasoning.

CHIP MARKS: Shallow depressions or indentations on or in the surface of dressed lumber caused by shavings or chips getting embedded in the surface during dressing.

CHORD SEGMENTATION: The process of cutting short lengths of straight molding and joining them around a curve core which is not permitted under these standards.



CLAMP NAIL: Double Tapered, Corrugated or Flared are specifically designed for forming wood joints in furniture, cabinets, general construction, caskets, door frames and windows. The nails join two pieces of kerf-sawed wood together in a tight and accurate wood joint application that is simple and secure with a durable and lasting fit.

CLIMATE: Conditions found inside or outside a building that include temperature, humidity and barometric pressure.

CLIMATE CONTROLLED: Referring to the inside areas of a building where heat or air conditioning systems are installed and actively used for environmental controls.

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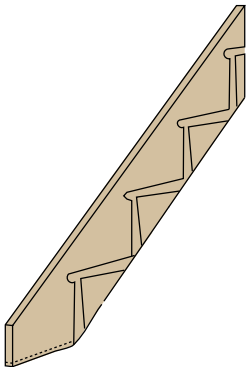
CLOSED GRAIN AND OPEN GRAIN: The size and distribution of the cellular structure of the wood influences the appearance and uniformity. Open grain hardwoods, such as Elm, Oak, Ash, and Chestnut, are "ring porous" species. These species have distinct figure and grain patterns. Close grain hardwoods, such as Cherry, Maple, Birch, and Yellow Poplar, are "diffuse porous" species. Most North American diffuse porous woods have small, dense pores resulting in less distinct figure and grain. Some tropical diffuse porous species (e.g., Mahogany) have rather large pores.

CLOSED STRINGER: In stairwork, a stringer that boxes in the treads and risers.

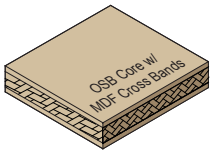


CLS: The HPL acronym for "Cabinet Liner", which has a color or pattern sheet to enhance its appearance and is intended for use in cabinet interiors.

COFFER: A sunken, decorative panel in a ceiling.

COMB GRAIN: A quality of rift cut veneer with exceptionally straight grain and closely spaced growth increments resembling the appearance of long strands of combed hair.

COMBINATION CORE: Panels are a hybridization of veneer and composition cores offering the advantages of both. Typically, these cores have internal layers which are constructed of three or five plies of veneer or a center layer of wafer board (randomly oriented wafers) or other wood fiber which are sandwiched between thin laminations of a composite product like MDF, particleboard, hardboard, etc. Shall meet or exceed the performance characteristics of ANSI A208.1 or 2 compositepanel.org



COMPACT LAMINATE: See "CGS".

COMPATIBLE FOR COLOR AND GRAIN: For purposes of these standards, means members shall be selected so that:

- Lighter than average color members will not be adjacent to darker than average color members, and there will be no sharp contrast in color between the adjacent members, and
- The grain of adjacent members shall not vary widely or be dissimilar in grain, character, and figure.

COMPATIBLE SPECIES: For purposes of these standards, means different species which are able to exist in a harmonious combination of color and grain.

CONCEALED SURFACE: Surface not normally visible after installation.

CONSPICUOUS: Detectable; readily visible with the naked eye when observed in normal light at a distance stated within these standards.

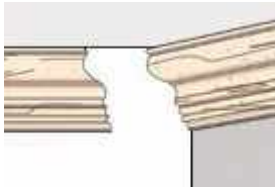
CONTACT ADHESIVE: Normally used for bonding HPL to a core.

CONTRACTOR: A general contractor or construction manager, normally holding the legal prime contract agreement for construction of an owner's project.

CONTINUOUS PRESSURE LAMINATE (CPL): Is decorative paper impregnated with resins and fused under heat and high pressure with resin impregnated backer(s). Laminate properties are similar to standard HPL and typical thickness range is .4 mm to 1 mm. CPL is available in desired sheet lengths or continuous rolls.

CONVERSION VARNISH: In finishing, a class of post-catalyzed coatings that are tough and exhibit excellent resistance to household chemicals.

COPE / COPED: To cut the end of one member to match the profile of another molded member.



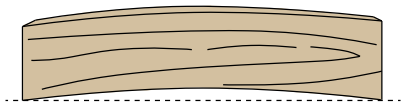
CORE: The material (typically, veneer, lumber, particleboard, medium density fiberboard, or a combination of these) on which an exposed surface material (typically, veneer or HPL) is applied.

CPL: The acronym for "Continuous Pressure Laminate", a type of HPL.

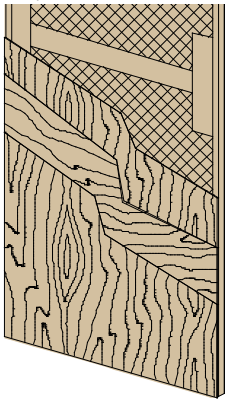
CRATERING: The formation of small depressions in a finish, sometimes called fisheye. Often caused by the contamination of the finish material or the core with silicone, oil, or other substances.

CREEP: The deflection over time of loaded or unloaded adjustable shelves, which fluctuates with temperature, humidity and load stress.

CROOK: A deviation, edgewise, from a straight line drawn from end to end of a piece. It is measured at the point of greatest distance from the straight line.



CROSSBANDING: A ply placed between the core and face veneer in 5 ply construction, or a ply placed between the back and face of a 3-ply skin in 7 ply construction. When the crossbanding has directional grain, it is placed at right angles to the grain of the face veneer. When used with HPL face doors, crossbanding may consist of more than one ply.



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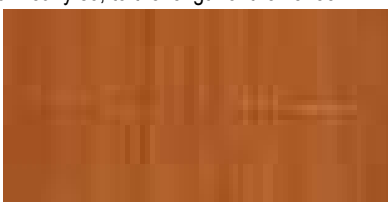
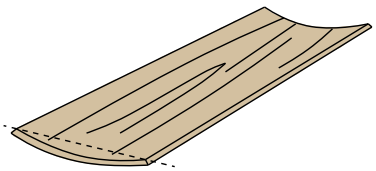
CROSS BAR: Irregularity of grain resembling a dip in the grain running at right angles, or nearly so, to the length of the veneer.



CROSS GRAIN: Refers to a board or panel where the grain is not parallel with the long edge of the board (also known as short grain). Cross grain or Crossfire may also refer irregular grain where the wood figure appears in a direction different than the grain direction. The irregularity is due to interlocked fiber, uneven annual rings, or to the intersection of branch and stem.

CROTCH: Comes from the portion of a tree just below the point where it forks into two limbs. The grain is crushed and twisted, creating a variety of plume and flame figures, often resembling a well-formed feather. The outside of the block produces a swirl figure that changes to full crotch figure as the cutting approaches the center of the block.

CUP: A deviation in the face of a piece from a straight line drawn from edge to edge of that piece. It is measured at the point of greatest distance from the straight line.



CURB STRINGER: See closed stringer.

CURING: The complete drying of a finish to the ultimate development of its properties.

CURLY: Figure that occurs when the fibers are distorted, producing a wavy or curly effect in the lumber or veneer. Primarily found in Maple or Birch.

CUSTOM GRADE: The default Grade in both material and workmanship, and intended for high quality, conventional work.

CUT HEART: See split heart.

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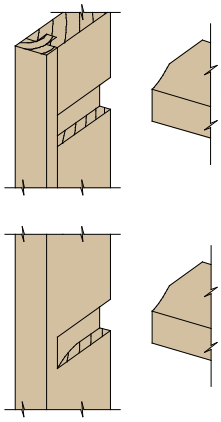
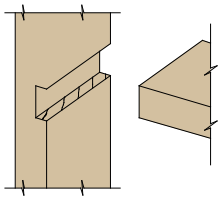
D

DADO, BLIND, OR STOPPED JOINT: A dado that is not visible when the joint is completed.



DADO JOINT: A rectangular groove across the grain of a wood member into which the end of the joining member is inserted; also, a housed joint. Variations include “mortise and tenon” and “stopped or blind dado” joints.



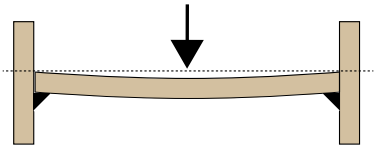
DECAY: Disintegration of wood due to the action of wood destroying fungi; “doze”, “rot”, and “unsound wood” mean the same as “decay.”

DECORATIVE COMPOSITE PANELS: For the purposes of these standards, a thermally fused panel flat pressed from a thermoset polyester or melamine resin impregnated paper (minimum 30%); see TFL.

DEFECT: Fault that detracts from the quality, appearance, or utility of the piece. Handling marks and/or grain raising due to moisture shall not be considered a defect.

DEFECT, OPEN: Open joints, knotholes, cracks, loose knots, wormholes, gaps, voids, or other openings interrupting the smooth continuity of the wood surface.

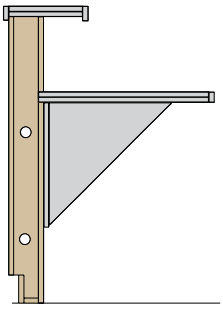
DEFLECTION: When weight is applied to a flat panel supported at two opposing ends in a horizontal position, such as a shelf, and the weight causes the shelf surface to become concave. Deflection is affected by the weight applied as well as the shelf core and finish materials.



DELAMINATION: Separation of plies or layers of wood or other materials through failure of the adhesive joint. When one lamination element is solid, veneer or composite wood and has not been subject to adverse environmental conditions (humidity & temperature) beyond its intended use, the absence of grain tear out shall be deemed an indicator of adhesive failure.

DESIGN PROFESSIONAL: An architect, interior designer, specification writer, or other individual qualified by virtue of education and/or training to provide services for the design of buildings, interiors, and furnishings.

DIE WALL: An assembly, typically vertical, that includes sub framing and a finish face on one or more sides. Die walls are commonly used at reception desks, nurse stations and low walls dividing areas within a larger room. They are typically self-supported or attached to floors or walls. A die wall typically allows other items to be attached, such as countertops, transaction countertops and casework. Sometimes known as low, knee or pony walls.



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DIMENSION LUMBER: Material that is precut in width and thickness to a standard size.

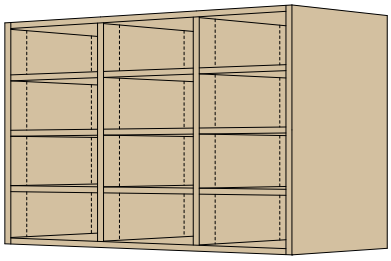
DIRECTIONAL PATTERN OR VENEER GRAIN MATCH: (see Veneer Grain or directional pattern Match).

DISCOLORATIONS: Stains in wood substances. Common veneer stains are sap stains, blue stains, stains produced by chemical action caused by the iron in the cutting knife coming in contact with the tannic acid of the wood, and those resulting from exposure of natural wood extractives to oxygen and light, to chemical action of vat treatments or the adhesive components, and/or to the surface finish.

DISTRESSING: In finishing, either a mechanical or chemical special effect.

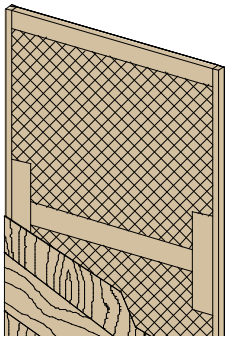
DISTRIBUTOR: A person or organization that provides products on a wholesale basis to a manufacturer of woodwork.

DIVISION: A fixed cabinet component that is not one of the two sides, top or bottom. A division divides a cabinet into sections. Divisions may be horizontal or vertical.

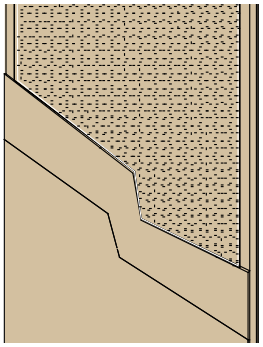


DOOR CORE, PASSAGE: As regulated by WDMA's ANSI/WDMA I.S. 1A, ANSI/WDMA I.S. 6A, and ANSI/WDMA TM 15 wdma.site-ym.com

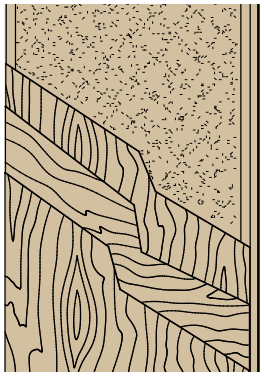
- **HOLLOW -** A core assembly of strips or other units of wood, wood derivative, or insulation board with intervening hollow cells or spaces that support the outer faces.



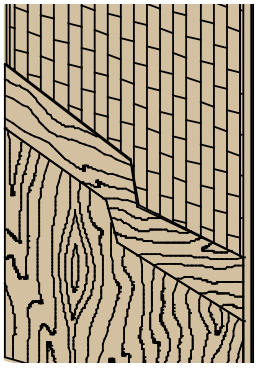
- **MINERAL -** A fire resistant core material generally used in doors requiring fire rating of 3/4 hours or more.



- **SOLID:** The innermost layer or section in flush door construction. Typical constructions are as follows:
- **PARTICLEBOARD -** A solid core of wood or other lignocellulose particles bonded together with a suitable binder, cured under heat, and pressed into a rigid panel in a flat platen press.



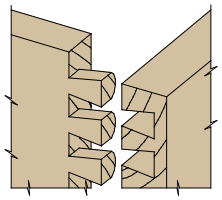
- **STAVE -** A solid core of wood blocks or strips.



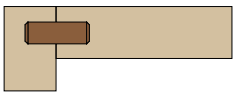
- **WOOD BLOCK LINED -** A solid core of two parts; a central wood block core bonded to two core liners of wood or other lignocellulose materials.

DOOR FURNISHER: As used in PRODUCT of section 09, is defined as the party responsible for the taking off, ordering and supplying of the doors to a project.

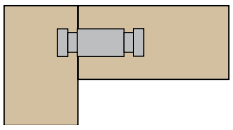
DOVETAIL JOINT: A joint formed by inserting a projecting wedge shaped member (dovetail tenon) into a correspondingly shaped cut out member (dovetail mortise); variations include the "dovetail dado" and the "blind dovetail dado."



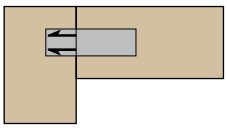
DOWEL: Cylindrical peg used to strengthen a wood joint.



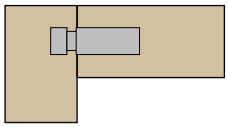
DOWEL LINK: Synthetic, cylindrical, rimmed cabinet assembly peg that mates to a machined, self-tightening and locking groove.



DOWEL (Twin) INSERTION CLIP / SPRING PIN: Synthetic, twin dowel mounted cabinet assembly fastener with elongated, self-locking member that mates to a machined pocket. The system is further strengthened with a accompanying metal spring dowel.



DOWEL (Twin) RETENTION CARRIAGE: Synthetic or metal, twin dowel mounted cabinet assembly fastener with elongated, self-locking carriage mates to a machined, self-tightening groove.



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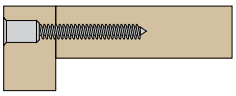
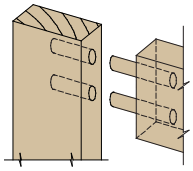
DOWEL SCREW: Metal cabinet assembly screw with a extended un-threaded shaft that functions much like a dowel.



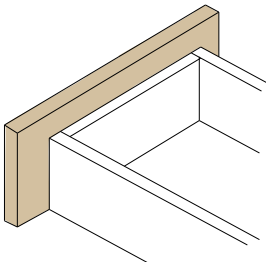
DOWELED JOINT: A joint using "dowels" (doweled construction); also "doweled edge joint."



DOUG FIR: Referring to Douglas Fir. Douglas fir is a common name for softwood evergreen coniferous trees of the genus Pseudotsuga in the family Pinaceae. Also known as Douglas Tree, False Hemlock and Oregon Pine. The heartwood of Doug Fir is moderately resistant to decay and is often used in exterior applications that require a smooth finish. The grain is typically straight.

DOZE: A form of incipient (early) decay characterized by a dull and lifeless appearance of the wood, accompanied by a loss of strength and softening of the wood substance.

DRAWER FRONT: Is the portion of the drawer box that is viewable even when the drawer is closed. Some drawer fronts are applied directly to the drawer box without use of a sub-front.



DRAWER SLIDES, BALL BEARING: A linear motion, load bearing system that incorporates two or more parallel rows of caged ball bearings running in hardened steel raceways. Minimum requirements within NAAWS based on BHMA's (Builders Hardware manufacturers Association, buildershardware.com) ANSI/BHMA A156.9 - Cabinet Hardware.

DRAWER SLIDES, ROLLER: A linear motion, load bearing system that incorporates mounted cylindrical rollers on opposing tracks. Minimum requirements within NAAWS based on BHMA's (Builders Hardware manufacturers Association, buildershardware.com) ANSI/BHMA A156.9 - Cabinet Hardware.

DRAWER AND SLIDE SYSTEM: A roller or ball bearing slide system combined drawer sides or bars that make up a drawer unit when combined with otherwise provide drawer front, bottom and back. Minimum requirements within NAAWS based on BHMA's (Builders Hardware manufacturers Association, buildershardware.com) ANSI/BHMA A156.9 - Cabinet Hardware.

DRAWINGS: Part of a project's design documents which, in combination with written specifications, define the scope, quality assurance, requirements, submittals, dimensions, product handling, and product specifications to the manufacturer. See Shop Drawings.

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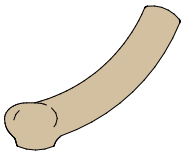
A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

E

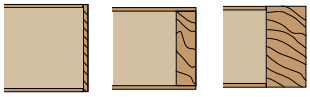
EASED EDGES: For the vast majority of work, a sharp arris or edge is not permitted. Such edges are traditionally "eased" by lightly striking the edge with a fine abrasive. Less often, or as a design element, such edges are machined to a small radius.

EASEMENTS: Short curved segments of handrail that provide for changes in pitch, elevation, or direction.



ECONOMY GRADE: A superseded grade in both material and workmanship and intended for work where price outweighs quality considerations. Economy Grade has been removed from these standards, as no longer being relevant to quality Architectural woodwork.

EDGEBANDING: The process of attaching a material to the edge of panels. Typically, machine applied with hot melt glue, however hand attachment is allowed. Edgeband application is subject to tolerances found in these Standards.

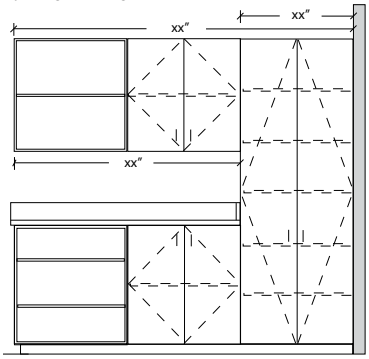


EDGE GRAIN (EG) OR VERTICAL GRAIN (VG): A piece or pieces sawn at approximately right angles to the annual growth rings so that the rings form an angle of 45 degrees or more with the surface of the piece resulting in tight, straight grain lines.

EDGE JOINT: At the edges of boards when glued together to increase the width.

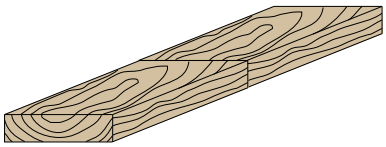
EFFECT: The result achieved in a finished wood surface, after the application of a clearly specified series of finishing procedures (steps) have been completed. Successfully achieving a specified "effect" requires the active participation of the design professional and the woodwork finisher.

ELEVATION: As used within these standards, a view of the front, back or end of an assembly or grouping of architectural woodwork components.



END BUTT JOINT:

- One end is glued to an edge or face of another board to form an angle (e.g., stiles and rails of a face frame)
- The end of one board is fastened to the end of another to increase its length (e.g., running trim).



END GRAIN: The grain seen in a cut made at a right angle to the direction of the fibers in a board.

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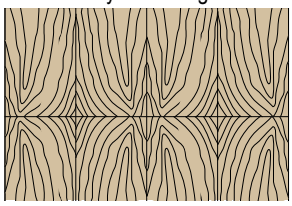
END MATCH: Butting adjacent veneer leaves end to end in sequence. Veneer leaves are book matched end to end. Generally used for very long panels or for projects in which only short length veneers are available.



ENGINEERED STONE: Is a composite material made of crushed stone bound together by an adhesive, (most commonly polymer resin, with some newer versions using cement mix). This category includes engineered quartz, polymer concrete and engineered marble stone. It also known Agglomerated Stone.

EQUILIBRIUM MOISTURE CONTENT: The moisture content at which wood neither gains nor loses moisture when surrounded by air at a given relative humidity and temperature.

ESCUTCHEON: A protective fitting around a keyhole; also, a shield like ornament.

EXPOSED EXTERIOR SURFACES: For purposes of these standards, specifically casework, means all exterior surfaces exposed to view.

EXPOSED FASTENERS: Any mechanical fastening device, filled or unfilled, that can be seen on exposed or semi-exposed surfaces of woodwork.

EXPOSED INTERIOR SURFACES: For purposes of these standards, specifically casework, means all interior surfaces exposed to view in open casework or behind transparent doors.

EXPOSED SURFACES: Surfaces normally visible after installation.

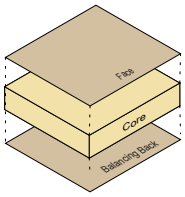
EXTERIOR (Building): That portion of the structure that is outside of the weather proofing of the building, including the weather proofing (non climate controlled).

EUROPEAN MULTI-PLY: Panel consisting of equally thick sheets of cross banded, void free hardwood veneer. This provides a void-less core with exceptional strength and screw holding attributes. The strong pattern of the edge is often used as a primary design element. Also commonly referred to as "Russian Birch", "Baltic Birch", "Finnish Birch" or "Multi-Ply". European multi-ply standards are established by Intergovernmental Standards GOST 3916.1-96. Typical examples include: 12/01/2021

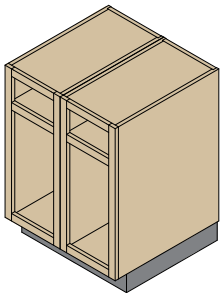
- 12 mm ≈ 1/2" (9 plies)
- 18 mm ≈ 3/4" (13 plies)
- 25 mm ≈ 1" (17 plies)

F

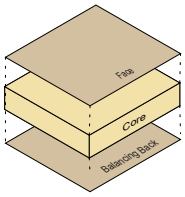
FACE: The better side of any panel in which the outer plies are of different veneer grades; also, either side of a panel in which there is no difference in veneer grade of the outer plies.



FACE FRAME CONSTRUCTION: A type of construction, where the front edge of the cabinet body components is overlaid with a frame.



FACE VENEER: The outermost exposed wood veneer surface of a veneered door, panel, or other component exposed to view when the project is completed.



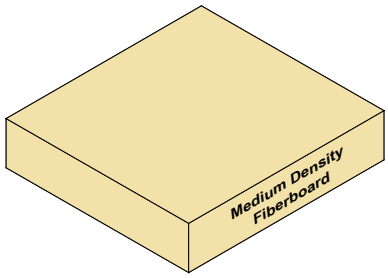
FALSE FRONT: Is a non-functional, exposed exterior member that gives the appearance of a drawer front without being attached to a drawer box. There is typically no usable space behind a false front, as it is only used for aesthetic purposes.

FASTENER, MECHANICAL: The generic term for securing devices that are used in the fabrication and/or installation of architectural woodwork, such as dowels, dowel screws, splines, nails, screws, bolts, staples, etc.

FEW: As applies to defects or natural characteristics, a small number without regard to their arrangement in the panel / board.

FIBER: One of the long, thick walled cells that give strength and support to hardwoods.

FIBERBOARD CORE: (Medium Density Fiberboard MDF) Manufactured from wood reduced to fine fibers mixed with binders and formed by the use of heat and pressure into panels.



FIDDLEBACK: A fine, strong, even ripple figure as frequently seen on the backs of violins. The figure is found principally in Mahogany and Maple but occurs sometimes in other species.

FIELD: With reference to work location, meaning in the field or jobsite versus in the manufacturing plant or shop. Can also refer to the raised portion of a stile and rail “raised” panel.

FIGURE: The natural pattern produced in the wood surface by annual growth rings, rays, knots, and natural deviations from the normal grain, such as interlocked and wavy grain, and irregular coloration.

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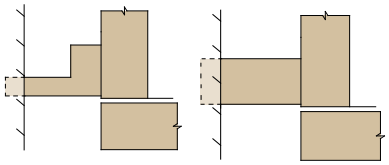
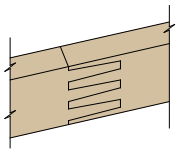
FILLER:

- In finishing, ground inert solids specifically designed to fill pores or small cavities in wood as one step in the overall finishing process.
- In casework, paneling, ornamental work, stairwork, frames, and some other architectural woodwork applications, an additional piece of trim material between woodwork members or between woodwork and some other material used to create a fill or transition between the members.



FINGER JOINT: When the ends of two pieces of lumber are cut to an identically matching set. Used most commonly to increase the length of the board. A series of interlocking fingers are precision cut on the ends of two pieces of wood that mesh together and are held rigidly in place with adhesive. Can also refer to an interlocking joint sometimes referred to as a Box Joint.



FIRE RATED DOOR: A door that has been constructed in such a manner that when installed in an assembly and tested will pass ASTM E-152 "Fire Test of Door Assemblies," and can be rated as resisting fire for 20 minutes (1/3 hour), 30 minutes (1/2 hour), 45 minutes (3/4 hour) (C), 1 hour (B), or 1-1/2 hours (B). The door must be tested and carry an identifying label from a qualified testing and inspection agency.

FIRE RETARDANT TREATMENT: Treatment with chemicals to reduce flammability and retard the spread of flame over the surface. This usually involves impregnation of the wood, under pressure, with salts and other chemicals.

FIRSTCLASS WORKMANSHIP: For architectural woodwork, the finest or highest class of workmanship for the Grade specified and shall be free of manufacturing and natural defects covered under grading rules in these standards.

FLAKE: See "Fleck, Ray".

FLAKEBOARD: See "particleboard."

FLAME SPREAD: A material's propensity to burn and spread flames, that is determined by laboratory standard test methodology such as: NFPA's (National Fir Protection Association, nfpa.org NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials and NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

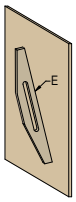
FLAME SPREAD CLASSIFICATION: The generally accepted measurement for flame spread rating of materials such as NFPA's (National Fir Protection Association, nfpa.org NFPA 80 and Life Safety Code NFPA 101.

Class	Flame Spread Index
A	0-25
B	26-75
C	76-200

FLAT GRAIN (FG) OR SLASH GRAIN (SG): A piece or pieces sawn approximately parallel to the annual growth rings so that all or some of the rings form an angle of less than 45 degrees with the surface of the piece.

FLAT SLICING: See "Plain Slicing".

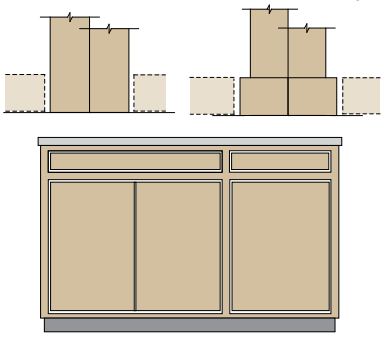
FLATNESS: A panel face having an even or smooth surface in one plane without depressions or projections.



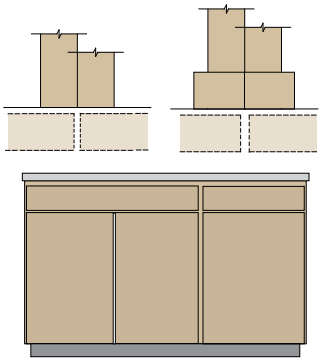
FLECK, RAY: Portion of a ray which usually appears on quarter cut veneers and solids faces. This feature is most common in oaks (mainly white oak) but appears in other species as well. Maple, beech, lacewood and sycamore can have a similar ray figure. See Medullary Ray.

FLITCH: The complete bundle(s) of thin sheets of veneer after cutting, laid together in sequence as they were sliced or sawn.

FLUSH INSET: Cabinet construction in which the door and drawer faces are set within and flush with the body members or face frames of the cabinet with spaces between face surfaces sufficient for operating clearance.

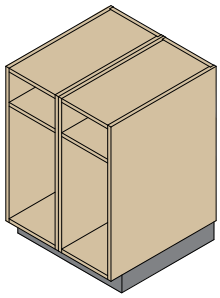


FLUSH OVERLAY: Cabinet construction in which door and drawer faces cover the body members of the cabinet with spaces between face surfaces sufficient for operating clearance.

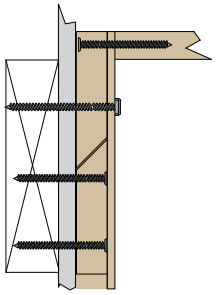


FLUTE: One of a series of parallel, lengthwise channels or grooves in a column, cornice molding, band, or furniture leg.

FRAMELESS CONSTRUCTION: A type of construction, where no frame is attached to the front edge of the cabinet body components which are typically edgebanded.



FRENCH CLEAT: A method of concealed panel or trim hanging where one component is screwed to the wall and the other component is screwed to the back of a architectural woodwork product. Each cleat has an opposing 45-degree edge, causing the two pieces to interlock. French cleats may be used for cabinet hanging provided it has been independently tested to show compliance to the Wall Cabinet Structural Integrity Test shown in **APPENDIX**.



FURRING: Material added to a building surface to create a true plane in order to install woodwork plumb and level.

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G

GABLE: Aside from the traditional usage referring to the end of a building, in casework the end or side of a cabinet.

GAP: An unfilled opening between adjoining surfaces.

GENERAL CONTRACTOR: See “Contractor”.

GLAZING: In finishing, an added step for achieving color or to heighten grain appearance. Otherwise a term regarding glass or the installation of glass elements.

GLOSS: See “Sheen”.

GLUE BLOCK: A wood block, often triangular in cross section, securely glued to an angular joint between two members for a greater glue bond area.

GLUE SPOTS: The discoloration or barrier to finish penetration caused by bleed through or un-removed glue on an exposed or semi-exposed wood surface.

GLUED, SECURELY: The bonding of two or more members with adhesive, forming an element without delamination or separation.

GRADE: Unless otherwise noted, this term means Grade rules for Custom, and/or Premium Grade.

GRADING RULES: Most hardwoods are graded utilizing the rules established by the National Hardwood Lumber Association. Softwoods, on the other hand, are graded by several grading associations. The three primary softwood grading associations are Western Wood Products Association, Southern Pine Inspection Bureau, and Redwood Inspection Service.

- Although lumber must be purchased by the manufacturer according to these grading rules, these rules should not be used to specify lumber for architectural woodwork. Specify the Grade of Work for the fabricated products under these standards.
- Softwood plywood is graded by the American Plywood Association (APA, The Engineered Wood Association). Grade markings are stamped on the back or edge of each sheet.
- Hardwood plywood is made under the standards of the Decorative Hardwoods Association (formally HPVA). Grade markings may vary by manufacturer and panel.

GRAIN: The fibers in wood and their direction, size, arrangement, appearance, or quality. When severed, the annual growth rings become quite pronounced and the effect is referred to as “grain”:

- **FLAT GRAIN (FG) or SLASH GRAIN (SG) -** lumber or veneer is a piece sawn or sliced approximately parallel to the annual growth rings so that some or all of the rings form an angle of less than 45 degrees with the surface of the piece.

- **MIXED GRAIN (MG) -** is any combination of vertical or flat grain in the same member. Vertical grain lumber or veneer is a piece sawn or sliced at approximately right angles to the annual growth rings so that the rings form an angle of 45 degrees or more with the surface of the piece.

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- **QUARTERED GRAIN -** is a method of sawing or slicing to bring out certain figures produced by the medullary or pith rays, which are especially conspicuous in Oak. The log is flitched in several different ways to allow the cutting of the veneer in a radial direction. Rift or comb grain is lumber or veneer that is obtained by cutting at an angle of about 15 degrees off of the quartered position. Twenty-five percent (25%) of the exposed surface area of each piece of veneer may contain medullary ray flake.

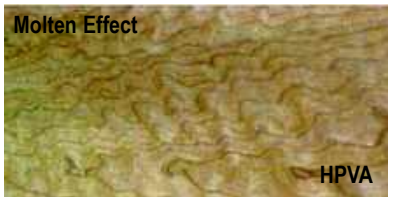
- **OPEN GRAIN AND CLOSED GRAIN -** The size and distribution of the cellular structure of the wood influences the appearance and uniformity. Open grain hardwoods, such as Elm, Oak, Ash, and Chestnut are “ring porous” species. These species have distinct figure and grain patterns. Close grain hardwoods, such as Cherry, Maple, Birch, and Yellow Poplar, are “diffuse porous” species. Most North American diffuse porous woods have small, dense pores resulting in less distinct figure and grain. Some tropical diffuse porous species (e.g., Mahogany) have rather large pores.

- **GRAIN RAISE -** When moisture in a finish swells and lifts wood fibers away from the surface of the wood being finished. The wood surface should be further sanded to eliminate grain raise.

- **RAISED GRAIN -** Roughened condition of the surface of dressed lumber on which hard summerwood is raised above the softer spring wood but is not torn loose from it.

GRAIN CHARACTER: A varying pattern produced by cutting through growth rings, exposing various layers. It is most pronounced in veneer cut tangentially or rotary.

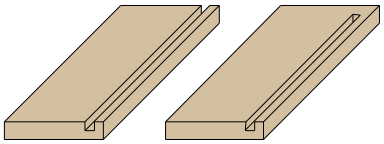
GRAIN FIGURE: The pattern produced in a wood surface by annual growth rings, rays, knots, or deviations from natural grain, such as interlocked and wavy grain and irregular coloration.



GRAIN SLOPE: Expression of the angle of the grain to the long edges of the veneer component.

GRAIN SWEEP: Expression of the angle or bend of the grain to the long edges of the veneer component over the area extending one-eighth of the length of the piece from the ends.

GROOVE: Rectangular slot of three surfaces cut parallel with the grain of the wood.



GROUND: A narrow strip of wood that serves as a guide for plaster as well as a base to which trim members are secured. Grounds are applied to rough interior openings especially doors and windows; along interior walls at the finish floor line; and wherever wainscot may be installed. The thickness of a ground is that of the combined lath and plaster, while the width varies from 1" (25.4 mm) to 3" (76 mm), which is often called plaster grounds (around interior or exterior openings) and base grounds (when used around base of rooms).

GROWTH RINGS: The layer of wood added by a tree in a single growing season, the markings of which contribute to the figure in finished woods. Annual (or Annular) growth rings include both summer and winter growth.

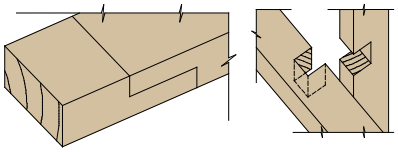
GUM POCKETS: Well defined openings between rings of annual growth, containing gum or evidence of prior gum accumulations.

GUM SPOTS AND STREAKS: Gum or resinous material or color spots and streaks often dark brown, black or golden, caused by prior resin accumulations sometimes found on veneer or lumber surfaces.

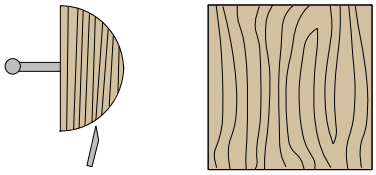
H

HAIRLINE: A very thin, barely perceptible line showing at the joint of two pieces of wood.

HALF LAP JOINT: A joint formed by extending (lapping) the joining part of one member over the joining part of another.



HALF ROUND SLICING: A method of veneer cutting similar to rotary cutting, except that the piece being cut is secured to a "stay log," a device that permits the cutting of the log on a wider sweep than when mounted with its center secured in the lathe to produce rotary sliced veneer. This adds width to a narrow log by increasing the radius of the cut. Half round slicing of wood is used to accentuate the grain in various woods such as burls and specialty veneers. It can also be used to achieve a flat sliced veneer appearance.



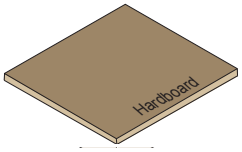
HANDLING MARKS: Scratches, dents, blemishes, mars, or scuffs left or created by physical handling or packaging.

HANDRAIL: See "Molding".

HAND RUBBED FINISH: In finishing, a manual step performed to alter the sheen of the topcoat.

HARDBOARD: A generic term for a panel manufactured primarily from inter felted lignocellulose fibers consolidated under heat and pressure in a hot press and conforming to the requirements of ANSIA 135.4 (latest edition), compositepanel.org.

- **TEMPERED HARDBOARD** has been coated or impregnated with an oil and then baked to give it more impact resistance, hardness, rigidity, tensile strength, and more resistance to scratches and moisture. Tempered hardboard is typically smooth on both sides and may have a darker smooth finish.



HARDNESS (in finishing): The property of a coating that causes it to resist denting or penetration by a hard object.

HARDWOOD: General term used to designate lumber or veneer produced from temperate zone deciduous or tropical broad-leaved trees in contrast to softwood, which is produced from trees that are usually needle bearing or coniferous. The term does not imply hardness in its physical sense. Minimum requirements within NAAWS based on enhancement of NHLA Grading Rules - nhla.com

HEARTWOOD: The non-active or dormant center of a tree, generally distinguishable from the outer portion (sapwood) by its darker color, sometime referred to as heart.

HGP: The **HPL** acronym for "Horizontal, General Purpose, Postforming Grade" laminate.

HGF: The **HPL** acronym for "Horizontal, General Purpose, Flame Retardant Grade" laminate.

HGS: The **HPL** acronym for "Horizontal, General Purpose, Standard Grade" laminate.

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HIGH DENSITY OVERLAY: A veneer core plywood manufactured with a thermosetting resin impregnated fiber surface bonded to one or both sides under heat and pressure. HDO is a very rugged overlaid panel for applications such as concrete forming and industrial tanks.

The tough resin overlay withstands severe exposure without further finishing. It also resists abrasion, moisture penetration and deterioration from many common chemicals and solvents.

HDO standards are established by the Engineered Wood Association (apawood.org), and minimum requirements are based on Voluntary Product Standard PS 1, nist.gov.

HIGH PRESSURE LAMINATE: See “HPL”.

HOLE: Applies to holes from any cause.

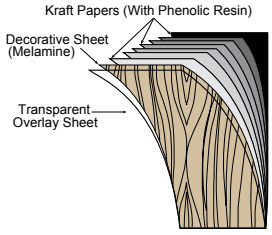
HOLES, WORM: Holes resulting from infestation by worms greater than 1/16” (1.6 mm) in diameter.

HONEYCOMB DOOR CORE: A method of using lightweight paper, wood or other material-based products to form a door core. The honeycomb provides some structural integrity and is a base for attachment of back bands or cross bands.

HONEYCOMB IN RED OAK: A structural defect found in Red Oak caused by bacterial heartwood infection resulting in abnormal odors in kiln dried lumber and an appearance of voids within the lumber.

HOUSED CABINET BACK: When a cabinet back is set in a three-sided groove such as a plow or groove.

HPL: Laminated thermosetting decorative sheets intended for decorative purposes. The sheets consist essentially of layers of a fibrous sheet material, such as paper, impregnated with a thermosetting condensation resin and consolidation under heat and pressure. The top layers have a decorative color or a printed design. The resulting product has an attractive exposed surface that is durable and resistant to damage from abrasion and mild alkalis, acids, and solvents, meeting the requirements of ISO-4586 (latest edition).



HPL COMPACT: See “CGS Compact Laminate”.

HUMIDITY: The common term for relative humidity; the amount of moisture in an atmosphere in relation to temperature.

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I

INCONSPICUOUS: Not readily visible without careful inspection (as a measurement of natural or machining characteristics).

INDENTATIONS: Areas in the face that have been compressed as the result of residue on the platens of the hot press or handling damage through the factory.

INNER PLIES: Plies other than face or back plies in a panel construction. Crossbands and centers are classed as inner plies (see core).

INSTALLER: A person or organization that regularly engages in the practice of installing architectural woodwork.

INTERIOR (Building)**:** That portion of a building that is inside the building envelope, not including the weather proofing (can be climate controlled).

INTUMESCENT COATINGS: A layer of protective substance that can be applied to the surface of flammable products to reduce flammability via chemical reaction generated by heat, resulting in swelling and formation of an insulating layer on the surface.

J

JOINT: The line of juncture between the edges or ends of two adjacent pieces of lumber or sheets of veneer, such as butt, dado (blind, stopped), dovetail, blind dovetail, finger, half lap, lock, miter (shoulder, lock, spline), mortise and tenon (blind slotted, stub, or through), rabbet, scarf, spline, and tongue and groove joint.

JOINT, OPEN: Joint in which two adjacent pieces of lumber or veneer do not fit tightly together.

JOINTS TIGHT, FACTORY: Any joints or a combination of joints and/or mechanical fasteners, that are used to join two members in the shop. Distance between members shall not exceed those set forth in these standards.

JOINTS TIGHT, FIELD: Any joints or a combination of joints and/or mechanical fasteners that are used to join two members in the field. Distance between members shall not exceed those set forth in these standards.

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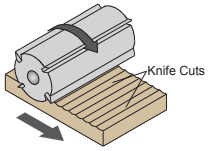
K

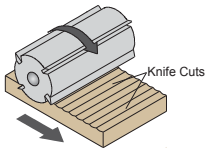
KCPI / CPI: Stands for "knife cuts per inch"; generally used when describing the result of molded profiles or S4S materials.



KERF: The groove or notch made as a saw passes through wood; also, the wood removed by the saw in parting the material.

KILN DRIED: Lumber dried in a closed chamber in which the removal of moisture is controlled by artificial heat and usually by controlled relative humidity.

KNIFE MARKS: The imprints or markings of the machine knives on the surface of dressed lumber.



KNOCKED DOWN (KD): Un-assembled, as contrasted to assembled.

KNOT: Cross section of tree branch or limb with grain usually running at right angles to that of the piece of wood in which it occurs

- **CONSPICUOUS PIN -** Sound knots 1/4 inch (6.4 mm) or less in diameter containing dark centers.

- **HOLES -** Openings produced when knots drop from the wood in which they were embedded.

- **OPEN -** Opening produced when a portion of the wood substance of a knot has dropped out or where cross checks have occurred to produce an opening or recess.

- **SOUND TIGHT -** Knots that are solid across their face and fixed by growth to retain their place.

- **SPIKE -** Knots cut from 0° to 45° to the long axis of limbs.

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L

LACQUER: A coating composed of synthetic film forming materials such as nitrocellulose, ethyl cellulose, natural and synthetic resins, which are dissolved in organic solvents and are dried by solvent evaporation.

LEAF, VENEER: The individual pieces of wood veneer that make up a flitch.

LEED®: Leadership in Energy and Environmental Design. An environmental building rating system created by United States Green Building Council (USGBC) to encourage and certify the environmental and energy saving attributes of a building and its operations.

LIFTING: In finishing, the softening of a dried film by the solvents of a succeeding coat, which causes raising and wrinkling of the first coat.

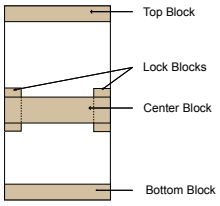
LIGHTS (Lites)**:** In door construction, openings to receive glazing.

LIPPAGE: Variation in the height of adjoining stone or epoxy resin countertop joints. The differences in elevation between edges of adjacent tile modules.

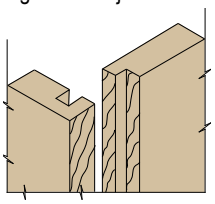
LIPPED EDGE: See “No-drip / Lipped Edge”

LISTING: A tabular method of describing materials or methods that do not require drawings.

LOCK BLOCK: A concealed block the same thickness as the door stile or core that is adjacent to the stile at a location corresponding to the lock location and into which a lock is fitted.



LOCK JOINT: Interlocking machine joint between two members.



LOOSE SIDE (of leaf)**:** In knife cut veneer, that side of the leaf that was in contact with the knife as the veneer was being cut and containing cutting checks (lathe checks) because of the bending of the wood at the knife edge. Due to the cellular structure of wood fibers, the Loose side and the Tight side reflect light differently.

LOOSE TENON: A method of joinery resembling a traditional mortise-and-tenon joint, with equal structural strength, the difference being that the tenon is a separate member.

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LOUVER: A slat or slats installed in a panel or door at an angle to the panel allowing various degrees of light, air or sound passage. May be constructed as adjustable or fixed.

LOW PRESSURE DECORATIVE LAMINATE (LPDL): See "Thermally Fused Laminate".

LUMBER: Pieces of wood no further manufactured than by sawing, planing, crosscutting to length, and perhaps edge machining.

LUSTER: See "Sheen".

M

MADE TO ORDER SEQUENCED PANELS: All panels are manufactured to width and/or height according to each elevation. All panels are balanced matched and sequenced to the adjacent panels.

MAHOGANY: The term "Mahogany" should not be specified without further definition. It must be understood that there are different species of Mahogany that should be specified.

African, Central and South American, or Tropical American, including American Mahogany, are genuine and true Mahoganies. American Mahogany varies in color from light pink to light red; reddish brown to golden brown or yellowish tan. Some Mahogany turns darker and some lighter in color after machining.

The figure or grain in American Mahogany runs from plain sliced, plain stripe to broken stripe, mottled, fiddleback, swirl, and crotches. As uniform color is not a natural characteristic of this species, if a uniform color is desired it is recommended that the finishing specification include a statement that toner or tint must be applied so that color variation shall be kept to a minimum.

Lauan White and Red, Tanguile, and other species are native to the Philippine Islands and are sometimes referred to as Philippine Mahogany. Those species are not a true Mahogany.

When only the word "Mahogany" is specified, it usually (but not always) means a true Mahogany as selected by the manufacturer unless a specific species is called for in the specifications. When Philippine Mahogany is specified, it nearly always means Lauan, Tanguile, and other natural Philippine species of wood.

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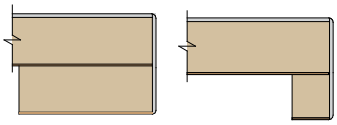
MANUFACTURER: For these standards, a person or organization that regularly engages in the practice of fabricating architectural woodwork.

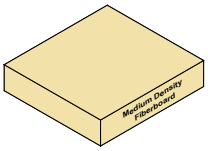
MATCHING EDGEBAND: An edge covering that is compatible in color and texture / pattern / grain as the adjoining surface material.



MATERIAL SUPPLIER: For these standards, a person or organization that furnishes material components (sheet goods, lumber, hardware, adhesives, etc.) for use by manufacturers of architectural woodwork.

MECHANICAL FASTENER: The generic term for securing devices that are used in the fabrication and/or installation of architectural woodwork such as dowels, dowel screws, splines, biscuit splines nails, screws, bolts, pins, etc.

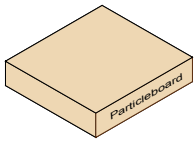
MEDIUM DENSITY FIBERBOARD (MDF): An engineered wood product made by breaking down hardwood or softwood residuals into fine wood fibers, combined with wax and a resin binder. Also See particleboard for a basic description. As used in these standards, whether as MDF alone or as core material. Minimum requirements based on CPA's (Composite Panel Association) ANSI A208.2 (latest edition), compositepanel.org.



MEDIUM DENSITY OVERLAY (MDO): A veneer core plywood manufactured with a thermosetting resin impregnated fiber surface bonded to one or both sides under heat and pressure. MDO is particularly well suited to opaque (paint) finishes; and most versions are highly moisture resistant.

MDO standards are established by the Engineered Wood Association (apawood.org), and minimum requirements are based on Voluntary Product Standard PS 1, nist.gov.

MEDIUM DENSITY PARTICLEBOARD: Generally, refers to particleboard manufactured to an approximate density of 45 lbs. per cubic foot (20.41 kg per cubic cm); the type of particleboard used for architectural woodworking cores. Minimum requirements based on CPA's (Composite Panel Association) ANSI A208.2 (latest edition), compositepanel.org.



MEDULLARY RAY: Extends radially from the center of a log toward the outer circumference. These rays serve primarily to store food and transport it horizontally. These rays vary in height from a few cells in some species to an excess of 4" (102 mm) in Oaks. In Oak, it produces the flake effect common to quarter sawn lumber.

MELAMINE: Resin impregnated paper used in decorative composite panel products (see TFL panel).

MEMBER: An individual piece of solid stock or plywood that forms an item of woodwork.

METAMERISM: An apparent change in color when exposed to differing wavelengths of light; the human perception of color (see Barber Pole and Book Match).

MIL: A mil (a thou) is 1/1000" or 0.001" (0.00254 mm).

MILL RUN: Molding run to pattern only, not graded, machined for assembly, or cut to length. The terms "material only" and "loose and long" mean the same as "mill run."

MILLWORK: See "architectural woodwork."

MINERAL STREAK: An olive to greenish-black or brown discoloration generally caused when the tree absorbs and deposits minerals from the soil.

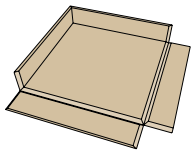
MIRROR POLISH FINISH: In finishing, several steps of wet sanding, mechanical buffing, and polishing to a very high gloss.

MISMATCH:

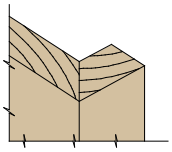
PHYSICAL - An uneven fit in worked lumber when adjoining pieces do not meet tightly at all points of contact or when the surfaces of adjoining pieces are not in the same plane.

APPEARANCE - Color, Grain and/or figure are not the same or similar.

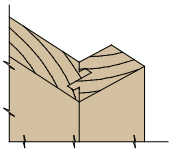
MITERFOLD: Made from a single panel in one machining process; includes placement of tape, machining, application of adhesive, folding, glue, clamp, and clean.



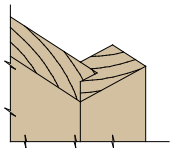
MITER JOINT: The joining of two members at an angle that bisects the angle of junction.



MITER, LOCK JOINT: A miter joint employing a tongue and groove to further strengthen it.



MITER, SHOULDER JOINT: Any type of miter joint that presents a shoulder, such as a lock miter or a splined miter.



MOCK-UP: A sample made by the manufacturer to demonstrate materials, assembly, finish and/or tolerances proposed for a project. A mock-up does not eliminate the requirements found in section 1 for shop drawings. Mock-ups, if approved, may be allowed to become part of the finished project.

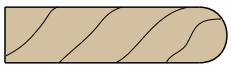
MODULAR CASEWORK: Casework produced from a manufacturer's standard details adapted for use rather than custom manufactured for a particular project.

MODULUS OF ELASTICITY (MOE): As referenced in this standard, the theoretically recoverable longitudinal deflection value of a material from an applied load. MOE is a measurement of the ratio of stress placed upon the wood compared to the strain (deformation) that the wood exhibits along its length.

MODULUS OF RUPTURE (MOR): (Sometimes referred to as bending strength), is a measure of a specimen's load bearing strength before rupture/breakage.

MOISTURE CONTENT: The weight of the water in the wood expressed in percentage of the weight of the oven dry wood. Within NAAWS, requirements based on US Forest Products Laboratory publications, fpl.fs.fed.us/index.php

MOLDED EDGE: Edge of piece machined to any profile other than a square or eased edge.



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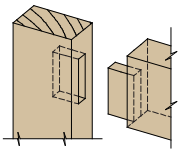
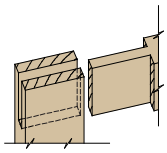
MOLDING (MOULDING): A decorative strip, usually having a curved or projecting surface. Some common moldings used are listed below.

- **ASTRAGAL -** A molding attached to one door of a pair of doors covering the gap between the doors.
- **BACK BAND -** Used in conjunction with casing or baseboard to create a wide variety of trim options for windows and doors. Generally, backband moldings create thicker or wider moldings than single piece components.
- **BASE BLOCK -** The square block terminating a molded baseboard at a doorway; a plinth block.
- **BASE CAP -** A molding applied to the top edge of a base molding to add aesthetic affect.
- **BASE or BASEBOARD -** Moldings used to trim the intersection of a wall or cabinet and the floor.
- **BASE SHOE -** A small molding combined with a base molding to complete the trimming of the wall and floor intersection.
- **BEAD MOLDING -** A narrow half round molding that is continuous or divided into bead like forms.
- **CASING -** Generally, a molding placed around a door frame or window frame.
- **BED MOLDING -** A molding or group of moldings used immediately beneath a projection.
- **CHAIR RAIL -** Applied along a wall for protection or as a design element between wall treatments, such as paneling, wallpaper, or paint. Traditionally placed at the horizontal location on the wall at a height that would be rubbed by a chair back, to protect the wall.
- **CORNICE -** A wood or composite wood molding detail along the top edge of a piece of a architectural woodwork assembly or a building. May be built up of several moldings or components to create one large profile.
- **COVE -** Similar to crown moldings, often smaller in size and less decorative.
- **CROWN -** Used to accent ceiling intersections and traditional pediments and casework tops.
- **FILLET** - A thin molding used to separate or decorate larger moldings and also refers to the infill strip that fits between the balusters on a staircase.
- **HANDRAIL** - A molding used along a hallway or corridor designed to be grasped by the hand to provide stability or support.
- **LATTICE -** A thin, flat molding, rectangular in cross-section, used to build decorative screening or conceal joinery.
- **OGEE -** A molding with reverse curved face that is concave above and convex below.
- **QUARTER ROUND -** A molding with a convex, quarter cylindrical shape.
- **PANEL MOLDING -** A decorative molding used to trim out raised or recessed wall panels.
- **SHOE -** A small molding with a concave channel and a square back.
- **TRANSITION MOLDING -** A molding that conceals the joint between uneven surfaces.

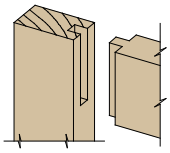
MORTISE AND TENON, BLIND JOINT: A mortise and tenon joint in which the tenon does not extend through the mortise and does not remain visible once the joint is completed; also “blind tenoned.”



MORTISE AND TENON, SLOTTED JOINT: A mortise and tenon right angle joint in which the tenon is visible on two edges once the joint is completed. Also referred to as a Bridle Joint.



MORTISE AND TENON, STUB JOINT: A short tenon inserted in a plow or groove.



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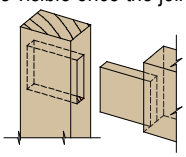
MORTISE AND TENON, THROUGH JOINT: A mortise and tenon joint in which the inserted tenon extends completely through the mortise and the end of the tenon remains visible once the joint is completed.



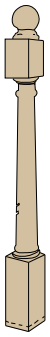
MOTTLE: Broken wavy patches across the face of the wood that give the impression of an uneven, although smooth, surface caused by a twisted interwoven grain with irregular cross figure, which is the mottle. The effect is due to reflected light on the uneven arrangement of the fibers. Other terms used to describe variations include bee's wing, fiddle, peacock, plum, ram, block, or stop mottle.

N

NAILED: Members secured together with nails, including power driven nails or staples. On exposed surfaces, staples and tee nails shall run parallel to the grain.

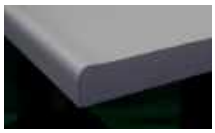
NATURAL: When referring to color and matching, veneers containing any amount of sapwood and/or heartwood.

NEWEL POST: In stairwork, an upright post that supports or receives the handrail at critical points of the stair, such as starting, landing, or top; the central vertical support of a spiral staircase.

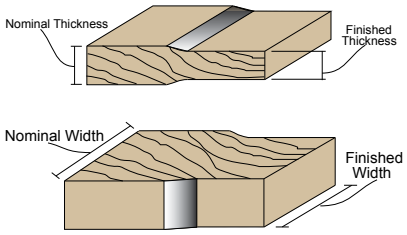


NGR STAINS: Refers to non-grain raising stains where the dye or pigment is dissolved in a very fast evaporating solvent.

NO-DRIP / LIPPED EDGE: A type of countertop edge that entraps or prevents fluids from running off the top.

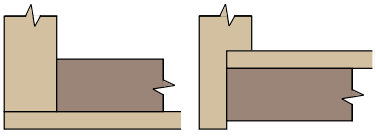


NOMINAL: The average sizes (width and thickness) of lumber just out of the sawmill before being processed into usable board stock. Always larger than "finished" dimensions. Also, a term that designates a stated dimension as being approximate and subject to allowances for variation. (e.g. Nominal 3/4" plywood is often actually 23/32" thick).



NON-CLIMATE CONTROLLED: Referring to the inside areas of a building where heat or air condition systems are not used for environmental controls.

NON-HOUSED CABINET BACK: When a cabinet back is set in a rabbet or is plant on back style.



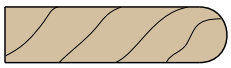
NON-TRADITIONAL MATERIALS: Materials re-purposed from other industrial and manufacturing areas but assigned to the woodwork manufacturer and treated similarly to traditional architectural woodwork items like wall paneling. Non-traditional materials often have unique characteristics and may or may not be subject to these Standards.

NON-WOOD: Refers to components made of material other than wood, veneer or paper-based products that are subject to this Standard's tolerance threshold values.

NON-WOOD-BASED PRODUCTS: Any material that is not made of wood, veneer or paper-based materials. Common non-wood-based products include: solid surface, stone, metals, fabrics, drywall, and masonry.

NON-WOOD TO NON-WOOD: A two or more component joint or assembly containing products that are not made of wood or wood-based products.

NOSING: A rounded convex edge, as on a stair tread, countertop, or sill.



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O

OCCASIONAL: In reference to grading, a small number of characteristics that are arranged somewhat diversely within the panel or board face.

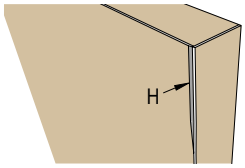
OPAQUE FINISH: A paint or pigmented stain finish that hides the natural characteristics and color of the grain of the wood surface and is not transparent.

OPEN GRAIN AND CLOSED GRAIN: See Grain.

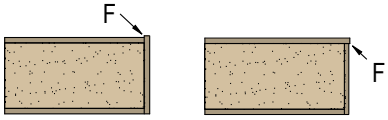
ORANGE PEEL: The description of a coating that does not flow out smoothly, exhibiting the texture of an orange.

ORIENTED STRAND BOARD (OSB): is an engineered wood product formed by layering strands (flakes) of wood in specific orientations. In appearance it may have a rough and variegated surface with the individual strips lying unevenly across each other. Minimum requirements based on Voluntary Product Standard PS 2 http://nist.gov

OVER FILING: In manufacturing, rough edges are required to be filed or sanded smooth. Over filing exposes the core of the HPL or otherwise causes defects in the finished product.



OVERLAP: A condition where the veneers comprising plywood are so misplaced that one piece overlaps the other and does not make a smooth joint. Also, the condition where HPL or veneer edges do not meet cleanly, with one face extending beyond the other.



OVERLAY: To superimpose or laminate a wood veneer of various species or a decorative item, such as HPL, or TFL to one or both sides of a given core, such as plywood, particleboard, or medium density fiberboard.

OVERSPRAY: The dry, pebble like surface caused when the sprayed finish begins to dry in the air before it hits the surface.

OXIDATION: The effect on the appearance of exposed wood faces caused by exposure to atmosphere. This is analogous to browning reactions in freshly cut fruit; for instance, apples. Hardwoods can develop deep yellow to reddish brown discolorations on the surface of the wood when exposed to air immediately after sawing or peeling. These discolorations are especially noticeable on Cherry, Birch, Red Alder, Sycamore, Oak, Maple, and Sweet Gum. Some species, such as Alder, Oak, Birch, and Maple, develop these discolorations during air seasoning. A related gray stain on several varieties of Southern Oaks also appears to be oxidative in nature. Proper selection, sanding, and finishing can minimize the effects of oxidation. Care should be taken when using filler, as it might not change the same as the wood.

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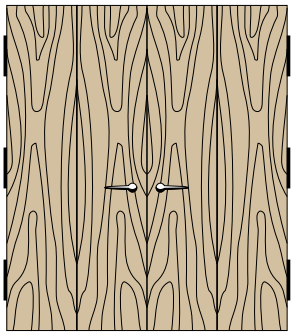
P

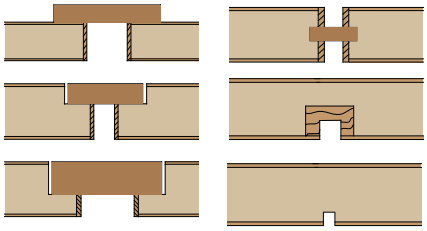
PAIR MATCH: Relating to passage doors, means doors are adjacent to each other or are next to each other with only a door frame member separating the two doors.



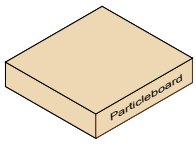
PANEL: Panels are consistent in thickness, with edges that are at right angles to the face and are either homogeneous or made up of three or more layers.

PANEL MATCH: Establishes the leaf layout in each individual panel.

PANEL REVEAL: A detail used in wall and ceiling surfacing panel design that allows for expansion and contraction between adjacent panels. The reveal is a space between adjacent panels or other architectural features that allows for panel expansion and contraction. Some reveals are decorative in nature only, and serve to accentuate joints, architectural details, or visual effect.



PARTICLEBOARD: A generic term for a panel manufactured from lignocellulosic materials (usually wood), primarily in the form of discrete pieces of particles, as distinguished from fibers, combined with a synthetic resin or other suitable binder, and bonded together under heat and pressure in a hot press by a process in which the entire interparticle bond is created by the added binder, and to which other materials may have been added during manufacturing to improve certain properties. Particles are further defined by the method of pressing. When pressure is applied in the direction perpendicular to the faces as in a conventional multi platen hot press, they are defined as flat platen pressed; and when the applied pressure is parallel to the faces, they are defined as extruded. Minimum requirements based on CPA's (Composite Panel Association) ANSI A208.2 (latest edition), compositepanel.org.



PARTICLEBOARD, FIRE RETARDANT TREATED: Particleboard treated to obtain Class A or Class B flame spread (often distinguishable with a red/pink tinted core). Minimum requirements based on CPA's (Composite Panel Association) ANSI A208.2 (latest edition), compositepanel.org.

PARTITION:

- A fixed panel within a cabinet.
- A panel or a panel assembly that is securely attached to floor, ceiling, walls or a supported frame used to divide room spaces.

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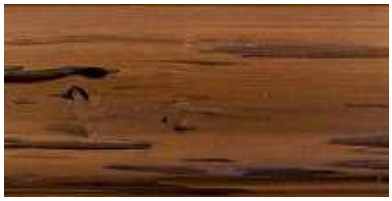
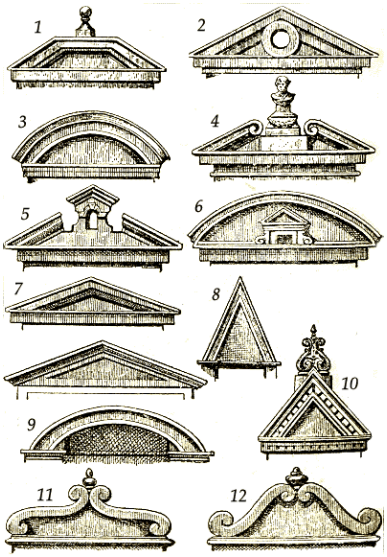
PATCH: A repair made by inserting and securely gluing a sound piece of wood of the same species in place of a defect that has been removed. The edges shall be cut clean and sharp and fit tight with no voids. "Boat" patches are oval shaped with sides tapering in each direction to a point or to a small rounded end; "router" patches have parallel sides and rounded ends; "sled" patches are rectangular with feathered ends.

PECKY: Pockets of disintegrated wood caused by localized decay or wood areas with abrupt color change related to localized injury such as bird peck. Peck is sometimes considered a decorative effect, such as bird peck in Pecan and Hickory or pecky in Cypress.



PEDIMENT: A triangular ornament above a cornice.



Fronton : 1. à pans ; 2. à jour ; 3. circulaire ; 4. brisé ; 5. entrecoupé ; 6. doublé ; 7. surbaissé ; 8. surmonté ; 9. sans retoure ; 10. triangulaire ; 11. sans base ; 12. par enroulement

PENETRATING OIL: In finishing, an oil-based material designed to penetrate the wood.

PERFORMANCE BASED: With reference to these standards, and in contrast to prescriptive based, refers to the lack of dictated or specifically required technical processes in lieu of a concept that allows innovation as long as the required outcomes are achieved.

PHENOL FORMALDEHYDE RESIN: A synthetic resin adhesive with a high resistance to moisture. The most common types require high temperatures during pressing to aid in the curing process.

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PHOTODEGRADATION: The effect on the appearance of exposed wood faces caused by exposure to both sun and artificial light sources. Obviously, if an entire face is exposed to a light source, it will photodegrade somewhat uniformly and hardly be noticeable; whereas partially exposed surfaces or surfaces with shadow lines may show non-uniform photodegradation. Some woods, such as American Cherry and Walnut, are more susceptible than others to photodegradation.

PILASTER: A fluted or carved, flat, decorative column vertically attached to a building or furniture.

PIN HOLES: All circular or nearly circular holes in the exposed surface.

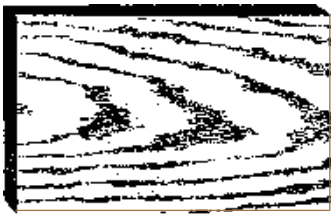
PITCH: An accumulation of resin that occurs in separations in the wood or in the wood cells themselves.

PITCH POCKET: A well-defined opening between the annual growth rings that contains pitch.

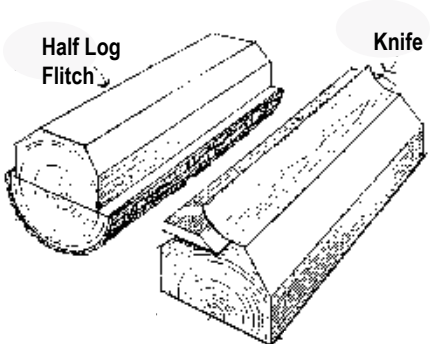
PITCH STREAK: A well-defined accumulation of pitch in the wood cells in a more or less regular streak.

PITH: A small, soft core occurring in the center of the log, branch or stem.

PLAIN SAWN: A hardwood figure developed by sawing a log lengthwise at a tangent to the annual growth rings. It appears as U shaped or straight markings in the board's face.

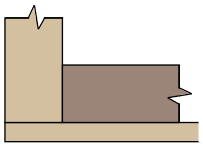


PLAIN SLICING: Most commonly used for hardwood plywood. The log is cut in half, and one half is placed onto a carriage and moved up and down past a fixed knife to produce the veneers. Veneer is sliced parallel to the pith of the log and approximately tangent to the growth rings to achieve flat cut veneer.



PLANK: A board, usually between 1-1/2" to 3-1/2" (38.1 to 89 mm) thick and 6" (152 mm) or wider, laid with its wide dimension horizontal and used as a bearing surface.

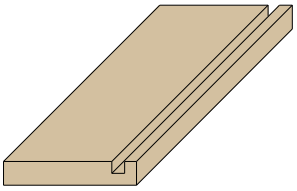
PLANT ON BACK: When a cabinet back is applied and fastened to the back edges of a cabinet box. The back is not set in grooves, plows or rabbets.



PLASTIC LAMINATE FINISH: See "HPL."

PLEASING MATCHED: A face containing components that provide a pleasing overall appearance. The grain of the various components need not be matched at the joints but will not be widely dissimilar in character and/or figure. Sharp color contrasts at the joints of the components are not permitted. Members are selected so that lighter than average color members are not placed adjacent to darker than average members.

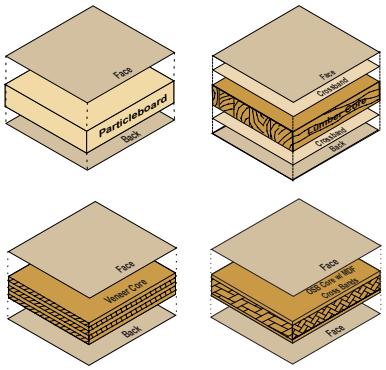
PLOW: A rectangular groove or slot of three surfaces cut parallel to the grain of a wood member, in contrast to a dado, which is cut across the grain.



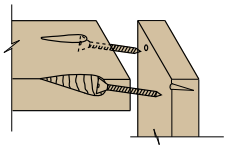
PLUS / MINUS or **(+/-):** References the maximum positive or negative variance allowed from one object to another object.

PLY: A single sheet of veneer or several strips laid with adjoining edges that may or may not be glued, which forms one veneer laminate in a glued panel (see layer). In some constructions, a ply is used to refer to other wood components such as particleboard or MDF.

PLYWOOD: A panel composed of a cross-banded assembly of layers or plies of veneer, or veneers in combination with a lumber, particleboard or fiberboard core, that are joined with an adhesive. Except for special constructions, the grain of alternate plies is always approximately at right angles, and the thickness and species on either side of the core are identical for balanced effect. An odd number of plies is always used.



POCKET SCREW: Pocket screw joints are created by aligning two pieces perpendicular, drilling angled pocket and pilot holes and then driving cabinet assembly screws to connect the pieces. These screws are used in concealed surface locations only.



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POLYESTER: In finishing, a very high solids content plastic coating, leaving a deep, wet look.

POLYURETHANE: A very hard and wear resistant finish, which is very difficult to repair. Most commonly used as a two-component system, comprising multifunctional isocyanate or moisture cured urethane, with a higher solids content than lacquers. Single component (excluding moisture cured) products are usually composed of pre-catalyzed urethane.

PRE-FINISHED: Product that is delivered with finish as opposed to field finishing.

PRE-MANUFACTURED SETS: Each panel, usually 48" x 96" (1220 mm x 2440 mm) or 48" x 120" (1220 mm x 3048 mm), is part of a sequenced set of running or balanced matched, pre-manufactured panels to be installed full width with the sequencing maintained. The panel's balanced match becomes unequal at the start, end, and any other opening or change in plane when trimmed.

PREMIUM GRADE: The highest Grade available in both material and workmanship intended for the finest work. This is naturally the most expensive Grade.

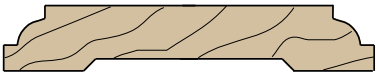
PRESCRIPTIVE BASED: With reference to these standards, and in contrast to performance based, refers to the manner in which regulations are expressed that dictate the technical processes by which the required outcomes are to be achieved.

PRESERVATIVE: (n.) A treating solution that prevents decay in wood; (adj.) having the ability to preserve wood by inhibiting the growth of decay fungi. Minimum requirements based on Window and Door Manufacturers Association (WDMA) WDMA I.S. 4-15A - wdma.com

PRESSED: As in panel layup, hot, cold, vacuum or mechanical requires pressure until glue sets and becomes rigid.

PRIMING: A process of applying the initial coating to architectural woodwork to maximize surface adhesion and finish performance.

PROFILE: A trim that has a shaped detail along one or more edges. Eased edges are included in profiles. Ends or faces may also have profiles.



PUR: Is a general adhesive with polyurethane as its primary component used in the woodwork industry. It is also referred to as PU and polyurethane reactive.

PUTTIED: See "fill."

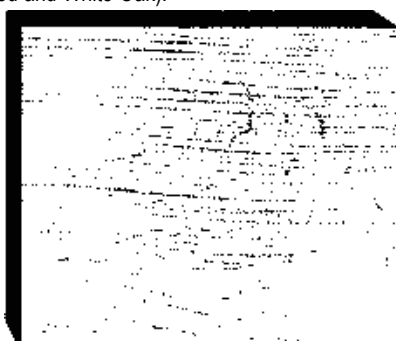
PVA: Is a wood adhesive with polyvinyl acetate as its primary component and is commonly referred to as wood glue, white glue, carpenter's glue, or PVA glue.

PVC: Abbreviation for "polyvinyl chloride," a synthetic decorative coating or edgebanding.

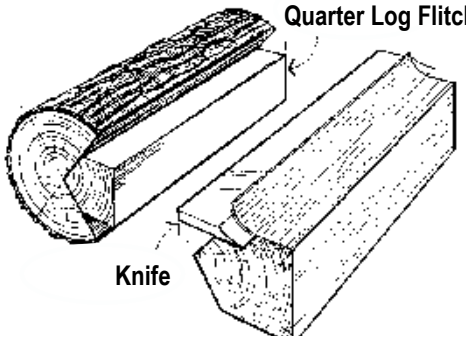
PVC EDGING: A polyvinyl chloride edging, usually in seamless rolls, typically applied by edgebanding machines using hot melt adhesives. Available in a variety of solid colors, patterns, and wood grain designs, in both textured and smooth finish.

Q

QUARTER SAWN (QUARTERED LUMBER): Refers to solid lumber cutting. Available in limited amounts in certain species. Yields straight grain, narrow boards with "flake" or figure in some species (particularly in Red and White Oak).



QUARTER SLICING: Produces a striped grain pattern, straight in some woods, varied in others. Veneer produced by cutting in a radial direction to the pith to the extent that fleck or ray flake is produced, and the amount may be unlimited. In some woods, principally Oak, fleck results from cutting through the radial medullary rays.

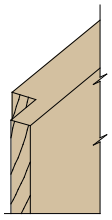


QUARTERS: The commercial thicknesses usually associated with the purchase or specification of hardwoods, such as "five quarter" (5/4 of 1"), meaning 1-1/4" (31.8 mm) in nominal thickness.

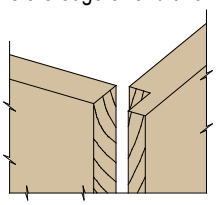
QUIRK: For purposes of these standards, means a sharp decorative incision or kerf in moldings or trim that can hide the use of mechanical fastener.

R

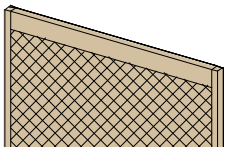
RABBET: Rectangular cut on the edge of a member; a "rabbet" has two surfaces, and a "plow" has three.



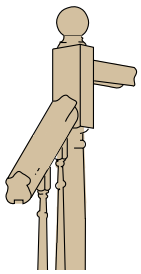
RABBET JOINT: A groove cut across the grain of the face of a member at an edge or end to receive the edge or end thickness of another member.



RAIL: The cross or horizontal pieces of a stile and rail assembly or the cross pieces of the core assembly of a wood flush door or panel.

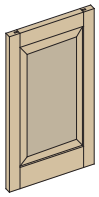


RAILING: In stairwork, the member that follows the pitch of the stair for grasping by the hand.

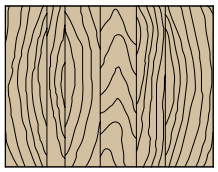


RAISED GRAIN: See “Grain”.

RAISED PANEL: Traditional door or wall panel with a bevel edge captured in a stile and rail frame.



RANDOM MATCH: Matching between adjacent veneer leaves on one panel face. Random selection in the arrangement of veneer leaves from one or more flitches producing a deliberate mismatch between the pieces of veneer.



RAY: One of the radial structures in a tree that stores nourishment and transports it horizontally through the trunk. In quarter sawn Oak, the rays form a figure called fleck.

RECONSTITUTED VENEER: Logs that are first sliced into veneer leaves, the leaves may be dyed, then glued under pressure in a mold to produce a large laminated block. The laminated block is then sliced across the glue line to create a faux grain with a designed appearance that is highly repeatable. Reconstituted veneer is an environmentally friendly alternative to expensive rare and exotic wood species. Reconstituted wood veneer can mimic exotic wood veneer species and is free from natural defects.

RECLAIMED OR RECYCLED WOOD: Processed wood retrieved from its original application for purposes of subsequent use. and the process of turning waste timber into usable products.

RED / BROWN: When referring to color and matching, veneers containing all heartwood, ranging in color from light to dark.

RED BIRCH: The heartwood of the Yellow Birch tree.

RELIEF: Defined as the difference in elevation between the high and the low parts of an area or where a form is raised (or alternatively lowered) from a flattened background without being disconnected from it.

REPAIRS: A patch, shim, or filler material inserted and/or glued into veneer or a panel to achieve a sound surface.

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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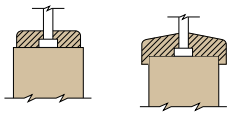
REPAIRS, BLENDING: Wood or filler insertions similar in color to adjacent wood so as to blend well.

RESORCINOL FORMALDEHYDE RESIN: For woodworking, a combination of resin and hardener that withstands long-term water immersion and has high resistance to ultraviolet light, formulated into water resistant glues.

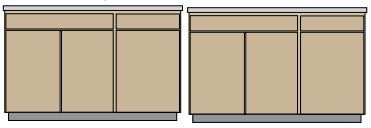
RESTRAINED: See "Captured".

RETENTION MOLDING: A molding used to capture or hold in place another material such as a panel, glass, metal or other architectural woodwork product.

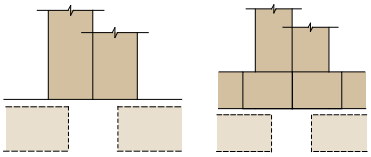


RETURN: Continuation in a different direction of a molding or projection, usually at right angles.

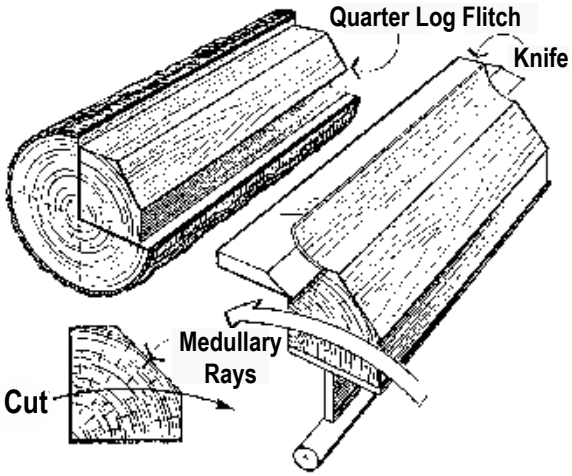
REVEAL, CABINET: The space between door edges and inset frames. The amount of viewable case edge when a door is in the closed position in flush overlay or reveal overlay cabinet construction.



REVEAL OVERLAY: Cabinet construction in which the door and drawer faces partially cover the body members or face frames of the cabinet with spaces between face surfaces creating decorative reveals.



RIFT CUT: A straight grain appearance achieved through the process of cutting at a slight angle, approximately 15 degrees, to the radial on the half round stay log or through the use of veneer cut in any fashion that produces a straight grain with minimal ray fleck. Twenty-five percent (25%) of the exposed surface may contain medullary ray flake.



RIGID GLUE LINE: For purposes of this standard, a rigid glue line is one that does not use a contact or otherwise flexible type adhesive.

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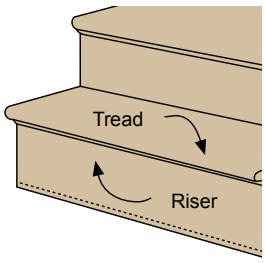
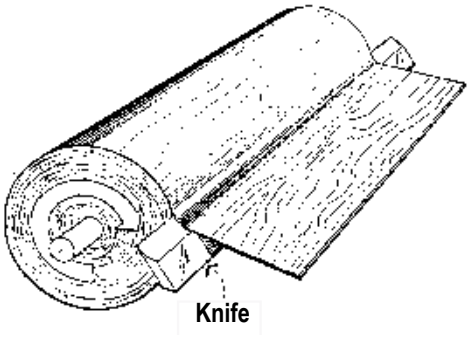
RING, ANNUAL GROWTH: The growth layer put on in a growth year.

RISER: The board at the back of a tread that "rises" to the bottom of the next tread above. In an "open riser" stair, this element is left out, and the gap between the treads is open. Open riser stairs are prohibited by code in many circumstances.



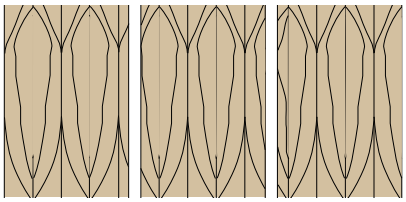
ROOM MATCH: Refers to the matching of panel faces within a room.

ROTARY SLICING: Most common method for preparing veneers for softwood plywood. The log is placed in a lathe and rotated against a stationary knife. This produces a continuous sheet of veneer, similar to pulling a long sheet off a roll of paper towels.



ROUGH CUT: Irregular shaped areas of generally uneven corrugation on the surface of veneer, differing from the surrounding smooth veneer and occurring as the veneer is cut by the lathe or slicer.

RUNNING MATCH: Each panel face is assembled from as many veneer leaves as necessary. Any portion left over from one panel may be used to start the next.



RUNNING TRIM: Generally combined in the term "standing and running trim" and refers to random, longer length trims delivered to the jobsite (e.g., baseboard, chair rail, crown molding). Running trim is generally installed horizontally. Standing trim installed vertically.

RUNS: The result of spraying a heavier coat on a vertical, or nearly vertical, surface than the viscosity of the finish will allow to hold without movement; when in close multiples are also called "sags."

RUPTURED GRAIN: A break or breaks in the grain or between spring-wood and summer-wood caused or aggravated by excessive pressure on the wood by seasoning, manufacturing, or natural processes. Ruptured grain appears as a single or series of distinct separations in the wood such as when spring-wood is crushed leaving the summer-wood to separate in one or more growth increments.

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S

S4S: Means "Surfaced Four Sides," and generally refers to the process of reducing nominal sized rough lumber to finished widths and thicknesses.

SAGS: In finishing, partial slipping of finish film creating a "curtain" effect.

SAND-THROUGH: A defect on the exposed visible surface, usually caused by too thin of veneers or over-sanding.

SANDED, CROSS: Sanded across, rather than parallel to, the grain of a wood surface.

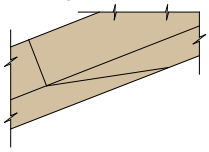
SANDED, MACHINE: Sanded by a drum or equivalent sander to remove knife or machine marks.

SANDED, SMOOTHLY: Sanded sufficiently smooth so that all machining, machine sanding marks, cross sanding, and other sanding imperfections will be concealed by the painter's applied finish work. The proper sanding grit varies with the species of material; however, it generally runs in the 120 to 150 grit range and grade of workmanship specified.

SAPWOOD: The living wood of lighter color occurring in the outer portion of a tree, sometimes referred to as sap.

SASH: A single assembly of stiles and rails into a frame for holding glass, with or without dividing bars, to fill a given opening. It may be either open or glazed.

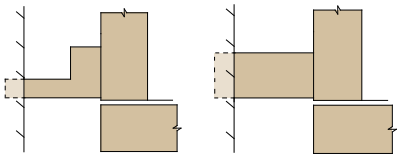
SCARF JOINT: When the ends of two boards are cut on an angle and glued together to increase the length of the board.



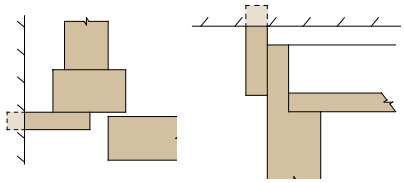
SCL: See "Structural Composite Lumber".

SCRIBE: To mark and cut an item of woodwork so that it will abut an uneven wall, floor, or other adjoining surface.

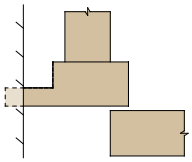
SCRIBE FILLER: A scribe filler is used to fill the space between a base or wall cabinet and an adjacent wall. The face of the scribe filler is typically set flush or a maximum of 1/16" (1.6 mm) set back from the face edge of the cabinet box.



SCRIBE MOLD: A scribe mold is used to cover the space between a base of wall cabinet and adjacent wall. The face of the scribe mold is typically set on top of the face edge of the cabinet box and not interfering with the door swing.



SCRIBE ALLOWANCE: A scribe allowance is an amount added to the all side of a cabinet face frame allowing the installer material to cut in order to achieve a tight fit to the wall.



SEALING: The process of applying a finish to the edges of cut outs and back surfaces of panels and trim.

SEALERS: Compounds that provide a sand-able coating and a smooth surface for final topcoat application, provide system toughness and moisture resistance, and contribute to build and clarity.

SEASONING: The process of allowing new cut wood to release moisture and achieve optimal moisture content without the aid of mechanical drying processes such as kiln drying, also known as air drying.

SECURELY ATTACHED: The attachment of one member to another by means of approved joinery, adhesive, mechanical fasteners, or by a combination of these means. Members shall not be considered to have been securely attached if they disassemble during standard usage and stress.

SECURELY FASTENED or BONDED: See "securely attached."

SELECT: A lumber grading term. Also, in architectural specifications, the term "select" is frequently used to describe, clarify, or qualify specific characteristics of the hardwood lumber being specified; for example, Select White Maple or Select White Birch, by using "select" as a descriptor, Natural, Brown, and Red Maple / Birch are excluded.

SELF-EDGE: See Matching Edgeband.

SEMI-EXPOSED SURFACES: Surfaces that are only visible under closer examination. At casework, those interior surfaces only exposed to view when doors or drawers are opened.

SET MATCH: Relating to passage doors, means three or more doors that are adjacent to each other or are next to each other with only a door frame member separating any of the doors.

SHADING: In finishing, transparent color used for highlighting and uniform color.

SHAKE: A separation or rupture along the grain of wood in which the greater part occurs between the rings of annual growth (see ruptured grain).

SHARP CONTRAST: For the purpose of this standard, this term applies to woodwork such as veneer of lighter than average color joined with the veneer of darker than average color. Two adjacent pieces of woodwork should not be widely dissimilar in grain, figure, and natural character markings.

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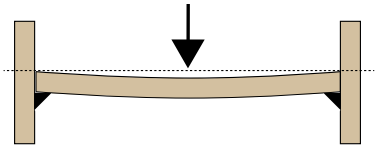
SHEEN: Finish shine or brightness; luster, patina, and radiance. The sheen or gloss level of a cured finish is traditionally measured with a 60-degree gloss meter. The words used to describe various sheens are not standardized between companies.

SHELF CLEAT: A piece of wood or other solid material attached directly to in wall blocking just below the bottom edge of a shelf.

SHELF DEFLECTION: Shelf deflection is the deviation from true flat of a shelf when placed under load.



SHELF LOAD: The amount of weight a shelf is designed to carry based on shelf core material, Modulus of Elasticity and surface materials.

SHELF PIN: a removable metal or plastic shelf support with or without an integral shoulder or stop and cylindrical shaft for insertion into bored holes in cabinet ends.

SHELLAC: A coating made from purified lac, a secretion from an insect (laccifera lacca) that is dissolved in alcohol and often bleached white.

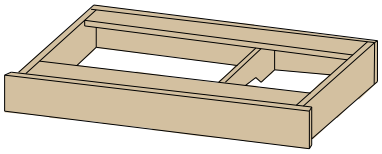
SHOP DRAWINGS: Shop drawings are detailed engineering drawings produced by the manufacturer for the fabrication of the architectural woodwork products and are often submitted to the design professional for review and comment. See Drawings.

SHOW THROUGH: Irregular surfaces visible on the face of a veneered panel (such as depressions, bumps, mechanical marks, or core or frame outlines).

SKIN: The hardwood plywood (usually 3 ply), hardboard, or composition panel, whether flat or configured, that is used for facings for flush doors, bending laminations, finished end panels, and the like.

SKIRT BOARD: A trim member similar to base, run on the rake along the wall adjoining a stairway. The skirt board covers the joint between the treads and risers and the wall. Also, the similar member below the treads at the open side of a stairway. A wall routed to receive the treads and risers may replace a skirt board.

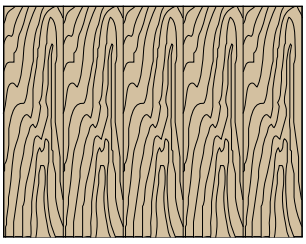
SLEEPER: A support member, usually vertical in placement, between the front and rear members of a non-integral toe base or kick assembly.



SLICED (SLICE): See “Veneer, Sliced”.

SLIGHT: As applied to grading, visible on observation, but does not interfere with the overall aesthetic appearance with consideration of the applicable grade of the panel / board.

SLIP MATCHED: Each leaf from a flitch is laid out in sequence from their place in the bundle, all faces in one direction. The result is that all the faces are either loose or tight, therefore reflect light the same, minimizing the barber pole or metamerism effect.



SMOOTH, TIGHT CUT: Veneer cut to minimize lathe checks.

SMOOTHNESS: The degree to which a surface has had machining and handling effects removed. Typically accomplished by sanding with progressively finer sanding grits until the required surface texture is achieved.

SOFT CONVERSION: An inch measurement is mathematically converted to its exact, or nearly exact metric equivalent. Inches are multiplied by 25.4 to determine millimeters. Example: 48" x 25.4 = 1219.2 mm, commonly rounded to 1220 mm.

SOFTWOOD: General term used to describe lumber or veneer produced from needle and/or cone bearing trees (see hardwood). Minimum requirements within NAAWS based on enhancement of Voluntary Product Standard PS 20, nist.gov.

SOLID PHENOLIC: See "CGS Compact Laminate"

SOLID STOCK: Solid, sound lumber (as opposed to plywood), that may be more than one piece of the same species, securely glued for width or thickness.

SOLID SURFACE: Filled cast polymeric resin panel. The fillers enhance both its performance properties and aesthetics. With a homogeneous composition throughout its thickness, solid surface requires no finish coat and is capable of being fabricated with inconspicuous seams and repaired to its original finish. Minimum requirements based on CPA's (Composite Panel Association) ANSI/ICPA SS-1 - icpa-hq.org

SOUND: In reference to lumber or veneer, the absence of decay, pith, shake, doze and wane.

SPANDREL: The triangular element in a staircase between the stringer and the baseboard.

SPECIES: A distinct kind of wood.

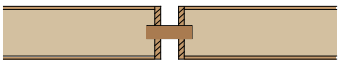
SPECIFIC GRAVITY: The ratio of the weight of a certain volume of a substance to the weight of an equal volume of water, the temperature of which is 39.2 degrees Fahrenheit (4 degrees Celsius). Higher ratios indicate denser woods.

SPECIFICATION: Directions provided by the design professional and found within a given project's contract documents, or addendum. Specifications may be modified by agreements such as change orders or field directives from the Design Professional.

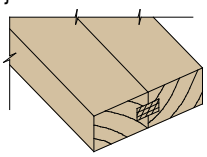
SPECIFIED: See "Specification".

SPECIFY: See "Specification".

SPLINE: A thin narrow strip forming a key between two members, usually of plywood, inserted into matching grooves that have been machined in abutting edges of panels or lumber to ensure a flush alignment and a secure joint.



SPLINE JOINT: A joint formed by using a "spline." Splines customarily run the entire length of the joint.



SPLIT: Separations of wood fiber running parallel to the grain.

SPLIT HEART: A method of achieving an inverted "V" or cathedral type figure by joining two face components of similar color and grain usually required by removal of the veneer leafs defective heart (center).

STAIN: In finishing, produces the desired undertone color with proper distribution, depth, and clarity of grain. Selection of the type of stain used is governed by the desired artistic result. In natural wood, a variation in the color tending toward blue or brown, but not to be confused with naturally occurring heartwood.

STAINING: An optional operation in wood finishing to achieve the desired undertone color and complement the wood with proper distribution of color, depth of color, and clarity of grain.

STAIRWORK: Wood material to form a stair or to clad stair parts constructed of materials other than wood, and that are custom manufactured to a design for a particular project.

STAND ALONE DOOR: A door in a room or space that is not required to be compatible color and grain or well matched for color and grain with other doors, casework, countertops, millwork, or paneling in the same space.

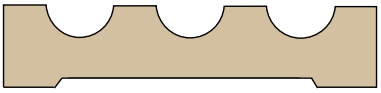
STANDARD, NON-PREMIUM COLORS AND FINISHES: The default terminology used within these standards to designate the exposed surface of panel products unless specified otherwise. Allows for manufacturer's choice of cost-effective, readily available products where no specific finishes, species, colors, or suppliers / brands have been indicated.

STANDING TRIM: Generally combined in the term "standing and running trim" and refers to vertically installed moldings of fixed length delivered to the jobsite (e.g., door jambs and casings, pre-machined window stools).

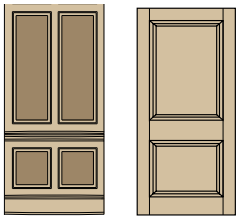
STAPLED: Members secured together with nails, including power driven nails or staples. On exposed surfaces, staples shall run parallel to the grain.

STAVED CORE: Typically refers to a core used in flush doors made up of end and edge glued wood blocks.

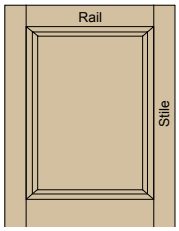
STICKING: A term used to describe shaped or molded solid wood members.



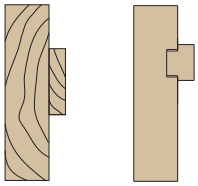
STILE AND RAIL CONSTRUCTION: A technique often used in the making of doors, wainscoting, and other decorative features for cabinets and furniture. The basic concept is to capture a panel within a frame, and in its most basic form it consists of five members: the panel and the four members that make up the frame. The vertical members of the frame are called stiles, while the horizontal members are known as rails. The panel(s) may be flat or raised. Stile and rails with flat panels are often referred to as "Shaker style".



STILES AND VERTICAL EDGES: The upright or vertical pieces of stile and rail assemblies; the vertical members of the core assembly of a wood flush door.



STOPS: Generally, a molding used to "stop" a door or window in its frame.



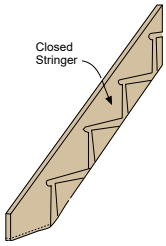
STOP SHAPED: Generally, refers to the action of stopping a shaped edge detail prior to the end of the of a run for added detail or joinery fit. As an example, the rounding over of the top edge of a drawer side is stopped before it reaches the drawer front or rear members.

STOP SILENCER: Generally, a felt or rubber pad applied to the back side of cabinet doors to silence their contact with the cabinet body.

STREAKS, MINERAL: Sharply contrasting elongated discolorations of the wood substance, generally caused when the tree absorbs and deposits minerals from the soil.

STRETCHER: A horizontal support member of base cabinet fabrication, used to attach the countertop, to space the end panels or used below a drawer to provide for a for door backstops.

STRINGER: A diagonal element supporting the treads and risers in a flight of stairs.



STRINGER TURNOUT: In stairwork, that portion of a stringer that curves or angles away from the basic run, typically used at the beginning tread.

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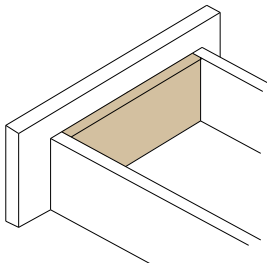
STRIPE: Stripe figure is a ribbon grain:

- **BROKEN STRIPE -** A modification of ribbon stripe. The figure markings taper in and out, due to twisted or interlocked grain, so that the ribbon stripe is not continuous as it runs more or less the full length of the flitch.
- **PLAIN STRIPE -** Alternating darker and lighter stripes running continuously along the length of a piece, due to cutting wood with definite growth rings on the quarter.
- **RAINDROP -** When the waves of the fibers occur singly or in groups with considerable intervals between, the figure looks like streaks made by raindrops striking a windowpane at a slant.
- **RIBBON STRIPE -** In some wood with interwoven grain, such as Mahogany, wide unbroken stripes can be produced by cutting on the quarter.
- **ROE -** Also called "roey". Short, broken ribbon or stripe figure in quarter sliced or sawn wood, due to the spiral formation of the fibers, or interlocked grain, in the growth rings. The irregular growth produces alternate bands of varying shades of color and degrees of luster.

STRIPPING: For purposes of these standards, means the process of removing an old or existing finish from a surface.

STRUCTURAL COMPOSITE LUMBER (SCL): A man made composite that utilizes stranded wood fibers from a variety of tree species, providing an alternative to dimension lumber. The material is engineered for strength and stability. While not really "lumber", it is marketed as a lumber substitute to be used in place of stave lumber core materials.

SUB FRONT: A front drawer box member over which a drawer front is placed.



SUBTOP: A separate support member for countertops.

SURFACE BEARING HEAD: A screw with a homogeneous head that has a flat bottom surface at least two times the diameter of the screw shaft and when tightened applies distributed pressure on the surfaces being screwed. Screws and washers are not considered surface bearing heads for the purpose of this Standard.

SURFACE CHECK: The separation of a wood, normally occurring across the rings of annual growth; usually as a result of seasoning and occurring only on one surface of the piece.

SWIRL: Figure obtained from that part of a tree where the crotch figure fades into the figure of the normal stem.

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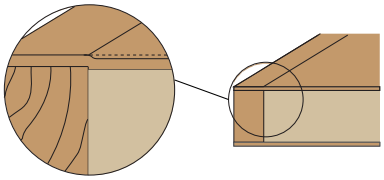
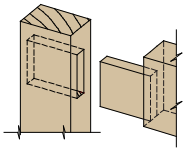
T

TAMBOUR: A rolling top or front in casework enclosing a storage space. It consists of narrow strips of wood fastened to canvas or a similar material.

TELEGRAPH OR TELEGRAPHING: In veneer or laminated work, the variations in surface refraction as a result of the stile, rail, core, core laps, glue, voids, or extraneous matter show through to the face of a panel or a door. The selection of high gloss laminates and finishes should be avoided because they tend to accentuate natural telegraphing.



TENON: The projecting tongue-like part of a wood member to be inserted into a slot (mortise) of another member to form a mortise and tenon joint.



TEXTURE: A term used to describe relative size and distribution of the wood elements. Coarse texture in veneer is associated with fast growth and harder, more difficult wood to cut. Soft or fine texture in veneer is associated with slower growth and with less summerwood, resulting in wood fibers that are easier to cut.

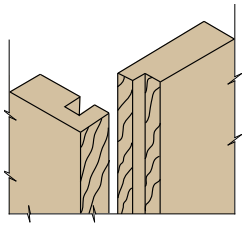
THERMALLY FUSED LAMINATE (TFL): A polyester or melamine resin impregnated paper, thermally fused under pressure to a composite core. Minimum requirements based on ISO's (International Organization for Standardization, ISO-4586) iso.org.

THICK PHENOLIC: See CGS (Compact Laminate).

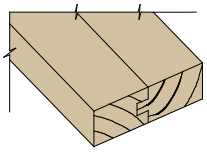
TIGHT: Set together so that there is no opening between members.

TIGHT SIDE (of leaf)**:** In knife cut veneer, that side of the leaf that was farthest from the knife as the veneer was being cut and containing no cutting checks (lathe checks). Due to the cellular structure of wood fibers, the Loose side and the Tight side reflect light differently.

TONGUE: Projection on the edge or end of a wood member that is inserted into the groove or plow of a similar size to form a joint.



TONGUE AND GROOVE JOINT: A joint formed by the insertion of the "tongue" of one wood member into the "groove" of the other.



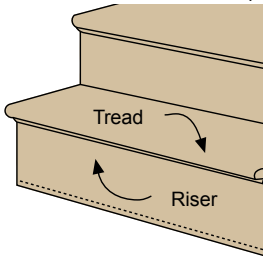
TOPCOAT: The final protective film of a finish system. There are various topcoats with different properties.

TOP FLAT SURFACE: The flat surface that can be sanded with a drum sander.

TORN GRAIN: A roughened area caused by machine work in processing.

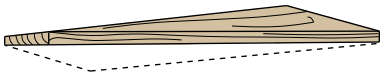
TRANSPARENT FINISH: A stain or a clear finish that allows the natural characteristics and color of the grain of the wood surface to show through the finish.

TREAD: The horizontal surface of a staircase step.



TREAD RETURN: A narrow piece of tread stock applied to the open end of a tread so that the end grain is not exposed. The leading corner of the return is mitered to the leading edge of the tread with a shoulder miter.

TWIST: A distortion caused by the turning or winding of the edges of the surface, so that the four corners of any face are no longer in the same plane.



U

UREA FORMALDEHYDE RESIN: A thermosetting resin adhesive, commonly used for Type I assemblies; relatively water resistant. Often requires curing by heat, but will cure at room temperature over time.

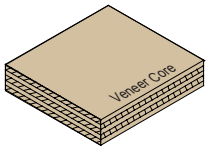
V

V-GROOVED: Narrow and shallow V- or U-shaped channels machined on a surface to achieve a decorative effect. V-grooving is most commonly encountered in mismatched or random matched wall panels as the grooves fall on the edge joints of the pieces of veneer, making the face appear as planking.

VARNISH: An oil-based finish used to coat a surface with a hard, glossy film.

VENEER: A thin layer of wood, rotary cut or sliced from a log or flitch. Thickness may vary from 1/100" (0.3 mm) to 1/4" (6.4 mm).

VENEER CORE: Core of plywood constructed using an odd number of veneer plies, with face and back veneers of overlays adhered thereto.



Specialty versions include a veneer core mdf cross bands to limit telegraphing of core grain or defects

and void free hardwood veneer core with an increased number of thin veneer plys for additional strength and rigidity.

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VENEER GRAIN OR DIRECTIONAL PATTERN MATCH: Produced by cutting one or more components from the same panel and assembled maintaining grain or pattern alignment.

VENEER LOSS: The figure and grain misalignment as a result of manufacturer's perimeter trimming of pre-manufactured or made-to-order veneer panels within a panel sequence.

VENEER, RIFT CUT: See "Rift Cut".

VENEER, ROTARY CUT: See "Rotary Slicing".

VENEER, SLICED: Veneer in which a log or sawn flitch is held securely in a slicing machine and is thrust downward into a large knife that shears off the veneer. See "Rift Cut", "Quarter Cut" or "Plain Sliced".

VENEER, WRAPPED: A process wherein a profiled core material is thermo-fused with a wood veneer on its exposed surfaces.

VERTICAL GRAIN: Produced by cutting perpendicular to a log's growth rings, where the member's face is no more than 45 degrees to the rings. This produces a pleasing straight grain line. Vertical grain is defined as having no less than an average of five growth rings per inch on its exposed face.

VGF: The **HPL** acronym for "Vertical, General Purpose, Flame Retardant" laminate.

VGP: The **HPL** acronym for "Vertical, General Purpose, Postforming Grade" laminate.

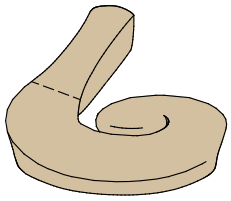
VGS: The **HPL** acronym for "Vertical, General Purpose, Standard Grade" laminate.

VINE MARK: Bands of irregular grain running across or diagonally to the grain which are caused by the growth of climbing vines around the tree.

VINYL LACQUERS: In finishing, catalyzed lacquers with a plastic rather than a nitrocellulose base.

VISCOSITY: The property of resistance to flow in a fluid or semi-fluid.

VOLUTE: The spiral decorative element terminating the lower end of a stair rail.



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W

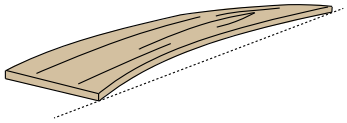
WAFERBOARD: See “Oriented Strand Board (OSB)”.

WAINSCOT: A lower interior wall surface that contrasts with the wall surface above it. Often refers to half-height wall paneling lining a room, below the chair rail and above the baseboard.

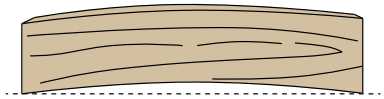
WANE: Is defined as bark or missing areas of wood on the edge or corner of lumber, except eased edges. Live edge slabs typically feature prominent wane edges.

WARP: Any deviation from a true or plane surface, including bow, crook, cup, twist, or any combination thereof. Warp restrictions are based on the average form of warp as it occurs normally, and any variation from this average form, such as short kinks, shall be appraised according to its equivalent effect. Pieces containing two or more forms of warp shall be appraised according to the combined effect in determining the amount permissible.

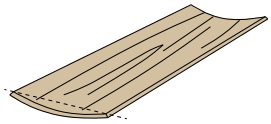
- **BOW -** A deviation flatwise from a straight line drawn from end to end of a piece. It is measured at the point of greatest distance from the straight line.



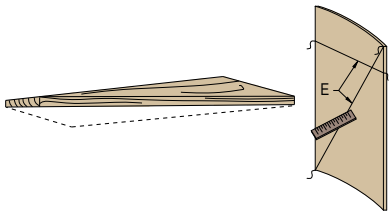
- **CROOK -** A deviation edgewise from a straight line drawn from end to end of a piece. It is measured at the point of greatest distance from the straight line.



- **CUP -** A deviation in the face of a piece from a straight line drawn from edge to edge of a piece. It is measured at the point of greatest distance from the straight line.



- **TWIST -** A deviation flat wise, or a combination of flat wise and edgewise, in the form of a curl or spiral, and the amount is the distance an edge of a piece at one end is raised above a flat surface against which both edges at the opposite end are resting snugly. In passage doors, any distortion in the door itself and not its relationship to the frame or jamb in which it is to be hung, measured by placing a straight edge or a taut string on the concave face.



WASH COATS: Thin solutions applied as a barrier coat to wood. Used prior to wiping stains for color uniformity.

WATER REPELLENT: A wood treatment solution that deposits waterproof or water-resistant solids on the walls of wood fibers and ray cells, thereby retarding their absorption of water; having the quality of retarding the absorption of water by wood fibers and ray cells.

WAVY: Curly grain with large undulations; sometimes referred to as “finger roll” when the waves are about the width of a finger.

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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WELL HOLE: In stairwork, the open space in which the stairway is set.

WELL MATCHED FOR COLOR AND GRAIN: For the purpose of these standards, means that the members that make up the components of an assembly and components of an adjacent assembly are:

- Similar and nearly uniform in color, and
- Have similar grain, figure, and character. Adjacent members must be of the same grain type whether flat grain (plain sliced), vertical grain (quarter cut), rift grain, or mixed grain.

WHITE: When referring to color and matching, veneers containing all sapwood ranging in color from pink to yellow.

WHITE BIRCH: Term used to specify the sapwood of the Yellow Birch tree.

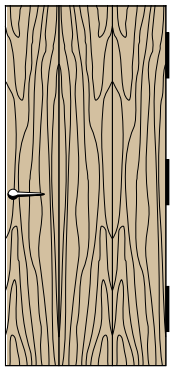
WINDOWS: In architectural woodwork, all frames and sashes for double hung, casement, awning, sidelights, clerestory, and fixed windows. Stock and name brand units are not included.

WIPING STAINS: Refers to pigmented oils or solvents applied to wood.

WOOD-BASED PRODUCTS: Products made primarily of wood, veneer or paper-based materials such as HPL, CGS (Compact Laminate) and engineered panels.

WOOD FILLER: An aggregate of resin and strands, shreds, or flour of wood, which is used to fill openings in wood and provide a smooth, durable surface.

WOOD FLUSH DOOR: An assembly consisting of a core, stiles and rails, and/or edgebands, with two or three plies of overlay on each side of the core assembly. All parts are composed of wood, wood derivatives, or HPL's.



WOOD TO NON-WOOD: A two or more component joint or assembly containing wood or wood-based products being installed next to non-wood based components.

WOOD TO WOOD: A two or more component joint or assembly containing wood or wood-based products.

WOODWORK: See "Architectural Woodwork".

WOODWORKER: See "Manufacturer".

WORKMANSHIP: See" First Class Workmanship".

WORMHOLES: Holes resulting from infestation of worms.

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WORM TRACK: Marks caused by various types of wood attacking larvae. Often appear as sound discolorations running with or across the grain in straight to wavy streaks. Sometimes referred to as "pith flecks" in certain species of Maple, Birch and other hardwoods because of a resemblance to the color of pith.

X, Y & Z

END OF GLOSSARY

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A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS 4.0

RESOURCE GUIDE

GENERAL

REFERENCE SOURCE ACRONYM DIRECTORY

CONTINUING EDUCATION

AIA - American Institute of Architects
AIBD - American Institute of Building Design
APDIQ - Association Professionnele des Dsigners d'interieur du Quebec
BHMA - Builders Hardware Manufacturers Association
CRA - California Redwood Association
IDC - Interior Design of Canada
IIDA - International Interior Design Association
OAQ - Orde des architectes du Quebec
RAIC - Royal Architectural Institute of Canada

STANDARDS & REGULATIONS

AF&PA - American Forest & Paper Association
AHFA - American Home Furnishings Alliance
ANSI - American National Standards Institute
ARE - Association for Retail Environments
ASID - American Society of Interior Designers
AWMAC - Architectural Woodwork Manufacturers Association of Canada
BIFMA - Business + Institutional Furniture Manufacturers Association
CCP - Woodwork Institute Certified Compliance Program
CPA - Composite Panel Association
CSC - Construction Specifications Canada
CSI - Construction Specifications Institute
CSIP - Woodwork Institute Certified Seismic Installation Program
DHI - The Door and Hardware Institute
GIS - AWMAC Guarantee Inspection Service
HPVA - Decorative Hardwoods Association (formally HPVA)
ICC - International Code Council
ISFA - International Surface Fabricators Association
ISO - International Organization for Standardization
IWPA - International Wood Products Association
MCP - Woodwork Institute Monitored Compliance Program
NAM - National Association of Manufacturers
NEMA - National Electrical Manufacturers Association
NFPA - National Fire Protection Association
NHLA - National Hardwood Lumber Association
NIST - National Institute of Standards & Technology
SEFA - Scientific Equipment & Furniture Association
SFI - Sustainable Forest Initiative
UL - Underwriters' Laboratories
WDMA - Window & Door Manufacturers Association
WI - Woodwork Institute
WWPA - Western Wood Products Association

TESTING AND GRADING

APA - The Engineered Wood Association
ASTM - American Society for Testing and Materials
ITS - Intertek Testing Services / Warnock Hersey

SUSTAINABLE BUILDING

CaGBC - Canada Green Building Council
FSC - Forest Stewardship Council
Green Globes:
USA - The Green Building Initiative
Canada - ECD Energy and Environment
SFI - Sustainable Forestry Initiative Inc.
TFF - Tropical Forest Foundation
USGBC - U.S. Green Building Council and Green Build Conferences

SPECIALIZED PRODUCT

KCMA - Kitchen Cabinet Manufacturers Association
LMA - Laminating Materials Association, Inc.
MMPA - Moulding and Millwork Producers Association
NHLA - National Hardwood Lumber Association
WDMA - Window & Door Manufacturers Association
WRCLA - Western Red Cedar Lumber Association

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REFERENCE SOURCE CONTACT INFORMATION

AF&PA - American Forest & Paper Association
1111 19th Street NW, Suite 800, Washington, DC 20036
Ph: 800-878-8878 - Fax: 202-463-2700, afandpa.org

AHFA - American Home Furnishings Alliance
Box HP-7, High Point, NC 27261
Ph: 336-884-5000 - Fax: 336-884-5303, ahfa.us

AIA - American Institute of Architects
1735 New York Avenue NW, Washington, DC 20006
Ph: 800-242-3837 - Fax: 202-626-7547, aia.org

AIBD - American Institute of Building Design
529 14th Street, NW, Suite 750, Washington, DC 20045
Ph: 800-366-2423 - Fax: 855-204-0293, aibd.org

ANSI - American National Standards Institute
25 West 23rd Street, 4th Floor, New York, NY 10036
Ph: 212-642-4900 - Fax: 212-398-0023, ansi.org

APA - The Engineered Wood Association
7011 South 19th Street, Tacoma, WA 98466
Ph: 253-565-6600 - Fax: 253-565-7265, apawood.org

ARE - Association for Retail Environments
4651 Sheridan Street, Suite 407, Hollywood, FL 33021-3657
Ph: 954-893-7300 - Fax: 954-893-7500, nasfm.org

ASID - American Society of Interior Designers
608 Massachusetts Avenue NE, Washington, DC 20002-6006
Ph: 202-546-3480 - Fax: 202-546-3240, asid.org

ASTM - American Society for Testing and Materials
100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
Ph: 610-832-9585 - Fax: 610-832-9555, astm.org

AWMAC - Architectural
Woodwork Manufacturers Association of Canada
PO Box 36525, RPO MacTaggart, Edmonton, AB T6R 0T4
Ph: 403-81-7300, awmac.com

BHMA - Builders Hardware Manufacturers Association
355 Lexington Avenue, 15th Floor, New York, NY 10017
Ph: 212-297-2122 - Fax: 212-370-9047, buildershardware.com

BIFMA - Business + Institutional Furniture Manufacturers Association
678 Front Avenue, NW Suite 150, Grand Rapids, MI 49504-5368
Ph: 616-285-3968 - Fax: 616-265-3765, bifma.org

CPA - Composite Panel Association
19465 Deerfield Avenue, Suite 306, Leesburg, VA 20176
Ph: 703-724-1128 - Fax: 703-724-1588, compositepanel.org

CRA - California Redwood Association
818 Grayson Road, Suite 201, Pleasant Hill, CA 94523
Ph: 925-935-1499 - Fax: 925-935-1496, calredwood.org

CSC - Construction Specifications Canada
120 Carlton Street, Suite 312, Toronto, ON, M5A 4K2, Canada
Ph: 416-777-2198 - Fax: 416-777-2197, csc-dcc.ca

CSI - Construction Specifications Institute
99 Canal Center Plaza, Suite 300,Alexandria, VA 22314
Ph: 800-689-2900 - Fax: 703-684-8436, csinet.org

DHI - The Door and Hardware Institute
14150 Newbrook Drive, Suite 200, Chantilly, VA 20151-2223
Ph: 703-222-2010 - Fax: 703-222-2410, dhi.org

FSC - Forest Stewardship Council
USA:
212 Third Avenue North, Suite 445, Minneapolis, MN 55401
Ph: 612-353-4511 - Fax: 612-208-1565, fscus.org
Canada:
70 The Esplanade, Suite 400, Toronto, ON M5E 1R2
Ph: 514-394-1137, fsccanada.org

GREEN GLOBES:
USA:
The Green Building Initiative
2104 SE Morrison, Portland, Oregon 97214
Ph: 877-424-4241 - Fax: 503-961-8991, hegbi.org
Canada:
ECD Energy and Environment
165 Kenilworth Avenue, Toronto, ON M4L 3S7
Ph: 416-699-6671, greenglobes.com

HPVA - Decorative Hardwoods Association (formally HPVA)
1825 Michael Faraday Drive, Reston, VA 20190
Ph: 703-435-2900 - Fax: 703-435-2537, decorativehardwoods.org

ICC - International Code Council
500 New Jersey Avenue NW, 6th Floor, Washington, DC 20001-2070
Ph: 888-422-7233 - Fax: 202-783-2348, iccsafe.org

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REFERENCE SOURCE CONTACT INFORMATION (continued)

IDC - Interior Design of Canada
C 536-43 Hanna Avenue, Toronto, Ontario, M6K 1X1, Canada
Ph: 416-649-4425 - Fax: 416-921-3660, idcanada.org

IIDA - International Interior Design Association
13-122 Merchandise Mart, Chicago, IL 60654-1104
Ph: 312-467-1950 - Fax: 312-467-0779, iida.org

ISFA - International Surface Fabricators Association
P. O. Box 627, Ingomar, PA 15127
Ph: 888-599-4732, isfanow.org

ISO - International Organization for Standardization
Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland
Ph: +41 22 749 01 11, iso.com

ITS - Intertek Testing Services
Ph: 800-967-5352, intertek.com

IWPA - International Wood Products Association
4214 King Street West, Alexandria, VA 22302
Ph: 703-820-6696 - Fax: 703-820-8550, iwpawood.org

KCMA - Kitchen Cabinet Manufacturers Assoc.
1899 Preston White Drive, Reston VA 20191-5435
Ph: 703-264-1690 - Fax: 703-620-6530, kcma.org

LEED® - Leadership in Energy and Environmental Design

USGBC - U.S. Green Building Council
2101 L Street, NW, Suite 500, Washington, DC 20037
Ph: 800-795-1747 - Fax: 202-828-5110, usgbc.org

CaGBC - Canada Green Building Council
47 Clarence Street, Suite 202, Ottawa, ON K1N 9K1
Ph: 866-941-1184 - Fax: 613-241-4782, cagbc.org

MMPA - Moulding and Millwork Producers Association
507 First Street,Woodland, CA 95695
Ph: 530-661-9591 - Fax: 530-661-9586, wmmpa.com

NAM - National Association of Manufacturers
733 10th Street, NW, Suite 700, Washington, DC 20001
Ph: 800-814-8468 - Fax: 202-637-3182, nam.org

NEMA - National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752, Rosslyn, Virginia 22209
Ph: 703-841-3200 - Fax: 703-841-5900, nema.org

NFPA - National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169-7471
Ph: 617-770-3000 - Fax: 617-770-0700, nfpa.org

NHLA - National Hardwood Lumber Association
6830 Raleigh-Lagrange Road, Memphis, TN 38184-0518
Ph: 901-377-1818 - Fax:901-382-6419, nhla.com

NIST - National Institute of Standards & Technology
100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460
Ph: 301-975-6478 - Fax: 301-926-1630, nist.gov

RAIC - Royal Architectural Institute of Canada
330-55 Murray Street, Ottawa, Ontario, K1N 5M3, Canada
Ph: 631-241-3600 - Fax: 613-241-5750, raic.org

SEFA - Scientific Equipment & Furniture Association
65 Hilton Avenue, Garden City, NJ 11530
Ph: 877-294-5424 - Fax: 516-294-4765, sefalabs.com

SFI - Sustainable Forest Initiative, Inc.

USA:
2121 K Street, NW, Suite 750, Washington, DC 20037
Ph: 202-596-3450 - Fax: 202-596-3451

Canada:
1306 Wellington Street, Suite 400, Ottawa, ON K1Y 3B2
Ph: 613-747-2454 - Fax: 613-747-2453, sfiprogram.org

TFF - Tropical Forest Foundation
2121 Eisenhower Avenue, Suite 200, Alexandria, VA 22314
Ph: 703-518-8834 - Fax: 703-518-8974, tropicalforestfoundation.org

UL - Underwriters' Laboratories
333 Pfingsten Road, Northbrook, IL 60062-2096
Ph: 847-272-8800 - Fax: 847-272-8129, ul.com

WDMA - Window & Door Manufacturers Association
2025 M Street, NW, Suite 800, Washington DC, 20036-3309
Ph: 800-223-2301 - Fax: 847-299-1286, wdma.com

WI - Woodwork Institute
1455 Response Rd., Ste. 110, Sacramento, CA 95815
Ph: 916-372-9943 - Fax: 916-372-9950, woodworkinstitute.com

WRCLA - Western Red Cedar Lumber Association
1501-700 West Pender Place 1, Business Building, Vancouver, BC, Canada V6C 1G8
Ph: 866-778-9096, realcedar.org

WWPA - Western Wood Products Association
Yeon Building, 522 SW Fifth Avenue, Portland, OR 97204-2122
Ph: 503-224-3930 - Fax: 503-224-3934, wwpa.org

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MISCELLANEOUS CODES

PRESERVATIVE & WATER REPELLENT TREATMENTS

- **Within the U.S**. - Governed under I.S. - 4, latest edition, as published by the Window and Door Manufacturers Association (WDMA), wdma.com, subject to any applicable EPA or local Air Quality Management District's restrictions on what may be used for the project location.
- **Within Canada** - Governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at nrc.ca.

FIRE RETARDANT COATINGS

Fire retardant coatings are typically subject to listing by an accredited testing laboratory and require a registration number for approval recognized by fire inspectors.

FIRE CODES

- **Within the U.S.** - Governed by the International Code Council, Inc. (ICC), iccsafe.org, and the National Fire Protection Association (NFPA), nfpa.org.
- **Within Canada** - Governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at nrc.ca.

ADA REQUIREMENTS

- **Within the U.S.** - Governed by the Federal Americans with Disabilities Act (ADA) subject to any applicable state or local requirements that might be more stringent for the project location. Contact the Access Board at access-board.gov and ADA.gov.
- **Within Canada** - Contact the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at nrc.ca.

RATED FIRE DOOR ASSEMBLIES

- **Within the U.S.** - Rated fire door assemblies are governed in accordance with the National Fire Protection Association's Publication NFPA 80, nfpa.org, "Standard for Fire Doors and Fire Windows," subject to any applicable state or local requirements that might be more stringent for the project location.
- **Within Canada** - Governance is by the National Building Code of Canada, Section 3.8, Appendix A, which can be reviewed at nrc.ca.

BUILDING CODE REQUIREMENTS

- **Within the U.S.** - Governed by the International Building Code (IBC), iccsafe.org, subject to any applicable state or local requirements that might be more stringent for the project location.
- **Within Canada** - Governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at nrc.ca.

SEISMIC FABRICATION & INSTALLATION REQUIREMENTS

- **Within the U.S.** - Governed by the International Building Code (IBC), iccsafe.org, subject to any applicable state or local requirements that might be more stringent for the project location.
- **Within Canada** - Governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at nrc.ca.

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SUBMITTALS

INTRODUCTION

At the beginning of every woodwork project is the submittal stage, the various items are the foundation of every project – Shop Drawings, Approvals, Samples and Scheduling.

PURPOSE

Shop drawings are the means by which the design concept is turned into reality, serving as the primary instructions for woodwork engineering and fabrication, and as a guide for other trades. As the primary communication among manufacturer, general contractor and design professional, shop drawings serve a valuable coordinating function. Shop drawings should indicate methods of construction, exact material selections, finishes, method of attachment and joinery, exact dimensions and should include the manufacturer's technical suggestions.

WHAT TO EXPECT

The key to achieving a detailed and useful set of shop drawings is concise and continual communication between design professional and manufacturer.

The manufacturer shall submit samples, product data and shop drawings of sufficient detail and scale to demonstrate compliance with the Grade specified.

LEVEL OF DETAIL

The level of detail required on shop drawings is established by the complexity of the project. The specifier is at liberty to specify any level of detail as a requirement of the project and of the contract documents. It should be noted that requirements for local codes and utilization of fire-retardant wood products is to be researched and directed by the design professional and are not the responsibility of the manufacturer.

What constitutes the minimum expectation for a set of shop drawings is not simple, since there are many variables as to the complexity, quality and type of work being specified.

SCHEDULING

Most projects are encumbered by a tight production schedule, especially for the finish trades such as woodworking, painting, carpeting and wall coverings. Prompt review of shop drawings and accurate coordination of multiple trades can save weeks of time and eliminate problems before construction begins.

The design professional should work with the manufacturer through the contractor to determine the maximum "approval-to-fabrication" timeline needed to keep the job on schedule (e.g., "Shop drawings must be returned approved to fabricate seven (7) days after submittal").

Schedules vs. Drawings - In some cases shop drawings are not required to communicate the necessary quality, type, quantity and details of an item. Tabular schedules are used instead, generally for such items as doors, frames, stock factory cabinets, closet shelves, and furniture items.

APPROVALS

For the design professional, the approval stage provides an opportunity, prior to fabrication, to review the manufacturer's proposed shop drawings. Shop drawings, however, are not an extension of the design development process; therefore, changes by either party of intent or concept made during shop drawing review may result in a change of cost and/or time.

During the review process the design professional should consider the following:

- Unless noted otherwise, two copies are necessary for checking purposes. After being reviewed, one marked copy should be returned to the contractor or manufacturer.
- Those charged with review of shop drawings should be familiar with woodwork fabrication, and have an understanding or working knowledge of the referenced standards as well as design concept.
- Deviations from the contract documents are often recommendations for improvement, and not necessarily a criticism of design. It is as wrong for a reviewer to arbitrarily stamp "Revise and Resubmit" on a shop drawing that proposes a change, as it is wrong to automatically accept shop drawings because they contain duplicates of the original plans.

For the manufacturer, shop drawings are drawings, diagrams, schedules and other data specifically prepared to illustrate their portion of the work. Their purpose is to demonstrate the way by which the manufacturer proposes to conform to the information given and the design concept expressed in the Contract Documents.

The four common levels of approval are:

- Approved
- Approved As Noted
- Revise and Resubmit
- Rejected

Approvals are generally indicated by a stamp on the cover sheet of the shop drawings. When selecting "Approved As Noted" rather than "Revise and Resubmit," the design professional can often save weeks of production time provided the concept and all changes are clearly marked on the drawings.

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INTRODUCTION

Solid wood, both Hardwood and Softwood, are covered here.

WOOD AS A PLANT

The trunk and its branches: The cross section of a tree shows the following well-defined features in succession from the outside to the center: bark and cambium layer, wood, which in most species is clearly differentiated into sapwood and heartwood, and pith, the small central core. The pith and bark, of course, are excluded from finished lumber.

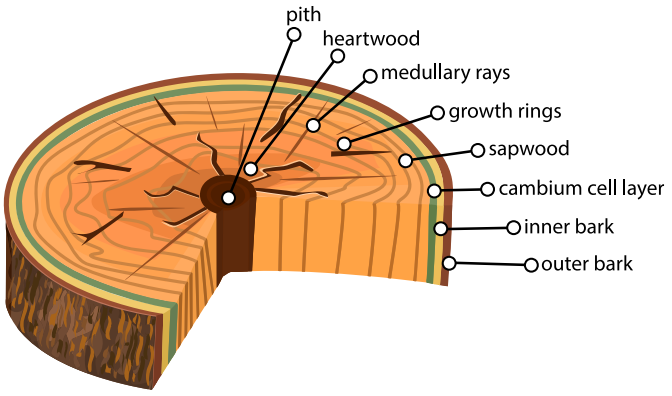

Figure: RG-001

Most branches originate at the pith, and their bases are inter-grown with the wood of the trunk as long as they are alive. These living branch bases constitute inter-grown or tight knots.

After the branches die, their bases continue to be surrounded by the wood of the growing trunk and therefore loose or encased knots are formed. After the dead branches fall off, the stubs become overgrown, and subsequently clear wood is formed.

Growth in thickness takes place in the cambium layer by cell division. No growth in either diameter or length takes place in wood already formed; new growth is purely the addition of new cells, not the further development of existing cells.

ANNUAL RINGS

Most species grown in temperate climates produce well-defined annual growth rings, which are formed by the difference in density and color between wood formed early and late in the growing season. The inner part of the growth ring formed first is called “spring wood,” and the outer part formed later in the growing season is called “summer wood.”

Spring wood is characterized by cells having relatively large cavities and thin walls. Summer wood cells have smaller cavities and thicker walls, and consequently are denser than spring wood. The growth rings, when exposed by conventional methods of sawing, provide the grain or characteristic pattern of the wood. The distinguishing features of the various species are thereby enhanced by the differences in growth ring formation.

Some tropical species, on the other hand, experience yearlong even growth which may result in less obvious growth rings.

HEARTWOOD

Heartwood consists of inactive cells formed by changes in the living cells of the inner sapwood rings, presumably after their use for sap conduction and other life processes of the tree have largely ceased. The cell cavities of heartwood may also contain deposits of various materials that frequently provide a much darker color. Not all heartwood, however, is darker.

The infiltrations of material deposited in the cells of heartwood usually make lumber cut from there more durable when exposed to weather. All wood, with the possible exception of the heartwood of Redwood and Western Red Cedar, should be preservative treated when used for exterior applications.

SAPWOOD

Sapwood contains living cells and performs an active role in the life processes of the tree. It is located next to the cambium and functions in sap conduction and storage of food. Sapwood commonly ranges from 1” to 2” (25.4 mm - 50.8 mm) in thickness. The Maples, Hickories, Ashes, and some of the Southern Yellow Pines and Ponderosa Pine may have sapwood 3” to 6” (76 mm - 152 mm) in thickness, especially in second growth trees.

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MEDULLARY RAYS

Medullary rays extend radially from the pith of the log toward the circumference. The rays serve primarily to store food and transport it horizontally. They vary in height from a few cells in some species to four or more inches in the Oaks and produce the fleck (sometimes called flake) effect common to the quarter-sawn lumber in these species.

FOREST MANAGEMENT CERTIFICATION

The Sponsor Associations acknowledge and have adopted the International Wood Products Association's (IWPA) Statement on Certification as modified below.

- We acknowledge the interest in certified timber products and verification of good forest management.
- A number of certification and verification systems are in operation or in development today, and we make no judgment against or endorsement of any single plan.
- Certification can serve as an audit of work already being done toward improved forest management. An absence of certification, however, does not mean there is a lack of quality forest management.
- We wish to recognize the efforts that many countries and companies are making with regard to improved forest management practices. Further, we strongly endorse the right of individual countries and companies that become involved with certification or the verification of forest management to pursue the development of their own internal auditing system or the selection of one that is already established.
- Global consensus has not been reached regarding the scope and viability for any single system of certification to be appropriate for all locations and conditions. Efforts are being made to develop an international framework of mutual recognition between credible and market-oriented sustainable forest management standards and certification systems.

The development of a mutual recognition process should ensure that these various certification or verification systems:

- Do not discriminate against different forest types.
- Should be regularly reviewed and updated.
- Should be transparent.
- Should be cost-effective.

We strongly endorse the development of a mutual recognition system and support any and all efforts that will further enhance management of the world's forests and the growth of global and sustainable trade in wood products.

LUMBER

Native species of trees and the lumber used in architectural woodwork produced by these trees are divided into two botanical classes:

- **Hardwoods (**angiosperms): are usually deciduous trees (broad leaf). There are more angiosperms on Earth than any other plant group, over 200,000 species. About 900 of those species are commonly available for lumber or veneer throughout the world.
- **Softwoods (**gymnosperms): are typically coniferous such as pine, spruce and fir which have needle-like or scale-like leaves. The gymnosperms are among the largest and oldest living plants and number approximately 600 species.

This botanical classification is sometimes confusing, because there is no direct correlation between calling a species a hardwood or softwood and the hardness or softness of the wood itself. Generally, hardwoods are denser than softwoods, but some hardwoods are softer than many softwoods. If hardness is a desired characteristic, refer to the Comparative Table of Wood Species later in this section.

SPECIES SELECTION

The selection of the proper wood species for an architectural design can be the end result of a number of contributing factors and conditions. Intended use, costs, hardness, and relative stability are among many important considerations.

Lumber grades should always be referenced when specifying architectural woodwork. Selection of a grade (Custom, or Premium) for the finished product will define both materials and workmanship for that product. Lumber grades defined by the lumber material suppliers' associations allow some defects which the manufacturer must remove (cut out), or otherwise work around (by gluing, etc.).

The architect and designer may make his selection from a large variety of foreign and domestic species, now commercially available. The unique quality that wood imparts to design is that each species has its own distinguishing characteristics. Once the species is chosen, its effectiveness may vary according to the manner in which it is sawn, sliced as veneer, treated, and finished.

This Section is designed to advise the architect and designer in the comparisons, considerations, and species which should be evaluated before decisions are made and specifications are written. This Section will help you correlate and tabulate the information needed. An informed choice will reward the owner with the best possible performance by a natural building material.

COMPARATIVE TABLE OF WOOD SPECIES

In order to simplify species selection, the following Comparative Table of Wood Species has been prepared showing pertinent characteristics of some species of domestic and foreign woods used by the architectural woodwork industry. The table can aid a design professional in proper species selection after studying the characteristics.

Careful analysis of the table will make it possible for an architect, designer or specification writers (who may have only a limited knowledge of architectural wood species) to make an informed selection. It is our intent that this tool will enhance understanding between the manufacturer of the woodwork you have designed and your profession, thereby enabling the building industry to better service the client, and:

- **Cost** has been broken into Low, Moderate, High, and Very High. The cost of lumber, as with other commodities, is influenced by supply and demand, both of which are constantly changing.
- **Hardness** is broken into Soft, Medium, Hard and Very Hard and takes into consideration the ability of the lumber species to sustain stress; resist indentation, abuse and wear; and to carry its anticipated load in applications such as shelving and structural members.
- **Dimensional stability** is helpful in selecting woods for use where humidity conditions may vary widely and where design or fabrication of a wood product does not allow free movement or the use of sheet products. The column figures indicate extreme conditions and show the maximum amount of movement possible in a 12" (305 mm) wide piece of unfinished wood where its moisture content increases or decreases from 10% to 5%. The possible change in dimension demonstrates that unfinished interior woodwork must be carefully protected prior to finishing by keeping it in rooms where relative humidity is between 25% and 55%. The column also shows the variation between species, and between flat grain and edge grain where such cuts are available commercially.

LUMBER (continued)

Table : RG-001 — **COMPARATIVE WOOD SPECIE VALUES**

Species	Costs [1]	Practical Size Limits [2]			Hardness	Dimensional Stability [3]
		Thickness	Width	Length		
Alder, Red	Low	1-1/2"	5-1/2"	10'	Soft	10/64"
Anigre	High	1-1/2"	5-1/2"	12'	Very Hard	No data
Ash, White	Moderate	2-1/2"	5-1/2"	12'	Hard	10/64"
Basswood	Low	2-1/2"	5-1/2"	10'	Soft	10/64"
Beech, American	Low	1-1/2"	5-1/2"	12'	Hard	14/64"
Beech, European	Moderate	2-1/2"	7-1/2"	16'	Hard	No data
Birch, Yellow - natural	Moderate	1-1/2"	5-1/2"	12'	Hard	12/64"
Birch, Yellow - select red	Moderate	1-1/2"	4-1/2"	11'	Hard	12/64"
Birch, Yellow - select white	Moderate	1-1/2"	4"	11'	Hard	12/64"
Cedar, Western Red	High	3-1/4"	11"	16'	Soft	10/64"
Cherry, American Black	High	2-1/2"	4"	7'	Hard	9/64"
Fir, Douglas - Flat grain	High	3-1/4"	11"	16'	Medium	10/64"
Fir, Douglas - Vertical grain	High	1-1/2"	11"	16'	Medium	6/64"
Hickory, True Group	Low	1-1/2"	4-1/2"	12'	Very Hard	11/64"
Mahogany, African - plain sawn	High	2-1/2"	9"	15'	Medium	7/64"
Mahogany, African - quarter sawn	Very High	2-1/2"	5-1/2"	15'	Medium	5/64"
Mahogany, American	High	2-1/2"	11"	15'	Medium	6/64"
Makore	High	1-1/2"	5-1/2"	12'	Very Hard	No data
Maple, Hard - natural	Moderate	3-1/2"	7-1/2"	12'	Very Hard	12/64"
Maple, Hard - select white	Moderate	2-1/2"	5-1/2"	12'	Very Hard	12/64"
Maple, Soft - natural	Moderate	3-1/2"	7-1/2"	12'	Medium	9/64"
Oak, English Brown	Very High	1-1/2"	4-1/2"	8'	Hard	No data
Oak, Red - plain sawn	Moderate	2-1/2"	7-1/4"	12'	Hard	11/64"
Oak, Red - rift sawn	High	1-1/16"	3-1/2"	8'	Hard	7/64"
Oak, Red - quarter sawn	High	1-1/16"	5-1/2"	8'	Hard	7/64"
Oak, White - plain sawn	Low	1-1/2"	5-1/2"	10'	Hard	11/64"
Oak, White - rift sawn	High	3/4"	3"	8'	Hard	7/64"
Oak, White - quarter sawn	High	3/4"	4"	8'	Hard	7/64"
Pecan Group, Hickory	Low	1-1/2"	4-1/2"	12'	Hard	11/64"
Pine, Eastern or Northern White	Moderate	1-1/2"	9-1/2"	14'	Soft	8/64"
Pine, Ponderosa	Moderate	1-1/2"	9-1/2"	16'	Soft	8/64"
Pine, Southern Yellow	Low	1-1/2"	7-1/2"	16'	Medium	10/64"
Pine, Sugar	Moderate	3-1/4"	11"	16'	Soft	7/64"
Poplar, Yellow	Low	2-1/2"	7-1/2"	12'	Medium	9/64"
Redwood, Flat grain heartwood	Moderate	2-1/2"	11"	16'	Soft	6/64"
Redwood, Vertical grain heartwood	Moderate	2-1/2"	11"	16'	Soft	3/64"
Teak	Very High	1-1/2"	5-1/2"	8'	Hard	6/64"
Walnut, American Black	Moderate	2-1/2"	4"	6'	Hard	10/64"

(1) Market conditions will cause these relationships to vary. These are raw costs without consideration of labor.
(2) Maximum practical sizes without lamination / gluing. Only 10% of any order is required to be at maximum sizes.
(3) These figures represent possible width change in a 12" (305 mm) board when moisture content is reduced from 10% to 5%. Figures taken are for plain sawn unless indicated otherwise in the species column.

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ALDER, RED (Alnus rubra)

Red Alder (also know as Oregon, Pacific Coast and Western Alder) has become an important utility lumber. Stable, economical and plentiful, it is used as a core for veneer and in the solid for mass produced furniture. The inner bark turns a reddish orange when exposed to the air, hence the name. Sourced predominately from the states of Oregon and Washington. Varies in color from almost white to pale pinkish brown and there is no visible boundary between heartwood and sapwood. Moderately light in weight and intermediate in most strength properties with relatively low shrinkage.

Figure: RG-002

ANIGRE (Aningeria poteria)

Anigre grows in Africa and is most common in the tropical areas of east Africa. The color varies from light yellowish brown with a pinkish tinge in the heartwood to golden brown. The grain is straight with uniform texture but can be wavy producing a mottled figure. Overall working characteristics are fair. Good nailing, screwing, gluing and staining properties. Used for cabinetwork and furniture.

Figure: RG-003

ASH, WHITE (Fraxinus americana)

While White Ash has always enjoyed widespread use for industrial products where hardness, shock resistance, stability and strength were important, its acceptance for architectural woodwork is increasing. It is open grained and has a strong and pronounced grain pattern. The heartwood is light tan or brown and its sapwood creamy white. Color contrast between the two is minor and its blonde effect makes it particularly appealing when a light or near natural finish is desired. Finished with darker tones it presents a bold effect. Its cost is moderate, and it is readily available in lumber form. In veneered form some size limitation may be experienced but it can be easily produced on special order.

Figure: RG-004

BASSWOOD (Tilia americana)

Basswood is well suited to woodcarving and pattern making. Its critical quality is there being no contrast between early wood and late wood. This is unusual in wood, as normally the late wood would tear as you attempt to work against its natural bias. Otherwise basswood is almost featureless. Creamy white to light tan in color with a pink hue; yellows when a finish is applied. Has a straight grain with fine and even texture. Shrinkage in width and thickness during drying is high; however, seldom warps in use.

Figure: RG-005

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BEECH, AMERICAN (Fagus grandfolia)

Beech grows in Eastern U.S. and adjacent Canadian Provinces. Color varies from nearly white sapwood to reddish brown heartwood; however, sometimes there is no clear demarcation between them. Heavy in weight with hard and strong properties that are highly suitable for steam bending. Machines smoothly, wears well, is well suited for turning and is easily treated with preservatives. Used for flooring, furniture, veneer, woodenware and when treated, for railroad ties.

Figure: RG-006

BEECH, EUROPEAN (Fagus sylvatica)

European Beech grows from the southern parts of Scandinavia to Sicily and from the French Atlantic coast to Poland. The color varies from pale pink brown heartwood to reddish brown tone when steamed and may have some dark veining. The grain is straight and fine with an even texture. The steam bending properties are exceptionally good. Stains well and is permeable for preservation treatment. Used for cabinetwork, furniture, flooring, heavy construction and marine piling (when pressure treated).

Figure:RG-007

BIRCH, YELLOW - Natural, Select Red, Select White (Betula alleghaniensis)

Yellow Birch has been and continues to be one of the prominent wood species used for architectural woodwork. This is due not only to its attractive appearance but also to its general availability both as lumber and as veneered products, its adaptability to either paint or transparent finish, and its abrasion resistance. The heartwood of the tree varies in color from medium to dark brown or reddish brown while its sapwood, which comprises a better than average portion of the tree, is near white. Despite its wide usage some confusion exists as to the common terms used to describe Birch lumber and/or veneer. Virtually all commercially used Birch is cut from the Yellow Birch tree, not from the White Birch tree, which botanically is a distinct species. The term “Natural” or “Unselected” Birch means that the lumber or veneer may contain both the sapwood, or white portion, as well as the heartwood, or dark portion, of the tree in unrestricted amounts. The term “Select Red” Birch describes the lumber or veneer produced from the heartwood portion of the tree, and the term “Select White” Birch describes the lumber or veneer produced from the sapwood portion of the tree. To obtain “Red” or “White” Birch exclusively requires selective cutting with corresponding cost premium as well as considerable restriction on the width and length availability in lumber form. Birch, in veneer form, is readily available in all “selections” and is usually rotary cut. While some sliced veneer is produced which simulates the same grain effect as lumber, its availability and cost reflect the same cutting restrictions that are incurred in producing the “select” forms of Birch lumber.

Natural

Figure: RG-008

Select Red

Figure: RG-009

Select White

Figure: RG-010

CEDAR, WESTERN RED (Thuja plicata)

Found in the Pacific Northwest and along the Pacific Coast to Alaska. With nearly white sapwood which is typically narrow, its heartwood runs reddish or pinkish brown to dull brown. It is generally straight grained with uniform coarse grain. With very low shrinkage, its lightweight, moderately soft, low in strength; however, very resistant to decay. Principally used for shingles, exterior siding, decks, standing and running trim, sash and doors.

Figure: RG-011

CHERRY, AMERICAN BLACK (Prunus serotina)

Wild Black American Cherry is a fine and especially stable close-grained cabinet and veneer wood. Its heartwood color ranges from light to medium reddish brown. Its sapwood, which is a light creamy color, is usually selectively eliminated from the veneer and lumber. In some respects, it resembles Red Birch, but has a more uniform grain and is further characterized by the presence of small dark gum spots which, when sound, are not considered as defects but add to its interest.

Cherry is available in moderate supply as lumber and architectural paneling and is usually plain sawn or sliced. Exceptionally rich appearance is achieved with transparent finishes which, together with its machining characteristics, justifies its identity with Early American cabinetry and furniture manufacturing, thus adding to its prestige as one of our most desirable native woods.

Figure: RG-012

FIR, DOUGLAS (Pseudotsuga taxifolla)

Douglas Fir is a large, fast growing species and is native to the northwest. It accounts for much of the lumber produced in North America. While the preponderance of its production is developed for structural and construction type products, some of its upper grades are used for stock and specialized architectural woodwork. Its heartwood is reddish tan while its sapwood is creamy yellow. Since its growth rings are conspicuous, a rather bold grain pattern develops when either plain sawn for lumber or rotary cut as is common in plywood. Some lumber and veneer is edge cut or vertical grain, producing a superior form of the product since the tendency to "grain-raise" is greatly reduced.

Figure: RG-013

HICKORY, PECAN GROUP

(Carya cordiformis, illinoensis, aquatica and myristiciformis)

Harvested typically in the Eastern half of the U.S. Sapwood is white to nearly white and relatively wide with somewhat darker heartwood. Predominately used for implement handles, furniture and decorative paneling.

Figure: RG-014

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HICKORY, TRUE GROUP (Carya ovata, glabra, and lacinosa)

Harvested typically in the Middle to Southern Atlantic and Central U.S. The sapwood is white and usually quite wide with reddish heartwood. It is extremely tough, heavy, hard, strong and experiences considerable shrinkage in drying. Typically used for implement handles, ladder rungs, furniture and flooring.

Figure: RG-015

MAHOGANY, AFRICAN (Khaya ivorensis)

This, one of the true Mahoganies, is perhaps the most widely used of the several Mahogany species. This is due to its excellent cutting and working characteristics and versatility. While its use has been largely for interior purposes, its innate stability and moderate decay resistance justifies its consideration for selected and demanding exterior applications. It has a very pleasing open grain, with its heartwood ranging in color from light to medium dark reddish brown. In lumber form it is more readily available as plain sawn and selectively so as quartersawn.

In veneer form the quarter or "ribbon striped" cut predominates, but plain sliced, as well as many of the exotic "figure" cuts, can be produced on special order.

Figure: RG-016

MAHOGANY, AMERICAN (Swietenia macrophylla) **CITES** listed

This Mahogany species is commonly known as "Honduras Mahogany," but actually encompasses all of this species that grow throughout Mexico, Brazil, Peru, and Central America. Its traditional identity with casework and furniture justifies its position as one of the finest woods for this purpose. Its stability, workability, warm appearance, and firm grain make it a favorite of all woodworking craftsmen. It is a semi open grain wood, with its heartwood color ranging from light tan to a rich golden brown depending to some extent on the country of its origin. Its outstanding stability and decay resistance expands its potential to include exterior applications for "monumental" projects. It is most generally available as plain sawn lumber and plain sliced veneer with different veneer cuts available on special order.

Figure: RG-017

MAKORE (Tieghemella heckelii, Tieghemella africana)

Makore grows in Western and Middle Africa. The color varies from pink to reddish brown. The grain has a fine texture with closed pores and can be straight, interlocked or wavy. Generally easy to work, although sections with interlocked grain can cause tear out during planing. Suitable for turning and is easy to glue and finish. Used for cabinetwork, furniture, flooring, boat building and turned objects.

Figure: RG-018

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MAPLE, SOFT GROUP

(Acer saccharinum, rubrum, negundo and macrophyllum)

Typically found in Eastern U.S. with some in the Oregon Pacific Coast. Similar in appearance to hard Maple, heartwood is somewhat lighter in color than sapwood and wider. Soft Maple is not as heavy, heard or strong as Hard Maple. Typically used for railroad ties, furniture, veneer and wooden ware.

Figure: RG-019

MAPLE, HARD GROUP - Natural or Select White

(Acer saccharum and nigrum)

Hard Maple is very similar in general characteristics to Yellow Birch. It is heavy, hard, strong, and resistant to shock and abrasion. The heartwood of the tree is reddish-brown and its sapwood is near white with a slight reddish brown tinge. Another natural characteristic is the prevalence of dark mineral streaks (predominantly in the heartwood), which can be minimized in the sapwood by selective cutting. Like Birch, common usage of descriptive terms does occasion some confusion. The term “Natural” or “Unselected” Maple indicates that the lumber or veneer may contain both the white sapwood and the darker heartwood. The term “White” Maple means that the lumber or veneer is selected and separated from the pieces containing the dark heartwood. Unlike Birch, the heartwood is so low in content that no comparable selection is available. Maple’s close identity with furniture and specialized industrial use overshadows its potential for architectural woodwork. Its modest cost, and pleasing, mild grain pattern warrants its consideration, especially on items subject to hard usage.

Figure: RG-020

OAK, ENGLISH BROWN (Quercus robur)

The English Brown Oak, or Pollard Oak is a tree which varies in height from 60’-130’ (18-40 m) depending on soil conditions. It varies in color from a light tan to a deep brown with occasional black spots. It produces burls and swirls which are very brittle and fragile, but beautiful work can be obtained with their use. English Brown Oak is considered one of the finest woods in use today.

English Brown Oak is obtained from trees which have had their tops cut out before reaching maturity. This pruning leads to the production of several new branches around the cut, and if these are subsequently lopped off, more new branches are formed. This wood is difficult to season and to work, tending to warp and twist in drying and to tear in working. The best figure is obtained from trees which have been cut out regularly every few years, the branches never being left long enough for the production of large knots. The constant exposure of freshly cut surfaces promotes attack from parasites, the result being that a considerable portion of these trees become decayed sooner or later. This has made the timber relatively scarce and costly.

Figure: RG-021

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OAK, RED (Quercus rubra)

Red Oak is one of the most abundant of our domestic hardwoods. Its moderate cost, strength, wear ability, and appealing grain characteristics make its use widespread. It is open grained and in its plain sawn or sliced form expresses a very strong “cathedral” type grain pattern. The heartwood is reddish tan to brown and very uniform in color. Its sapwood is lighter in color and minimal in volume, making its elimination by selective cutting very easy. Red Oak is also available in rift sawn or sliced form, which produces a very uniform straight grained effect. Less frequently it is quarter sawn or sliced, still producing a straight grain but with the fleck (sometimes called flake) of the medullary ray accented. Some sacrifice in width and length availability occurs when producing either rift or quarter sawn lumber.

Rift

Figure: RG-022

OAK, WHITE (Quercus alba)

White Oak, like Red Oak, is perhaps one of the best-known hardwoods in the world, and its use for architectural woodwork is widespread. It is hard and strong. Its heartwood has good weathering characteristics, making its use for selected exterior applications appropriate. It is open grained and in its plain sawn form is highly figured. The heartwood varies considerably in color from light grayish tan to brown, making the maintenance of color consistency difficult. Its sapwood is much lighter in color, is fairly prevalent, and its elimination is accomplished by selective ripping. White Oak is often rift sawn or sliced, producing a very straight grained effect or frequently quarter sawn or sliced, producing straight grain, but with the fleck (sometimes called flake) of the medullary ray greatly pronounced. The special cuts mentioned are more readily attained in veneer form since the solid lumber cutting techniques greatly restrict its width and length potential.

Plain Sliced

Rift

Figure: RG-023

PECAN - (see Hickory, Pecan Group)

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PINE, PONDEROSA (Pinus ponderosa)

Ponderosa Pine is said to be the softwood species most commonly used for exterior and interior woodwork components. Its heartwood is tannish pink, while its sapwood is a lighter creamy pink. Its supply is extensive; found in commercial quantities in every state west of the Great Plains. Ponderosa Pine grows in pure stands and is abundant in mixed stands. Also, like most Pines, the proportion of sapwood is high and its heartwood has only a moderate natural decay resistance. Fortunately, its receptivity to preservative treatment is high, and since all Pines should be so treated when used on the exterior, it can be used interchangeably with them.

Figure: RG-024

PINE, EASTERN WHITE (Pinus strobus)

Found from Maine to Northern Georgia and the Great Lake States, it is typically called White Pine. Heartwood light brown, often with a reddish tinge and turns darker when exposed to air. Has relatively uniform texture, straight grain, low shrinkage and high stability. It's light weight, moderately low in strength and stiffness. Extensively used in patterns, sash, doors, furniture, interior woodwork, knotty paneling and caskets.

Figure: RG-025

PINE, SOUTHERN YELLOW - Short Leaf (Pinus echinata)

Southern Yellow Pine, commonly called Short Leaf Pine, is commercially important in Arkansas, Virginia, Missouri, Louisiana, Mississippi, Texas, and South and North Carolina, and is found in varying abundance from New York and south-central Pennsylvania, south and westerly to eastern Texas and Oklahoma. The yellowish wood is noticeably grained, moderately hard, strong, and stiff. A cubic foot of air dried Southern Yellow Pine weighs 36 to 39 pounds. It is used extensively in-house building, including framing, ceiling, weather boarding, panels, window and door frames, casing, and carved work. The grain shows well in natural finish or when stained. Frames of overstuffed furniture, chairs, desks, agricultural machinery, wood pulp, mine props, barrels, and crates are also made of this Pine.

Figure: RG-026

PINE, SUGAR (Pinus lambertiana)

The world's largest species of pine typically found in California and South Western Oregon. Its heartwood is buff to light brown and sometimes tinged with red. It's straight grained with fairly uniform texture, low shrinkage and dimensionally stable, lightweight, soft, and moderately low in strength and stiffness. Used almost exclusively for boxes, sashes, doors, frames, general architectural woodwork and foundry patterns.

Figure: RG-027

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POPLAR, YELLOW (Liriodendron tulipfera)

Yellow Poplar sometimes incorrectly called "Whitewood," is an extremely versatile and moderately priced hardwood that is well adapted to general interior woodwork usage. It is even textured, close grained, stable, of medium hardness, and has an inconspicuous grain pattern. The heartwood is pale greenish yellow while the sapwood is white. Occasional dark purple streaks also occur. The tight, close grain results in outstanding paint ability, while its modest figure and even texture permits staining to simulate more expensive hardwood. Due to its indistinct grain figure, Poplar is seldom used for decorative veneered products. Its white sapwood is not appropriate for use in exterior applications.

Figure: RG-028

REDWOOD heartwood (Sequoia sempervirens)

Redwood is the product of one of nature's most impressive accomplishments. The enormous size and unique inherent characteristics of this tree produce a material ideally suited for exterior applications. Its heartwood color is a fairly uniform brownish red, while its very limited sapwood is lemon colored. In its plain sawn form medium "cathedral" type figure develops, while in the vertical grain a longitudinal striped figure result. Its availability in "all heartwood" form with its outstanding natural resistance to decay accounts for its wide usage for exterior purposes. It is considered a very stable wood and its paint retention qualities are excellent. Redwood's principal identity with painted exterior application should not preclude its consideration for either exterior or interior use with transparent finish. Its pleasing and uniform color lends to a variety of such finishes suggesting the warmth and honesty of wood in its natural state. The size of the trees yields lumber of unusually character free widths and lengths.

Figure: RG-029

TEAK (Tectona grandis)

Teak is one of the most versatile and valuable woods and has attained great prestige value. The figure variations are extensive, and it is available in both lumber and veneered products. Adding to its appeal is its distinctive tawny yellow to green to dark brown color, often with light and dark accent streaks. It is perhaps most appealing in plain sawn or sliced cuts. While it has unique stability and weathering properties, making it ideal for exterior applications, its high cost usually limits its use to decorative interior woodwork, most often in veneer form. Its great beauty and interest dictate it being finished in its near "natural state".

Figure: RG-030

WALNUT, AMERICAN BLACK (Juglans nigra)

American Black Walnut is perhaps our most highly prized domestic wood species. Its grain pattern variations are extensive and in veneered form produces, in addition to its normal plain sliced cut, quartered or "pencil striped" as well as specialty cuts such as crotches, swirls, burls, and others. Its heartwood color varies from gray brown to dark purplish brown. The sapwood, which is very prevalent in solid lumber, is cream colored and its complete elimination by selective cutting is very costly. Fortunately, if this natural effect is felt to be undesirable, its appearance can be neutralized by sap staining in the finishing process. The growth conditions of Walnut result in significant width and length limitations in its lumber form. Its potential is best expressed in veneered products.

Figure: RG-031

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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OTHER SPECIES

There are many other species, both domestic and imported, used in woodworking. Nearly all are ecologically sound and appropriate for use. Using hardwoods for architecture gives value to the species, encouraging improved forest management techniques and the continuation of the species.

ENDANGERED SPECIES

For a current list of endangered species see the Convention on International Trade in Endangered Species (CITES) Appendix I restricted table at cites.org.

AESTHETIC CHARACTERISTICS

One of the qualities which contributes to the widespread use of wood is the option offered for aesthetic selection. It varies between species, between two logs of the same species, and between two boards from the same log. Aesthetic considerations in specifying wood are influenced by the following characteristics:

- **Color** - The basic hue of the species, which may be further enhanced by the finishing process employed.
- **Sapwood** and **heartwood** - The color of wood within a tree varies between the "sapwood" (the outer layers of the tree that continue to transport sap), which is usually lighter in color than the "heartwood" (the inner layers in which the cells have become filled with natural deposits). If desired, sapwood may be stained in the finishing process to blend with the heartwood. This difference in color is so pronounced in certain species that the sapwood is marketed under a different nomenclature from the heartwood.

  Some examples are:

  - **Select White Birch** - sapwood of Yellow or Paper Birch
  - **Select Red Birch** - heartwood of Yellow Birch
  - **Natural Birch** - both sapwood and heartwood of any Birch
  - **Select White Ash** - sapwood of White or Green Ash
  - **Select Brown Ash** - heartwood of Black Ash
  - **Natural Ash** - both sapwood and heartwood of any Ash
  - **Select White Maple** - sapwood of the Sugar Maple
- **Grain** - The appearance produced by the arrangement of wood fibers and pores of the species. Lumber grain may not match veneer grain.
- **Open Grain and Closed Grain** - Open grain woods are said to be ring porous and usually show a distinct grain pattern. Close grain woods are said to be diffuse-porous with even grain. The size and distribution of the cellular structure of the wood influences the appearance and uniformity. Open grain hardwoods, such as Elm, Oak, Ash, and Chestnut are ring-porous species. These species have distinct figure and grain patterns. Close grain hardwoods, such as Cherry, Maple, Birch, and Yellow Poplar, are diffuse-porous species. Most North American diffuse-porous woods have small, dense pores resulting in less distinct figure and grain. Some tropical diffuse-porous species (e.g., Mahogany) have rather large pores.
- **Figure** - Various species produce different grain patterns (figures), which influence the selection process. There will be variations of grain patterns within any selected species. The manufacturer cannot select solid lumber cuttings within a species by grain and color in the same manner in which veneers may be selected.
- **Finishing Characteristics** - The many species of wood vary considerably in their receptivity to the multitude of finishing processes on the market. Some woods, because of their open pores, will accept fillers while tighter grained woods will not. Some will show greater contrast between the "early wood" and the "late wood" when stained than others. Design professionals should take into consideration the finish that will be applied when selecting a particular species.

  Consult with a Sponsor Association member / affiliate about finishing prior to selection or specification. Providing large samples of the desired finish to manufacturers during the design phase and bidding process will assure the designer of obtaining an acceptable final product, while enabling the manufacturer to be aware of exactly what is required. Lumber might not accept transparent finishes in the same manner as veneer and special finishing techniques may be required.

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METHODS OF SAWING

Lumber is typically furnished plain sawn unless otherwise specified. Sawing methods, and the selection of boards after sawing the log, as shown below, produce the following types of lumber:

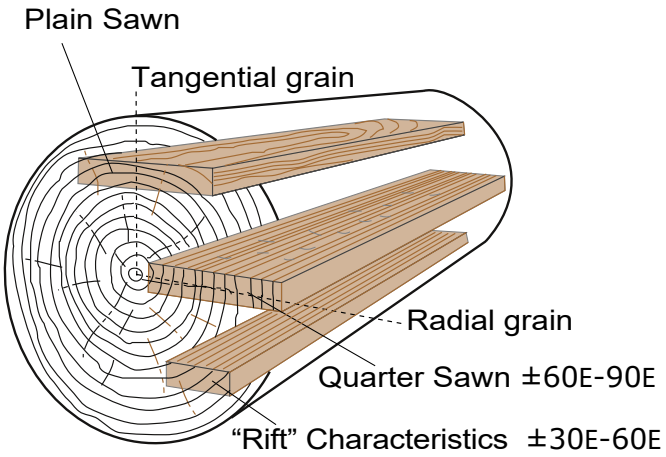

Figure: RG-032

- **Plain Sawn** (Flat Sawn) - Plain sawing, the most common type of lumber sawing, yields broad grain, the widest boards and least waste. The annular rings are typically 30 degrees or less to the face of the board.

Figure: RG-033

- **Quarter Sawn** - Most often cut as Rift and Quartered, and then sorted for appearance, quarter sawn lumber is available in certain species, yields a straight grain, narrow boards, and fleck (sometimes called flake) or figure which runs across the grain in some species (notably the Oaks). Dimensional stability across the grain is the best. The annular rings run approximately 60 to 90 degrees to the face of the board, with the optimum being 90 degrees. Quartered lumber is generally narrower and more expensive than plain sawn of the same species.

Figure: RG-034

- **Rift Sawn** - Rift sawing produces small flecks caused by cutting through the wood rays. Only certain species produce these flecks, primarily Red and White Oak. Rift cutting reduces yield and increases cost. The annular rings run about 30 to 60 degrees to the face of the board, with the optimum being 45 degrees.

Figure: RG-035

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AVAILABILITY and SIZE LIMITATIONS

The supply of lumber is in constant flux throughout the world. It is affected by many factors such as current demand, export regulations of the country of origin, natural forces of weather, fire, disease, political situations, etc. Certain trees (species) naturally grow larger, thus producing longer and wider lumber. Other trees are smaller and produce narrow and shorter boards. The manufacturer must work with the available lumber, which must be considered when selecting any species. Consult a Sponsor Association member / affiliate before specifying an uncommon species, or thickness, and/or long lengths which may not typically be available. If available, the cost may be substantially higher. Economies can be realized by detailing and specifying thicknesses and widths within the finish sizes of these standards.

VENEERED CONSTRUCTION

Lumber can be used to secure wide and thick members in species with limited cutting potential. An acceptable technique is to apply thin lumber or veneer to the faces and edges of a compatible density lumber, structural composite lumber (SCL), or a medium density fiberboard core.

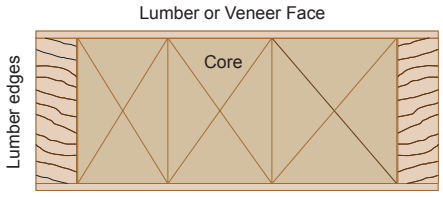

Figure: RG-036

DIMENSIONAL STABILITY, RELATIVE HUMIDITY, and MOISTURE CONTENT

All woods are affected significantly by moisture and to a lesser degree by heat. Lumber swells and shrinks primarily in two directions: thickness and width. There is insignificant change in length. The changes in dimension due to moisture vary with different species, thus influencing the selection of lumber to use and the design elements.

Prevention of dimensional problems in architectural woodwork products as a result of uncontrolled relative humidity is possible. Wood products perform, as they have for centuries, with complete satisfaction when correctly designed and used. Problems directly or indirectly attributed to dimensional change of the wood are usually, in fact, the result of faulty design or improper humidity conditions during site storage, installation, or use.

Wood is a hygroscopic material, and under normal conditions all wood products contain some moisture. Wood readily exchanges this moisture with the water vapor in the surrounding atmosphere according to the relative humidity. In high humidity, wood picks up moisture and swells. In low humidity, wood releases moisture and shrinks. As normal minor changes in humidity occur, the resulting dimensional response in properly designed construction will be insignificant. To avoid problems, it is recommended that the appropriate recommendations from Section 13 be maintained. Uncontrolled extremes are likely to cause problems. Together with proper design, fabrication, and installation, humidity control is the important factor in preventing dimensional change problems. The book *Understanding Wood* by Bruce Hoadley contains excellent data of wood and moisture.

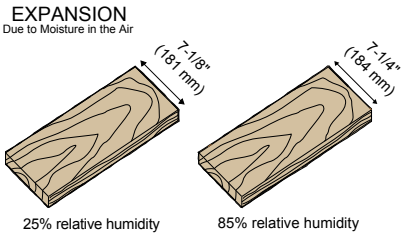

Figure: RG-037

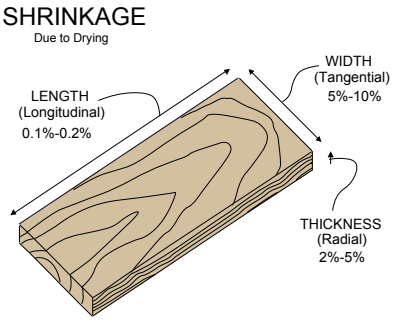

Figure: RG-038

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DIMENSIONAL STABILITY, RELATIVE HUMIDITY, and MOISTURE CONTENT (continued)

Wood is anisotropic in its shrinkage characteristics. It shrinks most in the direction of the annual rings when it loses moisture from the cell walls. This illustration from USDA's The Wood Handbook (latest edition), published by their Forest Products Laboratory, shows the typical distortion of cuts from various parts of a log.

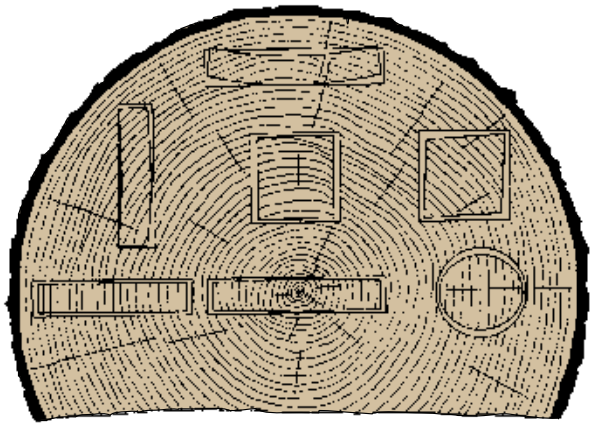

Figure: RG-039

Moisture can also cause iron stain (oxidation) in wood, also referred to as blue / black stain. Iron stain is a natural reaction of acids with iron, oxygen, and moisture (either high relative humidity or direct moisture) in wood. Control of moisture is a simple way to protect wood products from iron stain.

PRESERVATIVE TREATMENTS

Modern technology has developed methods of treating certain species to extend their life when exposed to the elements. Some lumber species used for exterior architectural woodwork may be treated with an industry tested and accepted formulation. One such formulation is a liquid containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient, which must be used according to material supplier's directions.

The Window & Door Manufacturers Association (WDMA), through the treatments and coatings committee, has reviewed information from third party testing laboratories which indicates that the number of formulations at the stated in use concentration meet the requirements of WDMA I.S.4 (latest edition). The formulations are acceptable for use under the WDMA Hallmark Water Repellent Non-Pressure Preservative Treatment Certification Program and are adopted to meet all requirements.

FIRE RETARDANT WOOD

The natural-fire retardant qualities and acceptability of treatments vary among the species. Where items of architectural woodwork are required to have a flame spread classification to meet applicable building and safety codes, the choice of lumber species must be a consideration. Most treated species are structural softwoods.

Following are some references to assist in making these choices. Additional data on various species may be available from USDA's The Wood Handbook (latest edition), published by their Forest Products Laboratory.

- **Built-up construction** to Improve Fire Rating: In lieu of solid lumber, it is often advisable, where a fire rating is required, to build up members by using treated cores clad with untreated veneers not thicker than 1/28" (0.9 mm). Some existing building codes, except where locally amended, provide that facing materials 1/28" (0.9 mm) or thinner finished dimension are not considered in determining the flame spread rating of the woodwork.

  In localities where basic model building codes have been amended, it is the responsibility of the specifier to determine whether the application of the facing material specified will meet the code.

- **Fire retardant treatments** (FRT): Some species may be treated with chemicals to reduce flammability and retard the spread of flame over the surface. This usually involves impregnating the wood, under pressure, with salts suspended in a liquid. The treated wood must be re-dried prior to fabrication. FRT wood may exude chemicals in relative humidity above 85%, damaging finishes and corroding metals in contact with the FRT surface. Consult with a manufacturer about the resulting appearance and availability of treated woods prior to specification.

  Hardwoods currently being treated (Flame spread less than 25) include 4/4 Red Oak, and 4/4 to 8/4 Poplar. These woods can be machined after treatment, although machining may void the label classification. Fire Retardant treatments may affect the finishes intended to be used on the wood, particularly if transparent finishes are planned. The compatibility of finishes should be tested before they are applied. (from Section 06)

  According to the traditional model codes in the USA and subject to local code modifications, untreated wood and wood products can usually be used in up to 10% of the combined surface area of the walls and ceiling. Casework, furniture, and fixtures are rarely fire rated, and can be built of combustible materials.

FLAME SPREAD CLASSIFICATIONS

This is the generally accepted measurement for fire rating of materials. It compares the rate of flame spread on a particular species with the rate of flame spread on untreated Oak. Most authorities accept the following classes for flame spread:

- Class A 0-25
- Class B 26-75
- Class C 76-200

Table: RG-003 - FLAME SPREAD and SMOKE DEVELOPED INDEXES

Common woods species, adapted from USDA's The Wood Handbook (latest edition), published by their Forest Products Laboratory, and based on 3/4" (19.0 mm) thick solid lumber:

Species	Flame Spread Index	Smoke Developed Index
SOFTWOODS		
Yellow Cedar	78	90
Bald Cypress	145 - 150	---
Cedar, Western Red	70	213
Fir, Douglas	70 - 100	---
Fir, Pacific Silver	69	58
Hemlock, Western	60 - 75	---
Pine, Eastern White	85 - 215	---
Pine, Ponderosa	105 - 230	---
Pine, Red	142	229
Pine, Southern	130 - 195	---
Pine, Western White	75	---
Redwood	70	---
Spruce, Eastern	65	---
Spruce, Sitka	74 - 100	---
HARDWOODS		
Birch, Yellow	105 - 110	---
Cottonwood	115	---
Maple	104	---
Poplar, Yellow	170-185	---
Oak, Red / White	100	100
Sweetgum	140-155	---
Walnut	130 - 140	---

RECLAIMED or RECYCLED WOOD

EVOLUTION - In recent years, with the interest in "Green" alternative materials and the reuse of previously used materials, the architectural woodwork industry has seen an increase in the specifying of reclaimed wood. While there are many similarities between reclaimed wood and new wood there are enough significant differences to create a need for enhanced industry standards.

MOTIVATION - The reuse of previously used wood in architectural woodwork projects comes from the desire to:

- Reduce the need for harvesting trees from our forests. Every board we can reclaim from prior use is a tree we do not need to cut down. This comes from a sincere desire to retain our natural resources for future generations.
- Reduce the unnecessary additions to our landfill. In the past most of the wood that was previously used was demolished and sent to landfill. In many cases the wood is of high quality and easily re-purposed for use again.
- Gain LEED credit.
- Create a connection to the past from characteristics such as weathering, nail holes, or other distress or patina imprinted on the material by time and previous use are elements which are valued in this design choice.

SOURCES - Examples of reclaimed lumber are so-called barn wood and wood from old demolished structures like water storage tanks, wine tanks, wood pilings and even underwater forests and sunken logs.

Sources and types of reclaimed materials vary greatly in their type, quality, availability. Aesthetics and cost. A sample of material used for selection may not match actual available material in species, color, texture, surface quality or structural composition when it comes time to make a purchase.

Design professionals and specifiers should be aware of the limitations of availability of species, cut, quantity, lead time, waste factor and cost of material. These materials are normally sold "as is" and are not returnable.

Logs harvested over 100 years ago and transported by water often sank in route to mills. The resulting "lost underwater forest" lay on the bottoms of rivers and lakes until recently as proper environmental and mechanical procedures for retrieving them have been developed.

RECLAIMED or RECYCLED WOOD (continued)

Reclaimed submerged materials are utilized in all aspects of construction of furniture, architectural woodwork and musical instruments. Submerged lumber is generally processed in both solid lumber, plain sliced and rotary veneer.

The uniqueness of the harvesting procedures, the high quality of the material and unusual aesthetic qualities are a few of desirable traits associated with this special material.

It is advisable that the design professional and woodworker see the material at the supplier to determine the availability and suitability for the intended use.

LACK OF STANDARDS - Whereas conventional wood and veneer materials have been relatively easy to set industry standards for, the very nature of reclaimed wood and the reasons we use it make its classification and standardization more subjective, such as:

- There are no standard dimensions for reclaimed wood.
- There are no grading standards for appearance or surface condition, therefore there are no measurable characteristics and defects established by which to reject unsuitable materials once such is purchased.
- Often, what are considered flaws and degrades in conventional lumber (checks, splits, knots and warp) might be considered desirable “character” in reclaimed applications.
- Because of the finite nature of reclaimed wood, the quantities available may not match the quantities required for a given project.

It is advisable that the design professional and woodworker see the material at the supplier to determine the availability, suitability and performance needs for the intended use and agree on the materials range of color, grain, distress, character, and patina.

MATERIAL SELECTION - Because reclaimed or recycled wood is unique and finite, specification begins with specific material selection made by the design professional or client, possibly in collaboration with the woodwork manufacturer.

Early involvement of the woodwork manufacturer will typically lead to a better understand the design intent and their assistance in finding suitable reclaimed material in the appropriate dimensions and quantities. They will also be able to help with suggestions about species, surface condition and color. Important considerations:

- Aesthetic consideration.
- Desired surface condition (original surface, re-sawn, surfaced).
- Desired finish condition (painted as it comes, newly painted, sealed, unfinished).
- Acceptability of natural defects (knots, checks, etc.), evidence of previous use (bolt holes, nail holes, gouges and notches) or evidence of previous bug infestation.
- Desired grain (flat sawn, vertical grain).
- Intended use (i.e. paneling, furniture, indoors, outdoors).
- Intended fastening (face nailed, blind nailed, panel clips).
- Approximate quantity of material required.

Once a material source has been selected, control samples (that are labeled, numbered, dated and signed) should be developed to establish the agreed acceptability of material finish, characteristics, whether natural or from previous use. Taking into consideration that providing large and repetitive samples to show a full range or material characteristics is recommended.

RECLAIMED or RECYCLED WOOD (continued)

CARE & STORAGE - Beyond the basic rules of Section 13 ambient humidity and initial moisture content of reclaimed wood can be very important factors in insuring dimensional stability of the end product:

- With reclaimed wood moisture content may need to be addressed on a case by case basis. Typically "barn wood" is supplied "dry" and is of little concern in this regard. On the other hand timbers encrusted in earth or reclaimed from moist environments exposed to rain and water may require further drying to ensure stability.
- Additional drying may be particularly important when secondary milling is required to create the final form. Wood that may appear to be dry may contain a reservoir of moisture at its core which could be activated by further milling. This could result in a product which checks, cracks and distorts in unacceptable ways.
- For some design purposes instability may be a desired result. In other words, initial high moisture content may cause lumber to twist and crack after installation over time in ways that achieve a particular aesthetic result. Achieving these effects is the responsibility of the design professional working in close collaboration with the architectural woodwork manufacturer.

DESIGN PROFESSIONAL RESPONSIBILITY With unique material like reclaimed or recycled wood for architectural woodwork the design professional needs to take an active role in sourcing and pre-approving their desired selections. With these materials there is no traditional guidelines to reassure either the woodwork manufacturer or architect of achieving the result they expect.

There will be situations where the design professional may have to directly participate in the selection process piecemeal, accepting some material and rejecting others as not suited to the purpose.

CONTRACT DOCUMENTS, shall clearly indicate or delineate all material, fabrication, installation and applicable building code / regulation requirements with the clear understanding that incomplete design choices, changes in scope or material selection, lack of material selection, or design choices made after initial bid may impact the cost or not be possible.

The contract documents shall specifically list the material source and identifier, and address the allowable:

- Variation in color or tone
- Defects, such as nail holes, checking, cracking, discoloration, milling marks, roughness in terms of quantity, locations, repetition, etc.
- Distortion in terms of straightness, cupping, flatness, etc.

NONTRADITIONAL MATERIALS

Covers materials re-purposed from other industrial and manufacturing areas but assigned to the woodwork manufacturer and treated similarly to traditional architectural woodwork items like wall paneling. From a design perspective, consideration of appearance, color, finish, variation and relation are deemed important as they would be with traditional wood products.

Examples of non-traditional materials could be a fiber / cement panel designed for fire resistance, insulation re-purposed as a decorative panel, metal products, cloth, acrylics, etc.

Because these materials are unique, contract documents, shall clearly indicate or delineate all the necessary material, fabrication, installation and building code / regulation direction and requirements as may be applicable for the manufacturer / installer to reasonably accomplish the intended design concept.

ENGINEERED PRODUCTS

STRUCTURAL COMPOSITE LUMBER (SCL) — A man made composite that utilizes grain-oriented wood strands from a variety of tree species, providing an alternative to dimension lumber. The material is engineered for strength and stability. While SCL is not really "lumber," it is marketed as a lumber substitute. SCL can be specified as core, stile backers, and core for stiles and rails, so long as all other criteria of these standards are met in relation to its use.

LAMINATED VENEER LUMBER (LVL) - A lumber substitute made with veneer plies bonded in parallel. LVL is made using many tree species and this diversity increases the performance characteristics and product potential.

Table: RG-004 - **SPECIFIC GRAVITY / WEIGHT OF MISCELLANEOUS SPECIES**

SPECIES	SPECIFIC GRAVITY [1]	WEIGHT [2]
ALDER, RED Alnus rubra	0.37	28
ASH, WHITE Average of 4 species	0.54	41
ASPEN Populus tremuloides	0.35	27
AVODIRE Turraeanthus africanus	0.48	36
BASSWOOD Tilia americana	0.32	26
BEECH Fagus grandifolia	0.56	45
BIRCH, SWEET Betula lenta	0.60	46
BIRCH, YELLOW Betula alleghaniensis	0.55	43
BUBINGA Guibourtia demeusil	0.78	55
BUTTERNUT Juglans cinerea	0.36	27
CATALPA, NORTHERN Catalpa speciosa	0.38	29
CATIVO Prioria copaifera	0.40	29
CHERRY, BLACK Prunus serotina	0.47	35
CHESTNUT Castanea dentata	0.40	30
COTTONWOOD, EASTERN Populus deltoides	0.37	28
CUCUMBER TREE, YELLOW Magnolia acuminata	0.44	34

SPECIES	SPECIFIC GRAVITY [1]	WEIGHT [2]
CYPRESS (BALD CYPRESS) Taxodium distichum	0.42	32
DOGWOOD, FLOWERING Cornus florida	0.64	51
EBONY, GABOON (NIGERIAN) Diospyros crassiflora	0.82	63
ELM, AMERICAN Ulmlus Americana	0.46	36
HACKBERRY Celtis occidentalis	0.49	37
HICKORIES, TRUE Average of 4 species	0.65	51
HOLLY Ilex opaca	0.50	40
IPE Handroanthus serratifolius	0.91	69
LIMBA Terminalia superba	0.45	34
LOCUST, BLACK Robinia pseudoacacia	0.66	48
MAHOGANY, AFRICAN Khaya ivorensis	0.43	31
MAHOGANY, CUBAN Swietenia mahogany	0.57	41
MAHOGANY, CENTRAL AMERICAN Swietenia species	0.45	32
MAKORE Tieghemella heckelii	0.55	40
MAPLE, RED Acer rubrum	0.49	38
MAPLE, SILVER Acer saccharinum	0.44	33

(continued)

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Table: RG-004 - **SPECIFIC GRAVITY / WEIGHT OF MISCELLANEOUS SPECIES** (continued)

SPECIES	SPECIFIC GRAVITY [1]	WEIGHT [2]
MAPLE, SUGAR Acer saccharum	0.57	44
MYRTLE Umbellularia Californica	0.51	39
NARRA Pterocarpus indicus	0.52	42
OAK, COMMERCIAL RED Average of 9 species	0.56	44
OAK, COMMERCIAL WHITE Average of 6 species	0.59	47
ORIENTAL WOOD (Queensland Walnut) Endiandro palmerstoni	0.53	44
OSAGE ORANGE Maclura pomifera	0.76	n/a
PADUAK (AFRICAN) Pterocarpus soyauxii	0.61	43
PADUAK (ANDAMAN) Pterocarpus dalbergioides	0.62	45
PADUAK (BURMA) Pterocarpus macrocarpus	0.75	54
PALDAO Dracontomelum dao	0.59	44
PECAN Carya illinoensis	0.60	47
PEARWOOD (EUROPEAN) Purus communis	0.52	43
PHILIPPINE HARDWOODS		
RED LAUAN Shorea negrosensis	0.40	36
WHITE LAUAN Pentacme contorta	0.43	36
TANGUILE Shorea polysperma	0.53	39

SPECIES	SPECIFIC GRAVITY [1]	WEIGHT [2]
POPLAR, YELLOW (TULIPTREE) Liriodendron tulipifera	0.38	28
PRIMAVERA Cybistax donnell-smithii	0.40	30
ROSEWOOD (BRAZIL) Dalbergia nigra	0.68	50
SAPELE Entandrophragma cylindricum	0.54	40
SATINWOOD (EAST INDIAN) Chloroxylon swietenia	0.83	67
SONORA (MANGGASINORO) Shorea philippinensis	0.42	31
SWEETGUM (RED AND SAP) Liquidambar styraciflua	0.44	34
SYCAMORE Platanus accidentalis	0.46	35
TEAK Tectona grandis	0.60	43
TIGERWOOD Lavoa klaineana	0.45	34
TUPELO, WATER Nyssa aquatica	0.46	35
WALNUT, AMERICAN (BLACK) Juglans nigra	0.51	39
WILLOW, BLACK Salix nigra	0.34	26
ZEBRAWOOD Microberlinia brazzavillensis	0.62	48

The data for native species as furnished on this chart are from both the U.S. Forest Products Laboratory's Technical Bulletin 158 http://fpl.fs.fed.us and The Wood Database wood-database.com.

[1] Based on green volume and oven dry weight.

[2] Based on pounds per cubic foot at 12% moisture content.

INTRODUCTION

Herein we address a wide range of sheet goods, Hardwood and Softwood Veneers, HPL, TFL, Backer, Solid Surface, CGS (Compact Laminate), Epoxy Resin, and Natural and Engineered Stone.

PLYWOOD

The term “plywood” is defined as a panel manufactured of three or more layers (plies) of wood or wood products (veneers or overlays and/or core materials), generally laminated into a single sheet (panel).

TYPES OF PANELS

There are a wide range of panel materials available for the fabrication of architectural woodwork.

Property and performance characteristics are influenced by the panel grade, panel thickness, and materials used for the core:

- Surface uniformity has a direct relationship to the performance of the face veneers.
- Dimensional stability relates to the effect of exposure to wide swings in temperature and relative humidity.
- Screw holding and bending strength are influenced by and should be considered in design engineering.

Architectural panels with applied decorative surface materials are made up of a variety of core types including: Particleboard, Medium Density Fiberboard (MDF), Veneer, Hardboard, Lumber, Combination and Agrifiber.

PRIMARY CORE MATERIALS

INDUSTRIAL GRADE PARTICLEBOARD - Sometimes referenced as composite core, is made of wood particles of various sizes that are bonded together with a synthetic resin or binder under heat and pressure.

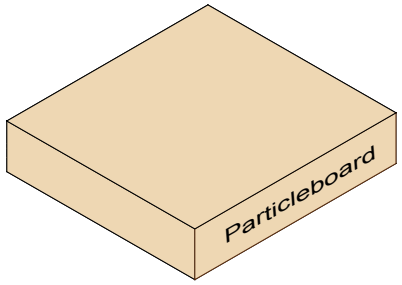

Figure: RG-040

Medium Density Industrial Particleboard is used in the broadest applications of architectural woodwork. It is especially well suited as a core for veneers and HPL or TFL.

When used as panels without surface plies, the product is referred to as particleboard. When used as an inner core with outer wood veneers, the panel is referred to as particle core plywood.

Industrial particleboard is commercially classified by “density,” which is measured by the weight per cubic foot of the panel product:

- **Medium Density** (M series) = generally between 40-50 pounds per ft^3 (640-800 kg per m^3).
- **High Density** (H series) = generally above 50 pounds per ft^3 (800 kg per m^3).

MOISTURE RESISTANT PARTICLEBOARD - Some Medium Density Industrial Particleboard is bonded with resins more resistant to swelling when exposed to moisture. The most common grades are ANSI A-208.1 (latest edition) Type M-2-Exterior Glue and M-3-Exterior Glue.

FIRE RETARDANT PARTICLEBOARD - Some Medium Density Industrial Particleboard has been treated during manufacture to carry a UL stamp for Class A flame spread rating (Flame spread 20, Smoke developed 450). Fire retardant Medium Density Fiberboard is also available.

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SHEET PRODUCTS (continued)

PRIMARY CORE MATERIALS (continued)

MEDIUM DENSITY FIBERBOARD (MDF) - Sometimes referenced as composite core, is made of wood particles reduced to fibers in a moderate pressure steam vessel, combined with a resin, and bonded together under heat and pressure.

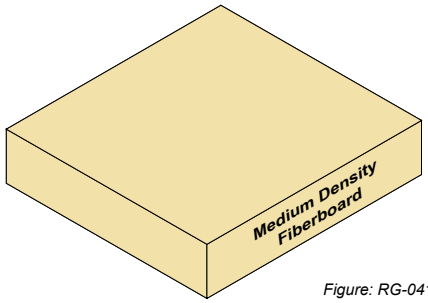

Figure: RG-041

Due to the finer texture of the fibers used in manufacturing Medium Density Fiberboard (MDF) it is smoother than Medium Density Particleboard. The uniform texture and density of the fibers create a homogenous panel that is very useful as a core for paint, thin overlay materials, veneers and decorative laminates. MDF is among the most stable of the mat formed panel products. When used as an inner core with outer wood veneers, the panel is referred to as MDF core plywood.

MOISTURE RESISTANT MDF - Can be manufactured to meet the ANSI A-208.2 (latest edition) reduced thickness swell criteria.

VENEER - Is separated into two groups according to materials and manufacturing:

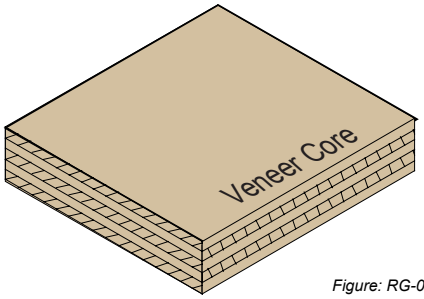

Figure: RG-042

- **Hardwood Veneer** - Panels manufactured of hardwood veneers.
- **Softwood Veneer** - Panels manufactured of softwood veneers.

Hardwood or Softwood Veneers used as a core is not recommended in many areas of these standards due to poor stability but do have many other structural characteristics. It is recommended that veneer core panels be used only when they can be housed or in areas where warping is not a significant issue.

What many think of as traditional “plywood”, is a panel core made up of an odd number of plies, 3 or more (except when the center is constructed of two unidirectional plies), alternating layers of veneers, all less than 1/4” (6.4 mm) thick, pressed and glued into a single sheet. The two outside veneer layers are the Face and Back. The interior veneer bands are cross bands and parallel bands. The latter are sometimes referenced as centers. Veneer bands are layered at right angles to the adjoining veneer layer.

HARDBOARD - Is defined as inter felted fibers consolidated under heat and pressure to a density of 500 kg per m^3 (31 pounds per cubic foot) or greater.

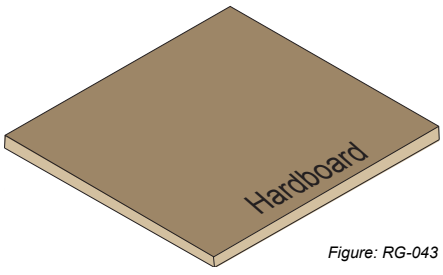

Figure: RG-043

Hardboard is available with either one side (S1S) or two sides (S2S) smooth. There are typically two types of hardboard core used by architectural manufacturers:

- **Standard** (untempered).
- **Tempered**, which is standard hardboard subjected to a curing treatment increasing its stiffness, hardness, and weight.

CG TC

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PRIMARY CORE MATERIALS (continued)

LUMBER - Is where the center ply, called the "core" is composed of strips of lumber edge glued into a solid slab.

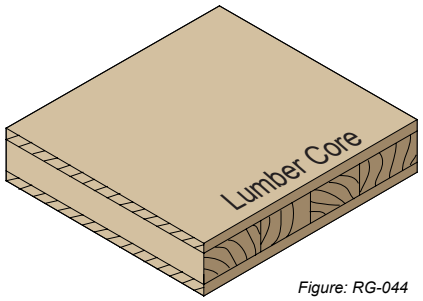

Figure: RG-044

This type is usually 5-ply, 3/4" (19.0 mm) thick, but other thickness from 1/2" (12.7 mm) to 1-1/8" (28.6 mm) are manufactured for special uses. There are three main types:

- **Staved** - is where the core strips are random length and butt joined.
- **Full Length** - is where the core strips are one piece in length.
- **Banded** - is where the outside strips run full length and the others are random length. Banding may be the same species of lumber as the rest of the core, but it is usually matched to the face and might include all four edges. Banded plywood is typically produced for special uses, such as furniture and desktops.

COMBINATION - A balanced hybrid blend of veneer and composition core materials offering some of the properties of both.

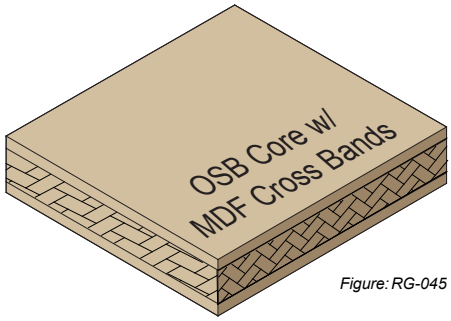

Figure: RG-045

Typically, these cores have internal layers which are constructed of three or five plies of veneer or a center layer of wafer board (randomly oriented wafers) or other wood fiber which are sandwiched between thin laminations of a composite product like MDF, particleboard, hardboard, etc.

Typically, these products result in stronger, lighter weight, dimensionally stable panels with increased screw holding ability, and superior surface flatness. Combination panels shall meet the standards of particleboard or MDF as stated in this manual, density excepted.

AGRIFIBER - Panel products made from straw and similar fiber are appearing in the marketplace. Panels shall meet the performance characteristics of ANSI A208.1 or ANSI A208.2 standards.

The characteristics of agrifiber core material performance vary by material supplier and are not included in the following table.

FORMING (Bendable) **-** Assembled and/or machined cores made of hardboard, veneer, particleboard and/or MDF for radius work are manufactured under various trade names. When used for freestanding work these Forming Cores must be a balanced panel but if bound (restrained) the panel is not required to be balanced.

CGS (Compact Laminate) - A composite of resins molded with a homogeneous core of organic fiber reinforced phenolic and one or more integrally cured surfaces of compatible thermosetting resins. CGS has seen some use in recent years as wall surfacing, casework parts, and countertops.

OTHER PANEL MATERIAL - Shall meet the minimum performance characteristics of ANSI A208.1, ANSI A208.2 or ANSI/HPVA HP-1 (latest edition) standards.

ENGINEERED WOOD / PANEL - Is a general term used to describe any wood or plant fiber composite panel. Such products as Particleboard, MDF, SCL and LVL are described as an engineered wood or plant fiber. Typically, they are made from wood or plant fiber or wood pieces and have specific esthetic and physical attributes.

BAMBOO - Is attracting much attention due to its quick replenishing and growing cycles as a green product. It is a grass product and not a true wood product. Due to its relatively new emergence in use as a building material, the performance evaluation as a stable and viable building material has not been established. These standards do not cover or endorse the use of bamboo and encourages the design professional to consult with Bamboo material suppliers and distributors as to its characteristics and viability as an architectural woodwork product.

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SHEET PRODUCTS (continued)

Table: RG-005 - **CHARACTERISTICS OF CORE PERFORMANCE**

It is important for the reader to understand the difference between "flatness" and "dimensional stability" characteristics. Particleboard and MDF are the recommended cores for HPL and wood veneer work because of their excellent flatness. Fair dimensional stability (expansion / contraction in panel size) is acceptable unless the product is exposed to wide swings in relative humidity, generally below 25% or above 55% with swings of more than 30 points.

Core Type	Flatness (Warp Resistance)	Visual Edge Quality	Surface Uniformity	Dimensional Stability	Screw Holding Face	Bending Strength
Particleboard, Medium Density	Excellent	Good	Excellent	Fair	Fair	Good
Particleboard, Moisture Resistant	Excellent	Good	Good	Fair	Fair	Good
Particleboard, Fire Retardant	Excellent	Fair	Good	Fair	Fair	Good
Medium Density Fiberboard (MDF)	Excellent	Excellent	Excellent	Fair	Good	Good
MDF, Moisture Resistant	Excellent	Excellent	Excellent	Fair	Good	Good
MDF, Fire Retardant	Excellent	Excellent	Excellent	Fair	Good	Good
Veneer	Fair	Good	Fair	Excellent	Excellent	Excellent
Lumber	Fair	Good	Good	Fair	Excellent	Excellent
Combination	Good	Fair	Excellent	Good	Excellent	Excellent

Various characteristics above are influenced by the grade and thickness of the core and specific gravity of the core species. Visual Edge Quality is rated before treatment with edgebands or fillers and Visual Edge Quality of lumber core assumes the use of "clear edge" grade. Surface Uniformity has a direct relationship to the performance of veneers placed over the surface. Dimensional Stability is usually related to exposure to wide swings in relative humidity. Screw Holding and Bending Strength are influenced by proper design and engineering.

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DECORATIVE FACE MATERIAL AND CONSTRUCTION BALANCE

All panels may be used as cores for the application of decorative faces (e.g. veneer, HPL) to the face and back. The whole is referred to as a panel. The parts being a core covered by a face and a balancing back. To achieve balanced construction, panels must be an odd number of layers (plies) symmetrical from the center line; e.g., inner plies, except the innermost middle ply, should occur in pairs, using materials and adhesives on both sides that contract and expand, or are moisture permeable, at the same rate.

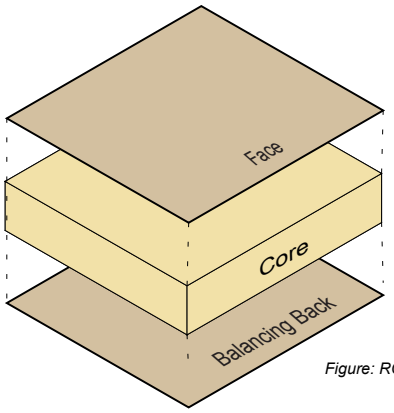

Figure: RG-046

A ply may consist of a single veneer, particleboard, medium density fiberboard, or hardboard. Each pair of inner plies should be of the same thickness and direction of grain at 90 degrees. Each ply of each pair is placed on opposite sides of the innermost ply or layer, alternating grain directions from the center out. (Particleboard and MDF do not have a specific grain orientation).

The thinner the facing material, the less force it can generate to cause warping. The thicker the core, the more it can resist a warping movement or force.

TYPES OF PLYWOOD PANELS:

PARTICLEBOARD CORE

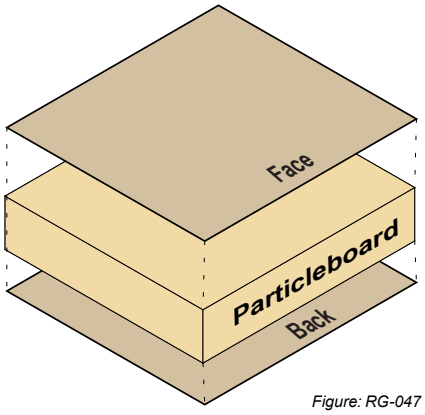

Figure: RG-047

MEDIUM DENSITY FIBERBOARD (MDF) CORE

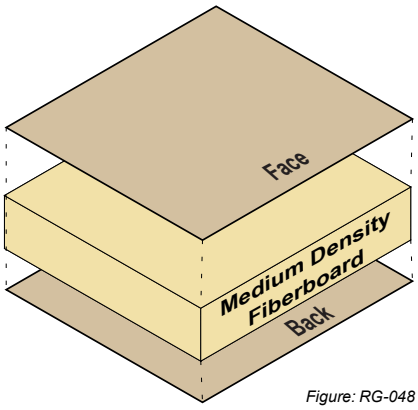

Figure: RG-048

VENEER CORE

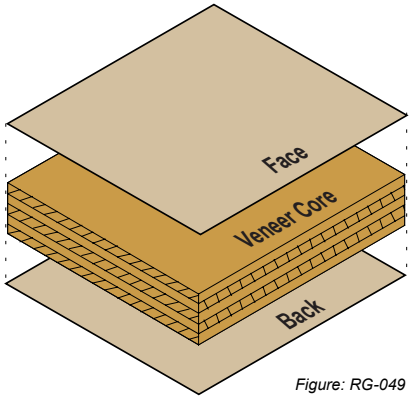

Figure: RG-049

SUGGESTION RESOURCE GUIDE

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A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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TYPES OF PLYWOOD PANELS (continued)

LUMBER CORE

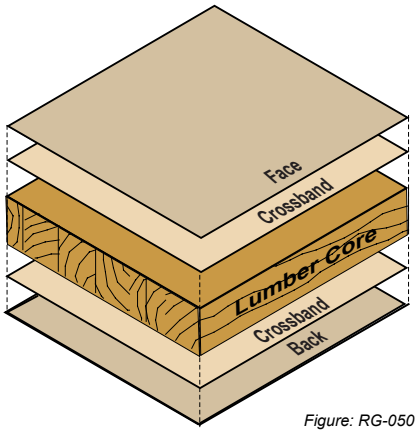

Figure: RG-050

COMBINATION CORE

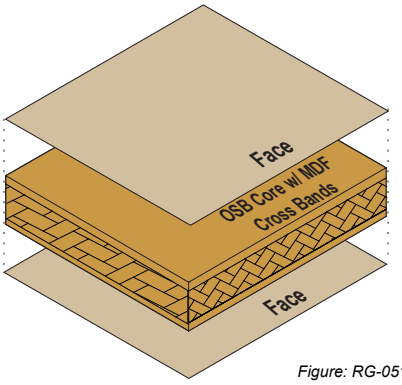

Figure: RG-051

WOOD VENEERS

Wood veneer is produced by veneer suppliers in a variety of "industry standard" thicknesses. The slicing process is controlled by a number of variables. The thickness of the raw veneer has little bearing on the ultimate quality of the end product so long as show-through and sand-through is avoided.

HARDWOOD VENEER - Species: Available in many domestic and imported wood species. Normally cut as plain sliced. Rift sliced and quarter sliced available in certain species at additional cost.

SOFTWOOD VENEER - Species: Most common is Douglas Fir; Pines are available; other softwoods in limited supply. Most softwood veneer is Rotary cut. Plain sliced softwood veneer and "vertical grain" (quarter sliced) softwood veneer are limited in availability with long lead times and higher prices associated with special orders.

Rotary-cut softwood sheets are typically manufactured in various grades referring to the appearance of the face, back, and interior plies of the sheet and are intended for exterior (with a fully waterproof glue line) or interior (with a moisture resistant, but not waterproof, glue line). Clear faces, free of patches, are not typically available.

VENEER GRAIN might not match the grain of solid stock, and it might not accept transparent finishes in the same manner; additional finishing steps might achieve similar aesthetic value.

FIGURE is not a function of a species grade, and special desires must be so specified.

SPECIAL CHARACTERISTICS, such as sapwood, heartwood, ribbon stripe, birdseye and comb grain, must be so specified.

NATURAL, as a type of wood species selection, allows an unlimited amount of heartwood and/or sapwood within a face and is the default selection, unless specified otherwise.

SELECT RED OR WHITE simply means all heartwood or all sapwood, respectively, and must be so specified.

SPECIES, such as Hickory, Pecan, Butternut, or Maple, may exhibit special character or figure and users are advised to thoroughly investigate the expected grain and color of these species.

RECONSTITUTED VENEERS are logs that are first sliced into veneer leaves, the leaves may be dyed, then glued under pressure in a mold to produce a large laminated block. The laminated block is then sliced across the glue line to create a faux grain with a designed appearance that is highly repeatable. Not all pre-dyed veneers are colorfast, consult with material supplier.

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SHEET PRODUCTS (continued)

SPECIALTY SHEET PRODUCTS

Plywood with textured faces, pre-finished plywood, overlaid plywood, composition sheets, flame spread rated plywood, moisture resistant plywood, lead lined sheets, projectile resistant armor (bullet proofing), reconstituted veneers, bamboo sheets, acrylic sheets, or PVC sheets are the products of the individual material supplier, and are covered by their specification - not by these standards.

PANEL ADHESIVES

Are defined as:

- **Type I** Waterproof bond (2-Cycle Boil Test plus Shear Test).
- **Type II** Water resistant bond (3-Cycle Soak Test).

FIRE RETARDANCE

Sheets are available with various types of fire-retardant treated core, such as veneer, lumber, particleboard, and mineral core.

Flame-spread rating will vary for different species of untreated face veneers on treated cores, directly with the density of the untreated face veneers; the higher the density, the higher the flame spread rating.

Fire Retardant treatments may affect the finishes intended to be used on the wood, particularly if transparent finishes are planned. The compatibility of finishes should be tested before they are applied.

Refer to the latest edition of the Underwriters' Laboratories listings for various flame-spread ratings available bearing U.L. Labels, ul.com.

PHOTODEGRADATION

The effect on the appearance of exposed wood faces caused by exposure to both sun and artificial light sources is called photodegradation. If an entire face is exposed to a light source, it will photodegrade somewhat uniformly and hardly be noticeable, whereas partially exposed surfaces or surfaces with shadow lines might show nonuniform photodegradation. Some woods, such as American Cherry and Walnut, are more susceptible than others, and extra care should be taken to protect against the effects of nonuniform photodegradation.

OXIDATION

The effect on the appearance of exposed wood faces caused by exposure to atmosphere is called oxidation. This is analogous to browning reactions in freshly cut fruit; for instance, apples. Hardwoods can develop deep yellow to reddish brown discolorations on the surface of the wood when exposed to air immediately after sawing or peeling. These discolorations are especially noticeable on Cherry, Birch, Red Alder, Sycamore, Oak, Maple, and Sweet Gum. Some species, such as Alder, Oak, Birch, and Maple, develop these discolorations during air-seasoning. A related gray stain on several varieties of Southern Oaks also appears to be oxidative in nature. Proper selection, sanding, and finishing can minimize the effects of oxidation.

VENEER CUTTING

The manner in which a log segment is cut with relation to the annual rings will determine the appearance of the veneer. When sliced, the individual pieces of veneer, referred to as leaves, are kept in the order in which they are sliced, thus permitting a natural grain progression when assembled as veneer faces. The group of leaves from one slicing is called a flitch and is usually identified by a flitch number and the number of gross square feet of veneer it contains. The faces of the leaves with relation to their position in the log are identified as the tight face (toward the outside of the log) and the loose face (toward the inside or heart of the log). During slicing the leaf is stressed on the loose face and compressed on the tight face. When this stress is combined with the natural variation in light refraction caused by the pores of the wood, the result is a difference in the human perception of color and tone between tight and loose faces.

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FOUR COMMON VENEER CUTS

- **Plain Slicing** (or Flat Slicing) - This is the slicing method most often used to produce veneers for architectural woodwork. Slicing is done parallel to a line through the center of the log. A combination of cathedral and straight grain patterns results, with a natural progression of pattern from leaf to leaf.

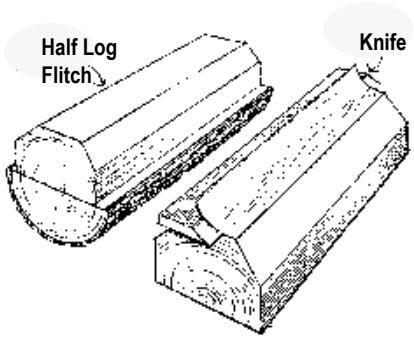

Figure: RG-052

- **Quarter Slicing** (or Quarter Cut) - Quarter slicing simulates the quarter sawing process of solid lumber, roughly parallel to a radius line through the log segment. In many species the individual leaves are narrow as a result. A series of stripes is produced, varying in density and thickness from species to species. "Fleck" (sometimes called flake) is a characteristic of this slicing method in Red and White Oak.

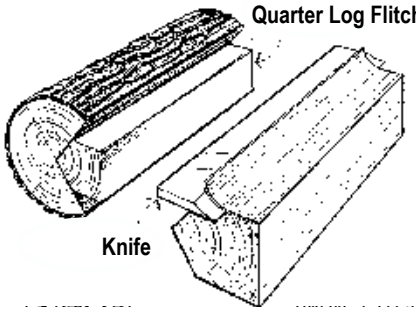

Figure: RG-053

Figure: RG-054

- **Rift Slicing** (or Rift Cut) - Rift veneers are produced most often in Red and White Oak. Note that rift veneers and rift sawn solid lumber are produced so differently that a "match" between rift veneers and rift sawn solid lumber is highly unlikely. In both cases the cutting is done slightly off the radius lines minimizing the "fleck" (sometimes called flake) associated with quarter slicing.

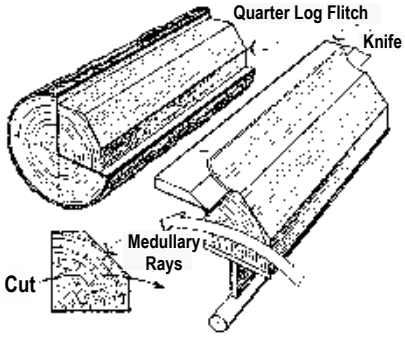

Figure: RG-055

- **Rotary Slicing** - The log is center mounted on a lathe and "peeled" along the general path of the growth rings like unwinding a roll of paper, providing a generally bold random appearance.

  When transparent finish is specified; rotary sliced hardwood veneers are sometimes specified for:

  - **Wall Surfacing**: Institutional panel faces.
  - **Doors:** Institutional flush door faces.
  - **Cabinets**: Semi-exposed (interior) surfaces and used in a limited way for exposed surfaces.

  Some species may possess a special figure, for example birds eye, which is achieved by rotary slicing.

  Careful consideration, specification, and communication are recommended when rotary cut is contemplated.

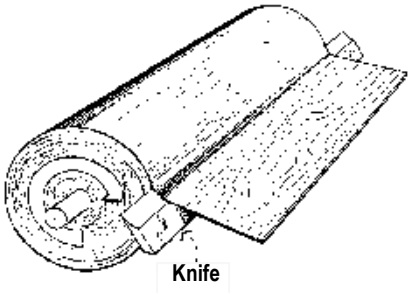

Figure: RG-056

SHEET PRODUCTS (continued)

Table: RG-006 - **COMMON HARDWOOD VENEER SPECIES and CUTS**

SPECIES	ROTARY	PLAIN SLICED	QUARTER SLICED	RIFT
Anigre		●	●	
Ash		●	●	
Beech		●	●	
Birch	●	●		
Cherry		●	●	
Hickory		●		
Lauan	●		●	
Mahogany, African		●	●	
Mahogany, American		●	●	
Makore		●	●	
Maple	●	●	●	
Oak, Red	●	●	●	●
Oak, White		●	●	●
Pecan		●		
Poplar	●	●		
Sapele		●	●	
Walnut		●	●	

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SHEET PRODUCTS (continued)

Table: RG-007 - **GENERAL CHARACTERISTICS OF SELECTED WOOD SPECIES:**

SPECIES	CUT (1)	WIDTH TO	LENGTH	FLITCH SIZE	COST (2)	AVAILABILITY
Alder	Plain Sliced	12" (305 mm)	10' (3048 mm)	Medium	Moderate	Moderate
Anigre	Plain Sliced	12" (305 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	High	Good
Anigre, Figured	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	Very High	Limited
Ash, American	Plain Sliced	12" (305 mm)	10' (3048 mm)	Large	Moderate	Moderate
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Medium	High	Moderate
Ash, European	Plain Sliced	10" (254 mm)	10' (3048 mm)	Medium	Moderate	Limited
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	Moderate	Moderate
Beech, European	Plain Sliced	10" (254 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Medium	High	Good
Birch, Natural	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	8" (203 mm)	10' (3048 mm)	Small	Medium	Limited
Birch, Select Red and White	Rotary	36" (914 mm)	10' (3048 mm)	Large	Moderate	Good
	Plain Sliced	8" (203 mm)	10' (3048 mm)	Small	High	Limited
Cedar, Western Red	Plain Sliced	18" (457 mm)	10' (3048 mm)	Medium	Moderate	Limited
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Limited
Cherry, American (3)	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Moderate
Ebony	Plain Sliced	6" (153 mm)	10' (3048 mm)	Very Small	Extreme	Very Limited
Fir, Douglas (Vertical Grain)	Quarter Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
Hickory	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	Moderate	Moderate
Jatoba	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good
Lacewood	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Very Limited
Lauan (4)	Plain Sliced	15" (381 mm)	12' (3658 mm)	Medium	Moderate	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Moderate	Moderate
Mahogany, African (5)	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Moderate
Mahogany, American (5) (Swietenia macrophylla CITES listed (6))	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Very Limited
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Very Limited
Makore	Plain Sliced	15" (381 mm)	12' (3658 mm)	Large	Moderate	Moderate
	Quarter Sliced	8" (203 mm)	12' (3658 mm)	Medium	High	Limited

(continued)

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SHEET PRODUCTS (continued)

Table: RG-007 - **GENERAL CHARACTERISTICS OF SELECTED WOOD SPECIES:** (continued)

SPECIES	CUT (1)	WIDTH TO	LENGTH	FLITCH SIZE	COST (2)	AVAILABILITY
Maple, American	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Moderate	Good (2)
	Quarter Sliced	6" (153 mm)	10' (3048 mm)	Small	High	Limited
Maple, Birds Eye	Rotary	24" (610 mm)	10' (3048 mm)	Medium	Very High	Limited
Meranti	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	10" (254 mm)	12' (3658 mm)	Medium	High	Moderate
Oak, English Brown	Plain Sliced	12" (305 mm)	10' (3048 mm)	Medium	High	Limited
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Very High	Limited
Oak, Red	Rotary	36" (914 mm)	10' (3048 mm)	Large	Low	Good
	Plain Sliced	18" (457 mm)	12' (3658 mm)	Large	Low	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Good
	Rift	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Good
Oak, White	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	Low	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	Moderate	Good
	Rift	8" (203 mm)	10' (3048 mm)	Small	Moderate	Good
Poplar	Plain Sliced	15" (381 mm)	10' (3048 mm)	Medium	Low	Good
Rosewood, American	Plain Sliced	10" (254 mm)	10' (3048 mm)	Small	Very High	Very Limited
Sapele	Plain Sliced	15" (381 mm)	10' (3048 mm)	Large	Moderate	Good
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Medium	Moderate	Moderate
Sycamore	Plain Sliced	15" (381 mm)	12' (3658 mm)	Medium	High	Moderate
	Quarter Sliced	8" (203 mm)	10' (3048 mm)	Small	High	Limited
Teak	Plain Sliced	12" (305 mm)	12' (3658 mm)	Medium	High	Moderate
	Quarter Sliced	5" (127 mm)	10' (3048 mm)	Small	High	Limited
Walnut (3)	Plain Sliced	15" (381 mm)	12' (3658 mm)	Large	Moderate	Good
	Quarter Sliced	6" (152 mm)	10' (3048 mm)	Small	High	Moderate
Wenge	Plain Sliced	10" (254 mm)	10' (3048 mm)	Small	High	Limited

(1) When only Plain Sliced is listed, the width dimension for quartered Cut is narrower.
(2) Seasonal factors may affect availability.
(3) Cherry, Walnut and certain other hardwood species are required to be specified by origin, such as American Cherry, American Walnut, or English Brown Oak, because they can be significantly different in color and figure.
(4) Lauan (White and Red), Tanguile, and other species are native to the Philippine Islands and are sometimes referred to as Philippine Mahogany; however, they are not a true Mahogany The generic term Mahogany should not be specified without further definition.
(5) Mahogany, American and African vary in color from a light pink to a light red, reddish brown to a golden brown or yellowish tan. Some Mahogany turns darker or lighter in color after machining. The figure or grain runs from plain sliced, plain stripe to broken stripe, mottled, fiddleback, swirl, and crotches.
(6) CITES, Convention on International Trade in Endangered Species or Wild Fauna and Flora.

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VENEER FACE GRADE DESCRIPTIONS as used in ANSI/ HPVA HP-1 (latest edition) decorativehardwoods.org Characteristic charts:

GRADE - AA - Veneer will be smooth, tight cut, and full length. When the face consists of more than one veneer component or piece, the edges will appear parallel and be edge matched. All components of a book or slip matched face will be from the same flitch. Rotary cut faces may be whole piece or multi piece with edge joints tight and no sharp color contrast at the joints. Species specified for natural color will allow color contrasts but will be book matched or conform to the type of matching as specified. The components of plain sliced (flat cut) and multi piece rotary faces will be book matched unless otherwise specified with a running, balanced, or center matched arrangement. Unless otherwise specified, components in plain sliced faces will have a matching arrangement selected by the material supplier. Plain sliced faces will consist of two or more components with no component less than 6" (152 mm) wide except for outside components, which may be less than 6" (152 mm) to allow for certain types of matching or panel edge loss. No plain sliced components will have a split heart. No full quartered cut is permitted in plain sliced faces. The width of any single component in quarter cut, rift cut faces will not be less than 3" (76 mm) except for outside components, which may be less than 3" (76 mm) to allow for certain types of matching or panel edge trim loss.

GRADE - A - Veneer will be smooth, tight cut, and full length. When the face consists of more than one veneer component or piece, the edges will appear parallel and be edge matched. All components of a book or slip matched face will be from the same flitch. Rotary cut faces may be whole piece or multi piece with edge joints tight; however, no sharp color contrasts are permitted at the joints, and the face will provide a good general appearance. Species specified for natural color will allow color contrasts but will be book matched or conform to the type of matching as specified. The components of plain sliced (flat cut) and multi piece rotary faces will be book matched, unless otherwise specified with a running, balanced, or center matched arrangement. Unless otherwise specified, components in plain sliced faces will have a matching arrangement selected by the material supplier. Plain sliced faces will consist of two or more components with no component less than 5" (127 mm) wide except for outside components, which may be less than 5" (127 mm) to allow for certain types of matching or panel edge trim loss. Split heart is permitted if manufactured cathedral is achieved. No full quarter cut is permitted in plain sliced faces. The width of any single component in quarter cut, rift cut, or comb grain faces will not be less than 3" (76 mm) except for outside components, which may be less than 3" (76 mm) to allow for certain types of matching or panel edge trim loss. In some species, sapwood is permitted; however, in other species, it may be permitted by agreement between buyer and seller.

GRADE - B - Veneer will be smooth, tight cut, and full length as described for the various species. All components of a book or slip matched face will be from the same flitch. Slip or book matched veneers are available if specified by the buyer. If not specified, multi piece faces will be pleasingly matched. Sharp color contrasts at the joints are not permitted. Species specified for natural color will allow color contrasts but will be book matched or conform to the type of matching as specified. Plain sliced faces will consist of two or more components with no component less than 4" (102 mm) wide to allow for certain types of matching or panel edge trim loss. Some full quarter cut is permitted in plain sliced faces. For some species, unlimited sapwood is permitted, and in other species, a percentage of sapwood is permitted.

GRADE - C - Permits unlimited color streaks and spots and color variation. An unlimited number of small burls and pin knots are permitted with no restrictions on the size of the dark pin knot centers, as long as the diameter of pin knots does not exceed 1/4" (6.4 mm) in diameter. The size of sound and repaired knotholes and similar shaped openings cannot exceed 1/2" (12.7 mm) in diameter, with a specified number permitted based on individual species. Faces will provide a sound face, free of open defects, with only minimal areas of rough grain.

TERMINOLOGY DEFINITIONS as used in ANSI/HPVA HP-1 (latest edition) decorativehardwoods.org Characteristic charts:

BARK POCKET: Bark around which normal wood has grown.

BRASHNESS: Condition of wood characterized by low resistance to shock and by abrupt failure across the grain without splintering.

BURL, BLENDING: A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch but does not contain a knot and does not contain abrupt color variation. A blending burl is detectable at 72" to 96" (1829 to 2438 mm) as a swirl or roundel.

BURL, CONSPICUOUS: A swirl, twist, or distortion in the grain of the wood which usually occurs near a knot or crotch. A conspicuous burl is associated with abrupt color variation and/or a cluster of small dark piths caused by a cluster of adventitious buds.

COMB GRAIN: A quality of rift cut veneer with exceptionally straight grain and closely spaced growth increments resembling the appearance of long strands of combed hair.

CROSS BAR: Irregularity of grain resembling a dip in the grain running at right angles, or nearly so, to the length of the veneer.

FLAKE: See Fleck, Ray.

FLECK, RAY: Portion of a ray as it appears on the quartered or rift cut surface. Fleck is often a dominant appearance feature in Oak.

GUM POCKETS: Well defined openings between rings of annual growth, containing gum or evidence of prior gum accumulations.

GUM SPOTS AND STREAKS: Gum or resinous material or color spots and streaks caused by prior resin accumulations sometimes found on panel surfaces.

HAIRLINE: A thin, perceptible line showing at the joint of two pieces of wood.

HEARTWOOD: The non-active or dormant center of a tree, generally distinguishable from the outer portion (sapwood) by its darker color, sometime referred to as heart.

KNOT: Cross section of tree branch or limb with grain usually running at right angles to that of the piece of wood in which it occurs, further defined as:

CONSPICUOUS PIN: Sound knots 1/4 inch (6.4 mm) or less in diameter containing dark centers.

HOLES: Openings produced when knots drop from the wood in which they were embedded.

OPEN: Opening produced when a portion of the wood substance of a knot has dropped out or where cross checks have occurred to produce an opening.

SOUND TIGHT: Knots that are solid across their face and fixed by growth to retain their place.

SPIKE: Knots cut from 0° to 45° to the long axis of limbs.

REPAIRS: A patch, shim, or filler material inserted and/or glued into veneer or a panel to achieve a sound surface.

RIFT CUT: A straight grain appearance achieved through the process of cutting at a slight angle to the radial on the half round stay log or through the use of veneer cut in any fashion that produces a straight grain with minimal ray fleck.

ROUGH CUT: Irregular shaped areas of generally uneven corrugation on the surface of veneer, differing from the surrounding smooth veneer and occurring as the veneer is cut by the lathe or slicer.

RUPTURED GRAIN: A break or breaks in the grain or between springwood and summerwood caused or aggravated by excessive pressure on the wood by seasoning, manufacturing, or natural processes. Ruptured grain appears as a single or series of distinct separations in the wood such as when springwood is crushed leaving the summerwood to separate in one or more growth increments.

SAPWOOD: The living wood of lighter color occurring in the outer portion of a tree, sometimes referred to as sap.

SLIGHT: Visible on observation but does not interfere with the overall aesthetic appearance with consideration of the applicable grade of the panel.

SPLITS: Separations of wood fiber running parallel to the grain.

STREAKS, MINERAL: Sharply contrasting elongated discolorations of the wood substance.

VINE MARK: Bands of irregular grain running across or diagonally to the grain which are caused by the growth of climbing vines around the tree.

WORMHOLES: Holes resulting from infestation of worms.

WORM TRACKS: Marks caused by various types of wood attacking larvae. Often appear as sound discolorations running with or across the grain in straight to wavy streaks. Sometimes referred to as "pith flecks" in certain species of Maple, Birch and other hardwoods because of a resemblance to the color of pith.

MATCHING ADJACENT WOOD VENEER LEAVES

It is possible to achieve certain visual effects by the manner in which the leaves are arranged. Matching of adjacent wood veneer leaves, as with the effect of different veneer cuts, can alter the appearance of a given panel or an entire installation. To create a particular appearance, the veneer leaves of a flitch are edge glued together in patterns.

Individual leaves of veneer in a sliced flitch increase or decrease in width as the slicing progresses. Thus, if a number of panels are manufactured from a particular flitch, the number of veneer leaves per panel face will change as the flitch is utilized. The manner in which these leaves are "laid up" within the panel requires specification.

Rotary cut veneers are difficult to match; therefore, most matching is done with sliced veneers. The matching of adjacent veneer leaves must be specified. Special arrangements of leaves such as "diamond" and "box" matching are available. Consult your manufacturer for choices.

White dashed lines on the following illustrations indicate the veneer trim lines.

BOOK MATCHING - A common match used in the industry. Every other piece of veneer is turned over so adjacent pieces (leaves) are opened like the pages of a book.

Figure: RG-57

- **Visual Effect -** Veneer joints match, creating a symmetrical pattern yields maximum continuity of grain. When sequenced panels are specified, prominent characteristics will ascend or descend across the match as the leaves progress from panel to panel.

- **Barber Pole Effect in Book Match** - Because the tight side and loose side of the veneer leaf faces alternate in adjacent pieces of veneer, they may accept stain differently, and this may result in a noticeable color variation. Book matching also accentuates cell polarization, causing the perception of different colors. These natural characteristics are often called barber pole and are not a manufacturing defect.

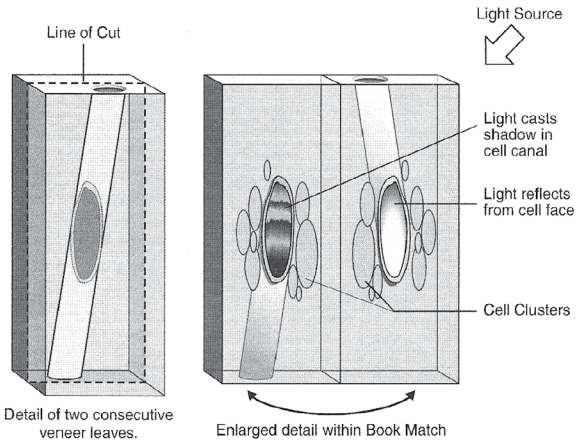

Figure: RG-058

SLIP MATCHING - Often used with quarter sliced and rift sliced veneers. Adjoining leaves are placed (slipped out) in sequence without turning, resulting in the same face sides being exposed.

- **Visual Effect -** Grain figure repeats; but joints do not show visual grain match.

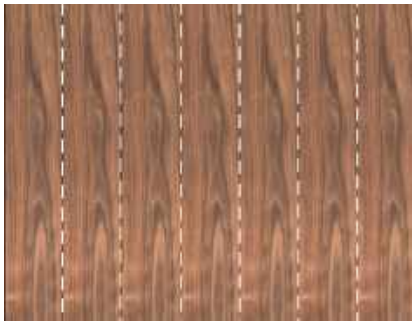

Figure: RG-059

The lack of grain match at the joints can be desirable. The relatively straight grain patterns of quartered and rift veneers generally produce pleasing results and a uniformity of color because all faces have the same light refraction.

MATCHING ADJACENT WOOD VENEER LEAVES (continued)

RANDOM MATCHING - Veneer leaves are placed next to each other in a random order and orientation, producing a "board by board" effect in many species.

- **Visual Effect -** Casual or rustic appearance, as though individual boards from a random pile were applied to the product. Conscious effort is made to mismatch grain at joints.

  Degrees of contrast and variation may change from panel to panel. This match is more difficult to obtain than book or slip match and should be clearly specified and detailed.

Figure: RG-060

END or BUTT MATCHING (aka Architectural End Match) - Often used to extend the apparent length of available veneers for high wall panels and long conference tables.

Leaves are individually book (or slip) matched, first end to end and then side to side, alternating end and side.

- **Visual Effect -** Yields best continuous grain patterns for length as well as width. Minimizes misalignment of grain pattern.

Figure: RG-061

MATCHING WITHIN INDIVIDUAL PANEL FACES

The individual leaves of veneer in a sliced flitch increase or decrease in width as the slicing progresses. Thus, if a number of panels are manufactured from a particular flitch, the number of veneer leaves per panel face will change as the flitch is utilized. The way these leaves are "laid up" within the panel requires specification, and is classified as follows:

RUNNING MATCH - The panel face is made from components running through the flitch consecutively. Any portion of a component left over from a face is used as the beginning component or leaf in starting the next panel.

THIS METHOD IS THE DEFAULT FOR CUSTOM GRADE.

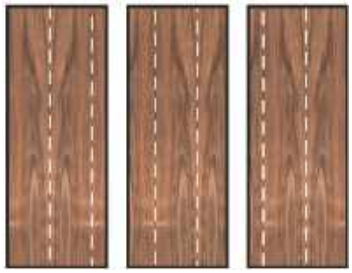

Figure: RG-062

BALANCE MATCH - Each panel face is assembled from veneer leaves of uniform width before edge trimming. Panels may contain an even or odd number of leaves, and distribution may change from panel to panel within a sequenced set.

THIS METHOD IS THE DEFAULT FOR PREMIUM GRADE

However, it must be specified for other Grades, and it is the most common assembly method at moderate cost.

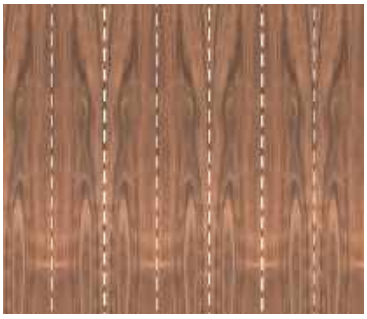

Figure: RG-063

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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MATCHING WITHIN INDIVIDUAL PANEL FACES
(continued)

BALANCE AND CENTER MATCH - Each panel face is assembled of an even number from veneer leaves of uniform width before edge trimming. Thus, there is a veneer joint in the center of the panel, producing horizontal symmetry. A small amount of figure is lost in the process. Considered by some to be the most pleasing assembly at a modest increase in cost over Balance Match.

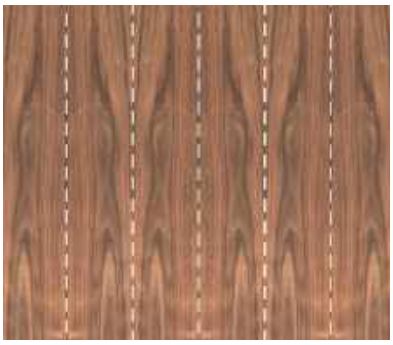

Figure: RG-064

SLIP, CENTER, BOOK MATCH - Each panel face is assembled of an even (four or more) number of veneer leaves, generally of uniform width. The veneer leaves are laid out as a slip matched panel face; then at the center, one half of the leaves are booked to the other half. Quarter and rift sliced veneers are generally used for this match, which allows for a pleasing balance of sweep and character marks.

Slip Left ◀ | ▶ Slip Right

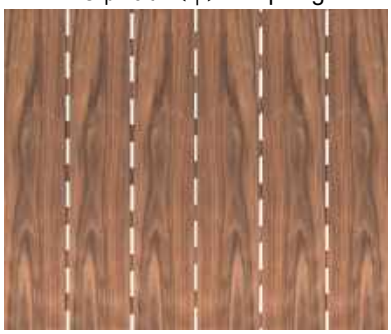

Figure: RG-065

SWING MATCH - is made by dividing the panel into multiple paired sets. For each paired set, two leaves of veneer are cut at half the width of the set. One of these two veneer leaves is rotated 180 degrees and joined to the other. This pair is then adjoined to the other pairs assembled in the same way.

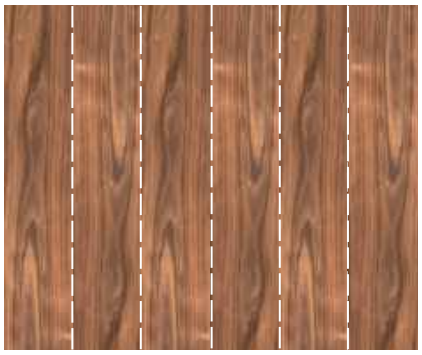

Figure: RG-066

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SHEET PRODUCTS (continued)

SPECIALTY OR SKETCH MATCHES OF WOOD VENEERS

There are regional variations in the "names" of the following veneer leaf matching techniques, drawn as squares for simplicity. It is strongly recommended that the design professional use both names and drawings to define the desired effect, using a rectangle, polygon, circle, ellipse, or other shape. Rift sliced, quarter sliced, and highly figured veneers are generally used for these specialty matches. The different matches of veneer cause the reflection of light to vary from adjoining leaves, bringing "life" to the panel. Due to the inherent nature of the layup process, alignment at corners might vary.

HERRINGBONE OR V BOOK MATCH - is one or more pairs of assembled slipped or booked leaves. Each assembled set of leaves is cut at generally 45 degrees to one edge of the panel. The assembled set of leaves is then end matched to the adjoining assembled set of leaves.

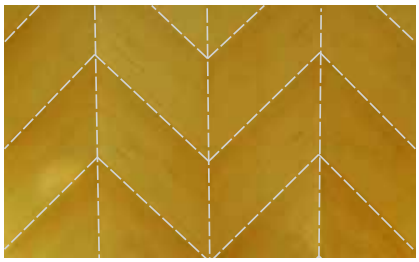

Figure: RG-067

SUNBURST MATCH - is made of six or more veneer leaves cut at the appropriate angle with the grain radiating from the center. These veneer leaves are then book matched, assembled, and trimmed for final size.

Figure: RG-068

BOX MATCH - is made of four leaves with the grain running parallel to the perimeter of the panel. The leaves are cut at the appropriate angle and end matched.

Figure: RG-069

REVERSE OR END GRAIN BOX MATCH - is made of four leaves with the grain running at right angles to the perimeter of the panel. The leaves are cut at the appropriate angle and book matched.

Figure: RG-070

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SPECIALTY OR SKETCH MATCHES OF WOOD VENEERS (continued)

DIAMOND MATCH - is made of four leaves with the grain running 45 degrees to the perimeter of the panel and surrounding the center. The leaves are cut at the appropriate angle and end matched.

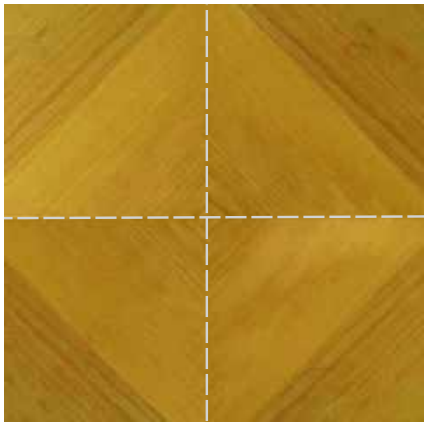

Figure: RG-071

REVERSE DIAMOND MATCH - is made of four leaves with the grain running 45 degrees to the perimeter of the panel and radiating from the center. The leaves are cut at the appropriate angle and book matched.

Figure: RG-072

PARQUET MATCH - is made by dividing the panel into multiple equal sized pieces and cutting the veneer to the same size. Each veneer leaf is joined at right angles to the adjoining piece of veneer.

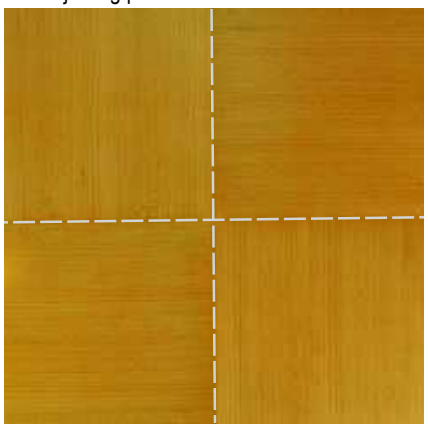

Figure: RG-0373

SHEET PRODUCTS (continued)

MATCHES BETWEEN PANELS

NOT MATCHED - Veneered panels are generally manufactured without matching and may or may not be similar in grain and color.

SEQUENCE MATCHED - Veneered panels may be sourced and/or manufactured in sequence. These panels will be well matched for grain and color.

SEQUENCE MATCHED & CUSTOM WIDTH - Generally veneered panels are manufactured in 4'x 8' and occasionally in 4'x 10' panels. The design professional may specify veneered sequence panels in custom width for the specific project and/or elevation. These panels will be well matched for grain and color.

BLUEPRINT MATCHED - The design professional may specify blueprint matched panels which will be custom sized height and width as well as sequencing for the specific project and/or elevation. These panels will be matched for grain and color.

DECORATIVE LAMINATES, OVERLAYS, and PRE-FINISHED PANEL PRODUCTS

Decorative surfacing materials are often applied to wood product cores such as industrial particleboard, fiberboard, hardboard, etc. Terminology and definitions of these overlay products follow, broadly grouped as:

- **Medium Density Overlay (MDO)** - Pressed resin impregnated paper overlays, highly resistant to moisture, applied to suitable cores for both interior and exterior uses. The seamless panel face and uniform density furnishes a sound base for opaque finishes and paint.
- **High Density Overlay (HDO)** - Is a thermosetting resin impregnated, cellulose fiber overlay that provides a hard, smooth, uniformly textured surface of such character that further finishing is not necessary. Some evidence of underlying grain may appear.
- **Thermoplastic Sheet** - Semi rigid sheet or roll stock extruded from a nonporous acrylic / polyvinyl chloride (PVC) alloy solid color throughout. Withstands high impact. Minor scratches and gouges are less conspicuous due to the solid color.
- **Vinyl Films** - Polyvinyl chloride (PVC) film, either clear or solid color, used extensively for decorative vertical surfaces in mobile homes, recreational vehicles, commercial panels and movable walls. Some films are available with scuff resistant top coatings.
- **HPL (High Pressure Laminate)** - Is a stand-alone product that can be laminated onto a core as the face of a sheet product or directly onto a structure as a covering. Decorative laminate is produced in a one step process by fusing together, under heat and pressure, multiple layers of Kraft paper saturated with thermosetting resin, together with a layer of melamine saturated decorative paper.

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DECORATIVE LAMINATES, OVERLAYS, and PRE-FINISHED PANEL PRODUCTS (continued)

- **HPL (High Pressure Laminate)** (continued)

  The assembly offers resistance to wear and many common stains and chemicals. Common uses include casework exteriors, countertops, and wall paneling.

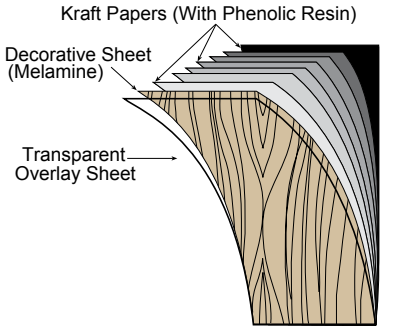

Figure: RG-074

  Some decorative laminates utilize a white background paper to achieve the high fidelity, contrast, and depth of color in their printed patterns, which leaves a white line at the exposed edges of the laminate and can be extremely noticeable in darker colors.

- **CONTINUOUS PRESSURE LAMINATE** (CPL) is an alternative to HPL, manufactured of multiple layers of thermosetting resin saturated Kraft paper in combination with a layer of decorative melamine saturated paper, fused together under heat and pressure with similar properties as HPL.

- **Thermally Fused Laminate (TFL)** - Decorative thermally fused panels flat pressed from a thermoset polyester or melamine resin impregnated web. Most products are pre-laminated to Industrial Particleboard or Medium Density Fiberboard cores when they arrive at the woodwork fabricator. Performance characteristics are similar to HPL except for the impact test.

  Thermally fused papers and foils are similar to that used in the manufacture of decorative laminate. Saturated with reactive resins and partially cured during manufacture to allow for storage and handling, the papers achieve final curing when they are hot press laminated to a core, providing a hard, permanent thermoset bond between the paper and the core:

  - Melamine - Impregnated papers, the most common, are noted for their hardness, scratch resistance, and color stability.
  - Polyester - Impregnated papers are noted for their chemical, stain, water, and impact resistance; color clarity; and machinability.

COMMON HPL TYPES

The basic types form the majority of applications of HPL in North America are:

GENERAL PURPOSE (HGP) Used for most horizontal applications, such as desktops and self-edged kitchen countertops, and offer durability, resistance to stains, and resistance to heat.

VERTICAL (VGP) A slightly thinner material, are produced for areas which will receive less wear and impact than typical horizontal materials. They are an excellent choice for cabinet doors, the sides of casework, primarily decorative display shelves and vertical panels.

POST-FORMING (HGP or VGP) Specifically for applications where a radiused surface is desirable and offer strong performance in both horizontal and vertical applications.

A major advantage of formed surfaces on the exposed corners of casework and service counters is the edge's resistance to chipping damage. Most chip damage occurs at sharp 90° corners. Surfaces are thermo-formed under controlled temperature and pressure.

CABINET LINER (CLS) A thin vertical sheet, this type is designed for areas where the surface, which is not considered decorative, generally white or off white in color, but will need to withstand less wear, such as the inside surfaces of cabinets and closets.

BACKING SHEET (BKL) Backing materials are essential in the fabrication of decorative laminate clad surfaces to prevent warping and to protect against dimensional instability of both laminate and core in conditions of changing temperature and humidity. Backing sheets are non-decorative, and both economical and effective in the creation of a successful application. Produced without a decorative face and available as standard (slightly thinner than decorative) or regrind (reclaimed decorative laminate with decorative sheet sanded off).

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SHEET PRODUCTS (continued)

COMMON HPL TYPES (continued)

FLAME RETARDANT (HGF) Some of these laminates can provide flame retardant characteristics as determined by test methods required by the authority having jurisdiction. HGF is the most common type used.

In summary, these common types have the following limitations of:

- They are for interior use only and will not be successfully used outdoors or under heavy exposure to the ultraviolet rays of the sun.
- They should not be used as cutting surfaces, because knives and other sharp tools will readily deface the surface and lower its other performance capabilities.
- They should not be exposed to caustic chemicals, such as drain and toilet bowl cleaners, which can permanently etch the surface.
- While they offer outstanding heat resistance, exposure to constant heat from a curling iron, an electric skillet or coffee pot, for example can harm the surface and may cause it to delaminate, discolor or blister.

COLOR THROUGH HPL

The interest in specifying solid color decorative laminates and the resurgence of interest in very pale pastels and neutral shades have caused increasing concern with the brown line visible at glued decorative laminate edges.

Color through decorative laminates were formulated specifically to provide light colors without this brown line.

Color through decorative laminate may be applied to cores in three basic ways:

- **As sheets**, to form a decorative face with a true monolithic look;
- **As edge trims**, to match a face of conventional decorative laminate or to accent a natural material such as wood or leather;
- **As decorative inlays**.

Color through decorative laminate is produced with multiple layers of decorative papers, rather than the decorative plus Kraft composition of conventional laminate. As a result, this material is slightly stiffer and slightly more brittle when flexed.

Selection of adhesive should take into consideration that a visible glue line may detract. Adhesive should be un-tinted.

CGS (Compact Laminate)

Are produced by several material suppliers in thicknesses adequate to preclude the use of a core (minimum 1/8" (3.2 mm)).

Unlike conventional sheets, they may be drilled and tapped, and offer significant screw holding capacity.

Depending on thickness, these laminates may be used for many flat applications, such as toilet and dressing room partitions, workbenches, shelving, and tabletops.

Panels are heavy for their size—an asset in sturdiness of the end application, but a factor which must be considered when planning for time and cost of labor and transportation as well as for support structures.

STATIC-DISSIPATIVE HPL

HPL is a good electrical insulator, in fact, it was for the specific purpose of electrical insulation that the product was originally developed.

HPL does not store static electricity, and it is therefore a suitable material for use in hospital areas, i.e.: operating rooms, X-ray rooms, and computer room controlled environments where the accumulation and retention of static electricity must be avoided.

However, the growing need for work surfaces in areas such as electronic clean rooms, where electrostatic charges must be actively, continuously channeled away, has triggered the development of specifically conductive (static-dissipative) laminates such as: Anti-Static, Static Dissipative and Conductive.

These HPL sheets have a conductive layer enclosed in, or backing, the sheet. Connected to suitable grounding, they create a decorative, sturdy, practical work surface. Applications include electronic workbench tops and work areas around instrument monitoring devices, in lab testing environments, around photo equipment and on computer desktops.

Antistatic laminates are produced in a number of compositions, thicknesses, colors and patterns. Consult material suppliers' literature for details.

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CHEMICAL-RESISTANT HPL

Chemical resistant HPL offers the familiar advantages of HPL: resistance to wear, conductive and radiant heat, and impact; as well as ease in cleaning, color fastness, and relatively light weight. Although this product may resist some chemicals, depending on the testing methods of the individual manufactures, it is the design professional's responsibility to select the appropriate material for the chemical resistance required.

These laminates may be applied on vertical as well as horizontal surfaces, to extend protection to cabinet doors and sides. And they may be post-formed for seamless edges.

Adhesives should be specified carefully. Edges which may be exposed to chemical attack should be glued with chemical-resistant adhesives.

Formulation of chemical-resistant decorative laminate differs from producer to producer. Consult product literature to make sure the material you specify meets the needs of your projects.

They are available in varying thicknesses and a number of color and patterns depending on material supplier.

METAL-FACED HPL

Is produced with metal veneers and a backer of Kraft paper and thermosetting resin.

The material used for much of the metal laminates is interior-type anodized aluminum. Other materials, including copper and nickel alloys may be specified in various formats; however, some metals, such as stainless steel or plated metal, are not conducive to machining with woodworking equipment.

FLAME SPREAD RATING of HPL

Safer materials for interiors are a primary concern for commercial and institutional design professionals across North America. The threat of fire and its concomitant hazard of smoke has created a critical need for interior materials that address this concern without aesthetic sacrifice.

Material suppliers of HPL offer fire and smoke retardant grades for interior application. The addition of fire retardant does not affect the performance characteristics of HPL; wear and stain resistance, ease of maintenance, and color stability remain very strong.

Rated HPLs are evaluated and certified according to ASTM-E-84 test procedures (cataloged as ASTM-E-84 Tunnel Test, astm.org; and as Test No. 723 by Underwriters Laboratories, Inc., ul.com. Similar Canadian testing is cataloged by Underwriters Laboratories of Canada as CAN/ULC S-102, canada.ul.com/ulcprograms/buildingandconstructionmaterials/

With appropriate choices of core and adhesive, panels clad with fire-rated decorative laminate may be produced to comply with Class A fire codes. Finished panels, already certified, may also be specified from some decorative laminate material suppliers.

Major applications of rated HPL include door, wall, and wainscot cladding in corridors, stairwells, entries, and elevators; as well as surfacing on fixtures and casework. These materials are supplied in both horizontal and vertical types, in a wide range of colors and patterns.

They may not be post-formed; the special formulation that produces fire retardant is not compatible with heat forming.

Adhesive choice for fire-rated HPL is important. As with many types of fire-retardant particleboard, some PVA adhesives are incompatible with the fire-retardant chemical composition of the decorative laminate material. Resorcinol adhesives are best for both chemical compatibility and flame spread rating of the end product. Contact adhesives do surprisingly well in some cases. Verify test ratings with your decorative laminate material supplier.

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SHEET PRODUCTS (continued)

NATURAL WOOD HPL

An excellent example of the ongoing evolution of the HPL process. Presently, natural wood laminates may be specified in two formats; both feature thin veneers of woods bonded under high pressure and heat to a core of Kraft papers and thermosetting resins. One process leaves the face of the wood untreated, and ready to finish. The other adds a protective face of melamine resin.

Performance characteristics vary with the presence or absence of the melamine resin.

In both cases, the ease of cutting and bonding, as well as the wear resistance, improve in comparison to raw wood veneer. With the melamine face, the natural wood assumes much of the easy care and long wear properties of conventional HPL.

Sequence matching of natural wood laminate panels is extremely limited; consult the laminate material supplier.

SPECIAL SHEET PRODUCTS

Included in this classification are special panel products such as lead lined panels for X-ray areas, bullet resistant panels, honeycomb core panels when light weight is a consideration, etc.:

- **Lead Lined Panels** - Usually a sheet of lead of a specified thickness, to meet X-ray shield requirements, is laminated between 2 layers of core material. A decorative overlay and balancing sheet can then be applied as required.
- **Bullet Resistant Panels** - Available as steel plate, glass, polycarbonate, acrylic or fiberglass reinforced material which can offer protection against many available small arms fire, depending upon the thickness specified. These panels are usually built into the interior of the structure of the counter, teller's lines, judge's benches, etc.

SOLID SURFACE

Solid Surface is a manufactured, filled cast polymeric resin panel. The fillers enhance both its performance properties and aesthetics. With a homogeneous composition throughout its thickness, solid surface requires no finish coat and is capable of being fabricated with inconspicuous seams and repaired to its original finish. Products (and material supplier's warranties) vary and should be fabricated according to material supplier's recommendations, including the use of unique fasteners and adhesives. Many decorative inlays are available. Consult your material supplier about performance issues, materials, colors, and patterns. To ensure color and pattern match it is suggested to use same batch material at adjacent sheets.

OTHER PANEL PRODUCTS

Many new panel products are available, from recycled glass and epoxy impregnated metal shavings to plastic or acrylic panels created from a variety of natural and recycled materials. The options are wide spread and the sheer volume of products make it difficult to quantify. These standards acknowledge these products and encourages design professionals to verify with individual product material suppliers that their products meet required performance standards. These standards do not at present address these products.

NONTRADITIONAL MATERIALS

These materials are re-purposed from other industrial and manufacturing areas but assigned to the woodwork manufacturer and treated similarly to traditional architectural woodwork items like wall paneling. From a design perspective, consideration of appearance, color, finish, variation and relation are deemed important as they would be with traditional wood products.

Examples of non-traditional materials could be a fiber / cement panel designed for fire resistance, insulation re-purposed as a decorative panel, metal products, cloth, acrylics, etc.

Because these materials are unique, contract documents, shall clearly indicate or delineate all of the necessary material, fabrication, installation and building code / regulation direction and requirements as may be applicable for the manufacturer / installer to reasonably accomplish the intended design concept.

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FINISHING

INTRODUCTION

Section 05 pertains to shop and field finishing of architectural woodwork. Thirteen finishing systems are outlined with application rules and methods of testing.

PURPOSE

The purpose of finishing woodworking is twofold. First, the finish is used traditionally to enhance or alter the natural beauty of the wood. Second, the finish shall offer protection to the wood from damage by moisture, contaminants, and handling. It is important to understand that a quality finish must offer acceptable performance and also meet the aesthetic requirements of the project.

The Standard illustrates a number of finishing systems. The finishing system provides a protective surface for the product. Some of these systems are in general use; others are intended for special conditions and can only be applied under a strictly controlled environment. The cost of the systems varies, the higher performing finishes usually being more costly than the lower performing finishes. Unnecessary cost could be added to a project through over specification.

When specifying, use the system name as set forth in these Standards. Involve your woodwork manufacturer early in the design process to evaluate the systems in relation to your project requirements. Choose performance characteristics which meet, but do not exceed, the needs of your project in the interest of value engineering.

The listing of a finish system in these Standards does not imply an endorsement of the materials and/or methods or compliance with federal and/or local Environmental Protection Agency or other requirements.

FACTORY or FIELD FINISHING

Both are permitted, provided there is no violation of applicable codes or regulations:

- **Factory finishing** is usually specified for high quality work where superior appearance and performance of the finish is desired. Benefits of factory finishing include consistency, control of film thickness, environmental compliance, and curing / drying of the finish in a controlled atmosphere. Its use assumes a maximum degree of manufacturer prefabrication so that site installation can be performed with a minimum amount of cutting, fitting, and adjustment to facilitate project completion.
- **Field finishing** is typically specified when there is not a demand or specific need for a superior appearance and is not necessarily part of the woodwork contract. This would normally be specified in the painting specification section. The finisher / painter is responsible for examining and accepting the woodwork as supplied prior to the commencement of finishing. The finisher / painter is responsible for meeting or exceeding the control sample for surface performance characteristics (such as color, texture, and sheen), including proper surface preparation, shading, and blending of color, and other requirements as defined in this standard when so referenced.
- **Wood parts on decorative laminate cabinets**: finish is required on all wood pulls, trims, applied molding, edgebands, drawer boxes, and interior wood parts of decorative laminate casework.

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FINISHING (continued)

IMPORTANT CONSIDERATIONS

- **Specifications** too often, call for finishes based on samples or guide language from a specialty material supplier.

  Select the performance criteria which best meets the needs of your client from the finish tables. Finish chemistry, performance, value to performance ratio, and your finisher's abilities should be considered.

- **Varying costs** of finish systems typically relate directly to their performing characteristics.

- **Intermixing systems** will likely cause quality and/or performance problems; they are usually not compatible with each other.

  Examples include the over specification of polyurethane or polyester topcoats when they are neither necessary or available from a custom fabricator.

- **Application** of finish material in excess of material supplier's film thickness recommendations can cause the finish to fail.

  Brush applied finishes are not recommended for factory finished architectural woodwork and are not covered by these Standards.

  Application techniques and other variances make the execution of the finish system difficult to determine. These standards provide the minimum requirements. The desired result is to provide a finish that is both durable and achieves the desired appearance.

- **Curing** of finish systems have a wide range of variance. Shortest cure time is UV cured coatings, and longest being water-based air dry coatings. Heat and air movement will speed the recoat and cure time.

  For the most part the method should not concern the design professional or specification writer. It is the performance of the topcoat which is important.

  UV (ultraviolet light) is typically used for high volume, repetitive applications, and requires special reactors to cure. A number of pre-finished panel products are coated with materials designed specifically for UV curing. A wide range of UV cured roll coat flat line panel finishes are available. Just as there are in the conventional spray / air cured coatings. Consult with the fabricator for performance tests and details.

- **Pre-finished Wood Panels** and decorative overlays have aesthetic and performance characteristics which meet or exceed these Standards, and should be evaluated, approved and specified by the design professional when desired.

- **Panel products** and/or wood doors require balanced coats of finishing materials for stability and to remain free of warp.

- **Barber pole** effect is most evident when veneer leaves are book matched. Because book matched veneer panels or door faces are made up by turning every other piece (leaf) of veneer over, like the pages of a book, the face of one leaf and the back of the next leaf is exposed. This exposes the "tight" and "loose" face of the leaves. One of the most striking examples of Barber Pole effect can be seen in book matched rift and quarter cut Oak. Check with your manufacturer when you are considering specifying rift or quartered veneers.

- **Grain** can significantly impact a finish's visual appearance and smoothness. If a filled finish is required it must be so specified. As a rule, close grain woods do not require filler. See Table.

  For finishing purposes, the following woods are classified as:

Open Grain	Close Grain
Ash	Alder, Red
Butternnut	Beech
Chestnut	Birch
Mahogany, African	Cherry
Mahogany, American	Fir
Mahogany,Philippine	Gum
Oak, Red	Maple
Oak, White	Pine
Walnut	Poplar

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FINISHING (continued)

IMPORTANT CONSIDERATIONS (continued)

- **Color** and **grain enhancement** of a system, from the addition of a single stain, to a multiple step build of one color on another with wash coats in between for enhanced appearance is not included in the basic systems and needs to be specified.

  Aesthetically, systems may vary from no stain, to a single stain, to a multiple step application. Some samples will require multiple color and finish steps in order to meet the architect's requirements. The system specified may not include all steps necessary to match the architect's example or requirements.

  Color and grain enhancement of some finishes require the build of one-color step on another. This will sometimes require an additional protective wash coat between color steps. Generally, this procedure adds to the depth and beauty of the finish. Each added step increases costs and shall be specified.

- **Color match** and **consistency** is often misleading. The best case achievable using a natural product like wood in a wide variety of lighting conditions is a good "blend" of color and tone throughout the project area. The natural color of the wood product is altered by the application of even a clear topcoat. Further alteration is achieved through the use of stains, glazes, bleaches, etc. Wood changes color; especially Cherry, Fir, American and African Mahogany, Walnut, Teak, and others. Filled nail holes will not change with wood. The apparent consistency of the color is a combination of light reflectance, cellular structure, natural characteristics, applied colors, and sheen.

  Color and "matching" of a sample are often highly subjective. Individual perception, ambient lighting, and reflectivity influence judgement. Design professionals are encouraged to consult directly with a manufacturer during the design and selection phase of each project.

- **Sheen** is the result of many factors, including finishing techniques, processes, stains, topcoats and the wood itself. Coating material suppliers use a variety of names for different sheens. An untrained eye can see a 10 point or greater difference in sheen.

  The following sheen ranges were developed by measuring the reflectance of a direct light source at a 60-degree angle with a gloss meter:

  - **Flat** = **8 - 14**
  - **Satin** = **15 - 25**
  - **Satin Gloss** = **26 - 49**
  - **Semi gloss** = **50 - 70**
  - **Gloss** = **71 - 90**

- **Transparent** finishes are applied in varying operations, typically consisting of some combination of hand sanding to remove job handling marks, staining, filling, sealing, sanding, and surface coating. Some exotic species have a high natural oil content and do not accept finishes similar to other hardwoods; because of this, the most common finish used is penetrating oil without any filling or sealing dyes or pigments in a stain.

- **Blotchy appearance** occurs because some wood species exhibit an uneven distribution of large and small pores in their structure. The occurrence of this is readily apparent in such hardwood species as Maple and Birch and, to a lesser degree, in Cherry. This irregular distribution of pores usually causes an uneven absorption of stain, hence, an apparent blotchy appearance in the finish. Reduction of the blotching condition can sometimes be achieved by proper sanding, wash coating (prior to staining) or by choosing non penetrating pigments, such as dyes, alcohol stains or glaze. When these steps are required or desired, they shall be specified in addition to finish system selection.

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TECHNIQUES TO CONSIDER

While a blotchy appearance and the "barber pole effect" may occur in any species, due to the natural characteristics of wood, there are steps that can be taken to reduce these effects. The following are two of the techniques that are of particular importance:

- **Sanding** - While the selection of species, cut and match are major factors in the final appearance of a project, the first step, in controlling the quality of finished appearance, is proper sanding.

  An important element of this standard is the statement "just prior to staining." Specifications that indicate "factory shall finish sand prior to shipment" do not provide a correct solution for proper surface preparation. Such a directive fails to take into account the length of time panels will be stored at the job site, potential damage from handling and the effects of changes in the relative humidity. Proper sanding can only be done, just prior to staining / finishing.

  The successful sanding of panels, or flush doors, is best accomplished with a hand block, powered pad sander, wide belt sander or stroke sander, exerting uniform pressure over the entire surface. Depending upon the condition of the surface it may be necessary to use successively finer grits of abrasive to properly prepare the surface, brushing off the surface between grits. These Standards set forth the smoothness requirement for all Grades of work. Proper and complete surface preparation is the key factor in the successful finish procedure.

- **Wash Coat** - A wash coat is a thin coat of material, usually clear lacquer or vinyl sealer (6 to 10 parts thinner to one-part sealer, topcoat). A wash coat can fulfill several purposes such as: to stiffen the small wood fibers that are raised by the staining operation, so they can be cut off easily with fine sandpaper (320 grit), to seal the stain, particularly if it is a bleeding type, to aid in the wiping and cleanup of filler, and to minimize excessive penetration of stain or filler to minimize blotchiness. As with any finish process, samples should always be prepared to ensure that the desired finish is achieved.

IRON STAIN

Iron stain occurs in some species of veneers when natural tannic acid in the wood comes in contact with iron and or moisture. Enough moisture may occur during heavy rains or high humidity in buildings not yet temperature controlled.

To prevent iron stain, never use steel wool on the bare wood. Fine particles of the wool will cling to the wood and cause trouble later. If you use shellac (a solvent for iron), it should not be stored in iron containers. To remove iron stain prior to finishing, we recommend a solution of oxalic acid crystals. The solution is made by dissolving 12 ounces of crystals in one gallon of lukewarm water. Use a plastic or rubber container. Wear rubber gloves while working with the solution. Apply it to the stained areas with a brush or sponge.

To remove the oxalic acid, use a sponge and a bucket filled with lukewarm water. Squeeze the sponge to remove excess water and wipe the entire surface of the Oak wood to remove the acid residue. Rinse the sponge frequently in clean lukewarm water as you wipe. Pour out the water and add 1 qt. of fresh lukewarm water to the bucket. Add 2 tablespoons. baking soda to the water and stir with a spoon to dissolve. Insert a fresh sponge into the solution and squeeze out the excess water. Wipe the entire surface of the Oak to neutralize any remaining acid residue and stop the bleaching process. Allow the surface to dry and sand with 150 to 180 grit sandpaper. The entire surface should be treated to avoid spotting. Failure to rinse the treated area adequately may have a damaging effect on the finish subsequently applied, or may cause damage to nearby glass, porcelain or other surfaces in confined areas. Damage may not result immediately but may result during storage or after installation.

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FIRE RETARDANT TREATED WOOD and COATINGS

Fire retardant treatments may affect the finishes intended to be used on the wood, particularly if transparent finishes are planned. The compatibility of finishes should be tested before they are applied.

"Fire retardant" coatings usually are of the intumescent type. They may be water based or solvent based, but both contain ingredients which, under the influence of heat, produce gases and char like products, resulting in the formation of a thick nonflammable crust that effectively insulates combustible cores from heat and flame. However, these ingredients are for the most part water sensitive and therefore reduce durability and range of usage of the coatings.

These coatings only delay the spread of fire and help contain it to its origin. To be of appreciable value, fire retardant coatings must be applied in strict conformance with the material supplier's instructions. These finishes are not particularly durable and their use should be restricted to application over interior surfaces.

The need for, and effectiveness of, fire retardant and fire-resistant finishes depends on the type of construction, nature of occupancy, and other technical features of the building. Because these finishes are considerably more expensive and have reduced durability, their use should be carefully limited to those areas where confining fire spread is the overwhelming consideration; for example, interior entrances, hallways, stairwells and ceilings.

NAAWS FINISHING SYSTEMS

Apply to both transparent or opaque applications, unless otherwise indicated: Specification of a system requires listing both the system number and the name, along with any desired enhancements.

SYSTEM - 1, Lacquer, Nitrocellulose

SYSTEM - 2, Lacquer, Pre-Catalyzed

SYSTEM - 3, Lacquer, Post Catalyzed

SYSTEM - 4, Latex Acrylic, Water Based

SYSTEM - 5, Varnish, Conversion

SYSTEM - 6, Oil, Synthetic Penetrating (available in transparent only)

SYSTEM - 7, Vinyl, Catalyzed

SYSTEM - 8, Acrylic Cross Linking, Water-Based

SYSTEM - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane

SYSTEM - 10, UV Curable, Water Based

SYSTEM - 11, Polyurethane, Catalyzed

SYSTEM - 12, Polyurethane, Water Based

SYSTEM - 13, Polyester, Catalyzed

NAAWS FINISHING SYSTEMS OVERVIEW TABLES

The following system overview tables are intended to give an overview of and help identify the correct standard or specialty finishing system to meet a project's needs; however, they are only relative to the topcoat, not any prior color or filler coats. Differences between systems of 10 points or fewer are not generally considered significant enough to justify the typical added expense of a higher-rated system. This systems listing does not imply an endorsement of the materials or compliance with applicable codes and regulations. Due to changing environmental regulations and finish technologies, design professionals need to discuss finish options with a manufacturer located in the area of the project.

FINISHING (continued)

Table: RG-008 - **GENERAL PERFORMANCE CHARACTERISTICS** of **NAAWS FINISHING SYSTEMS:**

	SYSTEM NUMBER and DESCRIPTION												
	Lacquer, Nitrocellulose	Lacquer, Pre Catalyzed	Lacquer, Post Catalyzed	Latex Acrylic, Water Based	Varnish, Conversion	Oil, Synthetic Penetrating (available in transparent only)	Vinyl, Catalyzed	Acrylic Cross Linking, Water-Based	UV Curable, Acrylated Epoxy, Polyester or Urethane	UV Curable, Water Based	Polyurethane, Catalyzed	Polyurethane, Water Based	Polyester, Catalyzed
	1	2	3	4	5	6	7	8	9	10	11	12	13
General Durability	2	2	3	2	4	1	4	2	5	5	5	3	5
Repairability	5	4	3	3	3	5	4	4	1	3	2	4	1
Abrasion Resistance	2	4	4	3	4	1	4	4	5	4	5	4	5
Finish Clarity	5	4	5	2	3	5	3	4	5	5	3	4	4
Yellowing in Time	1	2	3	5	4	2	1	4	3	5	4	4	3
Finish Flexibility	1	2	3	3	4	5	4	3	2	3	4	4	1
Moisture Resistance	3	3	4	1	4	1	5	3	5	4	5	4	5
Solvent Resistance	1	2	4	1	5	1	5	3	5	5	5	4	5
Stain Resistance	2	4	5	3	5	1	5	4	5	5	5	4	5
Heat Resistance	1	2	5	1	5	1	5	3	5	5	5	4	5
Household Chemical Resistance	3	4	5	3	5	2	5	4	5	5	5	4	5
Build / Solids	2	3	3	3	4	1	4	3	5	4	4	3	4
Drying Time	5	5	5	2	4	2	5	4	5	5	5	3	2

5 = Excellent to 1 = Poor. The numerical ratings are subjective judgments based on the general performance of generic products. Special formulations and facilities will influence some of the performance characteristics.

NOTES for *Table: RG-009* on following page.

Testing was evaluated in an ISO 9000-certified laboratory using the following ASTM test criteria: Chemical Resistance Testing - ASTM D1308 (latest edition), Wear Index - Abrasion Resistance Testing - ASTM D4060 (latest edition), Cold Check Resistance - ASTM D1211 (latest edition), Cross Hatch Adhesion - ASTM D3359 (latest edition). Baseline data for application prior to testing: A. 45-55% humidity at 70-80 degrees Fahrenheit; B. Water-borne coatings must be cured in a dehumidified atmosphere and can be assisted with infrared light and good air movement. Performance indicator numbers are used, with the following definitions:

For chemical resistance and wear index - abrasion resistance:

5 - No effect from the test.
4 - Minimal effect or slight change and little repair required.
3 - Some effect; noticeable change, and the coating will recover with minimal repairs.
2 - Moderate effect, performance adversely affected and repairs required.
1 - Poor performance and film failure is imminent and repairs difficult.

For cross-hatch adhesion:

5 - Edges of the cuts are completely smooth; none of the squares of the lattice are detached.
4 - Small flakes of the coating are detached at intersections; less than 5% of the area is affected.
3 - Small flakes of the coating are detached along the edges and at the intersections of cuts; 5 to 15% of the area is affected.
2 - Coating has flaked along the edges and on parts of the squares; 15 to 35% of the area is affected.
1 - Coating has flaked along the edges of the cuts in large ribbons and whole squares have detached; 35 to 65% of the area is affected.

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FINISHING (continued)

Table: RG-009 - **SPECIFIC PERFORMANCE CHARACTERISTICS for NAAWS FINISHING SYSTEMS**

	SYSTEM NUMBER and DESCRIPTION												
	Lacquer, Nitrocellulose	Lacquer, Pre-Catalyzed	Lacquer, Post Catalyzed	Latex Acrylic Water Based	Varnish, Conversion	Oil, Synthetic Penetrating (transparent only)	Vinyl, Catalyzed	Acrylic, Cross Linking, Water-Based	UV Curable Acrylated Epoxy, Polyester or Urethane	UV Curable Water Based	Polyurethane, Catalyzed	Polyurethane, Water Based	Polyester, Catalyzed
	1	2	3	4	5	6	7	8	9	10	11	12	13
Vinegar	3	4	5	4	5	3	5	5	5	5	5	4	5
Lemon Juice	3	4	5	4	5	3	5	5	5	5	5	4	5
Orange Juice	3	4	5	4	5	3	5	5	5	5	5	4	5
Catsup	3	4	5	4	5	2	5	5	5	5	5	4	5
Coffee	3	4	5	4	5	2	5	5	5	5	5	4	5
Olive Oil	2	3	5	3	5	2	5	5	5	5	5	4	5
Boiling Water	3	4	5	4	5	3	5	5	5	5	5	4	5
Cold Water	5	5	5	5	5	3	5	5	5	5	5	4	5
Nail Polish Remover	1	2	3	2	4	1	2	2	5	5	4	3	4
Household Ammonia	3	4	5	4	5	2	4	2	5	5	5	4	5
VM&P Naphtha	3	4	5	4	5	1	4	5	5	5	5	4	5
Isopropyl Alcohol	1	2	3	1	5	2	4	3	5	5	5	4	5
Wine	3	4	5	4	5	2	4	5	5	5	5	5	5
Windex™	3	3	4	3	5	2	3	4	5	4	5	4	5
409 Cleaner™	3	3	4	4	5	1	4	4	5	5	5	4	5
Lysol™	3	5	5	4	5	2	4	3	5	5	5	4	5
33% Sulfuric Acid	3	4	5	3	5	1	4	5	5	5	5	4	5
77% Sulfuric Acid	1	2	3	1	1	1	2	1	4	3	4	3	4
28% Ammonium Hydroxide	1	2	3	1	5	1	4	2	5	5	5	3	5
Gasoline	1	2	5	2	5	1	4	5	5	5	5	4	4
Murphy's Oil Soap™	5	5	5	5	5	2	4	4	5	5	5	5	5
Vodka 100 Proof	3	4	5	4	5	2	4	3	5	5	5	4	5
1% Detergent	3	4	5	4	5	3	4	5	5	5	5	5	5
10% TSP	3	4	5	4	4	1	5	2	5	5	5	5	5
SUBTOTAL	**65**	**86**	**110**	**82**	**114**	**46**	**100**	**95**	**119**	**117**	**118**	**97**	**117**
Wear	2	3	4	2	5	1	4	4	5	5	5	5	4
Cold Check	5	5	5	5	5	5	5	5	5	5	5	5	5
Adhesion	5	5	5	5	5	5	5	5	5	5	5	5	5
TOTAL SCORE	**77**	**99**	**124**	**94**	**129**	**57**	**114**	**109**	**134**	**132**	**133**	**112**	**131**

NOTES are on previous page.

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FINISHING (continued)

Table: RG-010 - **USAGE** and **PERFORMANCE SCORE COMPARISONS** for **NAAWS FINISHING SYSTEMS:**

	TYPICAL USAGE	SCORE	WHY AND WHY NOT
1 Lacquer, Nitrocellulose	Use in climate-controlled environment for trims, furniture, paneling, and ornamental work.	**77**	Why - Repairable; widely available; quick-drying Why not - Lack of durability and resistance to most solvents and water; yellows over time.
2 Lacquer, Pre-Catalyzed	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts (except treads), frames, windows, blinds, shutters, and doors.	**99**	Why - Repairable; stain-, abrasion-, chemical-resistance. Why not - Some yellowing; moderate build.
3 Lacquer, Post Catalyzed	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts (except treads), frames, windows, blinds, shutters, and doors.	**124**	Why - Repairable; finish clarity; stain-, heat-, abrasion-,chemical-resistance. Why not - Some yellowing; moderate build.
4 Latex Acrylic, Water Based	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts (except treads), frames, windows, blinds, shutters, and doors.	**94**	Why - Low VOCs; finish clarity (some formulations); stain resistance; yellowing resistance. Why not - Low durability; solvent- and heat-resistance; slow drying time.
5 Varnish, Conversion	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts, frames, windows, blinds, shutters, and doors.	**129**	Why - Durable; widely available; good build. Why not - Occasional lack of finish clarity.
6 Oil, Synthetic Penetrating	Use in climate-controlled environment on furniture or trims requiring a close-to-the-wood look or very low sheen.	**57**	Why - Close-to-wood, antique look; low sheen. Why not - Labor-intensive to apply and maintain, refreshing finish required from time-to-time; low resistance properties to most substances.
7 Vinyl, Catalyzed	Use in climate-controlled environment, often on kitchen, bath, office furniture, and laboratory casework.	**114**	Why - Durable; widely available; fast drying. Why not - Occasional lack of finish clarity.
8 Acrylic Cross Linking, Water-Based	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts, frames, windows, blinds, shutters, and doors.	**109**	Why - Fine durability; excellent abrasion-, solvent-, stain-, and chemical-resistance; moderately fast-drying; resists moisture Why not - Possibility of discoloration over time.
9 UV Curable, Acrylated Epoxy, Polyester or Urethane	Use in climate-controlled environment, doors, paneling, flooring, stair parts, and casework, where applicable; consult your finisher before specifying.	**134**	Why - Low VOCs; durable; near 100% solids usage; quick-drying (cure), may qualify as Green Guard. Why not - Difficult to repair with UV finish, as this requires a handheld UV lamp; availability varies; easy repair with lacquers or conversion varnish.
10 UV Curable, Water Based	Use in climate-controlled environment, doors, paneling, flooring, stair parts, and casework where applicable; consult your finisher before specifying.	**132**	Why - Low VOCs; quick-drying (cure), maybe Green Guard. Why not - Difficult to repair with UV finish, requires handheld UV lamp; availability varies; easy repair with lacquers or conversion varnish.
11 Polyurethane, Catalyzed	Use in climate-controlled environment; some formulas available for exterior environments; floors, stairs, high-impact areas; some doors; generally not good for casework, paneling, windows, blinds, and shutters.	**133**	Why - Durable; good build. Why not - Slow-drying; very difficult to repair; some formulations hazardous to spray-personnel without air make-up suits.
12 Polyurethane, Water Based	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, stair parts, frames, windows, blinds, shutters, and doors.	**112**	Why - Improved durability; excellent abrasion-, solvent-, stain-, and chemical-resistance; moderately fast-drying; resists moisture. Why not - Tannins in some wood species may cause Discoloration over time.
13 Polyester, Catalyzed	Use in climate-controlled environment for furniture, casework, paneling, ornamental work, blinds, shutters, and some doors.	**131**	Why - Durable; good build; can be polished. Why not - Not widely available; slow-curing; requires special facilities and skills; very difficult to repair; brittle finish flexibility.

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INTRODUCTION

Section 6 includes information on standing & running trim, door frames, window frames, sashes, blinds & shutters, screens, ornamental & miscellaneous architectural woodwork composed of solid wood and/or sheet products and their related parts.

METHODS OF PRODUCTION

Flat Surfaces:

- **Sawing** - This produces relatively rough surfaces that are not utilized for architectural woodwork except where a "rough sawn" texture or finish is desired for design purposes. To achieve the smooth surfaces generally required, the rough sawn boards are further surfaced by the following methods:
  - **Planing** - Sawn lumber is passed through a planer or jointer, which has a revolving head with projecting knives, removing a thin layer of wood to produce a relatively smooth surface.
  - **Abrasive Planing** - Sawn lumber is passed through a powerful belt sander with tough, coarse belts, which remove the rough top surface.
  - **Molded Surfaces -** Sawn lumber is passed through a molder or shaper that has knives ground to a pattern which produces the molded profile desired.

SMOOTHNESS of FLAT and MOLDED SURFACES

Planers and Molders: The smoothness of surfaces which have been machine planed or molded is determined by the closeness of the knife cuts. The closer the cuts to each other (i.e., the more knife cuts per inch [KCPI]) the closer the ridges, and therefore the smoother the resulting appearance.

Sanding and Abrasives: Surfaces can be further smoothed by sanding. Sandpapers come in grits from coarse to fine and are assigned ascending grit numbers. The coarser the grit, the faster the stock removal. The surface will show the striations caused by the grit. Sanding with progressively finer grit papers will produce smoother surfaces.

DESIGN and USE of RESOURCES

Moldings should be cut from lumber approximately the same size as the finished piece to make the best use of our natural resources. Designing moldings with the size of typical boards in mind has several advantages.

The typical 1" x 4" (25.4 mm x 102 mm) will yield a very nice 3/4" (19.0 mm) thick molding but will not be thick enough to develop a molding which is a full 1" (25.4 mm) thick in finish dimension. The typical 2" x 4" (50.8 mm x 102 mm) piece of lumber can be made into moldings about 1-3/4" (44.5 mm) thick in a similar manner.

Deep or large moldings are often best cut from more than one piece and built up to make the final profile. Just as in the manufacturing of single moldings, this process minimizes waste and reduces the tendency of the finished profiles to twist, warp, cup, or bow as a result of removing too much material from either side of the initial board.

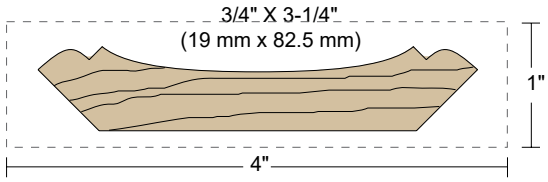

Figure: RG-075

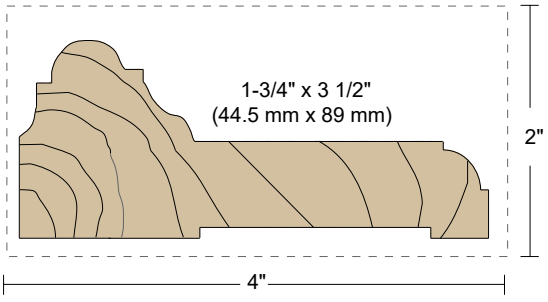

Figure: RG-076

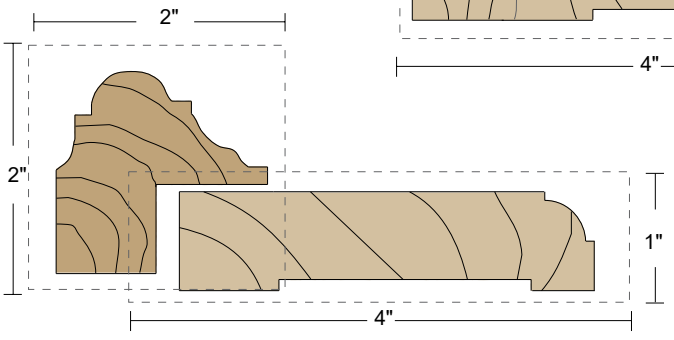

Figure: RG-077

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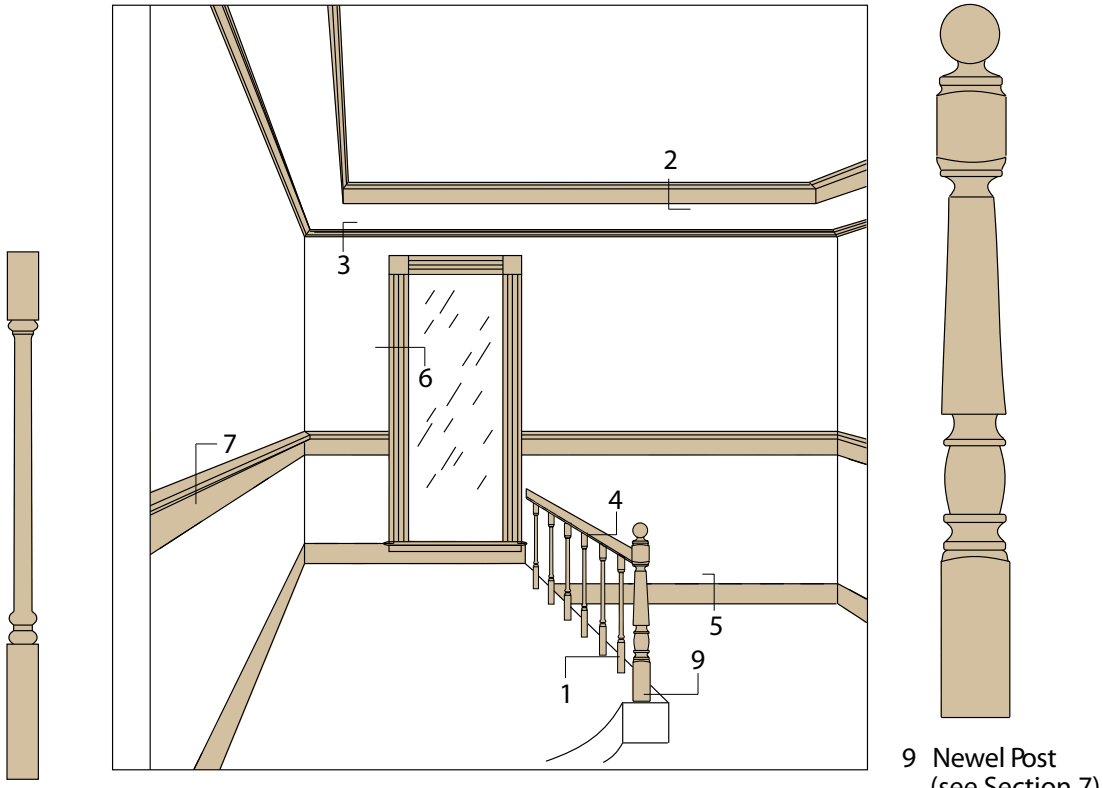
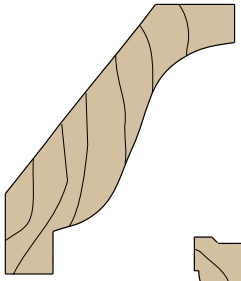
EXAMPLES OF STANDING and RUNNING TRIM and RAIL PARTS

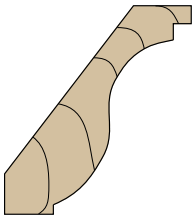


1 Spindle or Baluster (see Section 7)

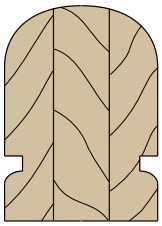
9 Newel Post (see Section 7)



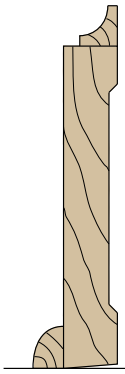
2 Crown Running Trim



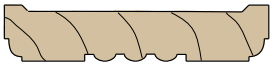
3 Crown Running Trim



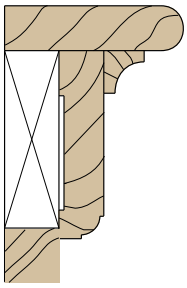
4 Handrail



5 Base Combination (Cove, board, shoe) Running Trim



6 Window Casing Standing Trim



7 Chair Rail Combination (Cap, cove & rail) Running Trim

Figure: RG-078

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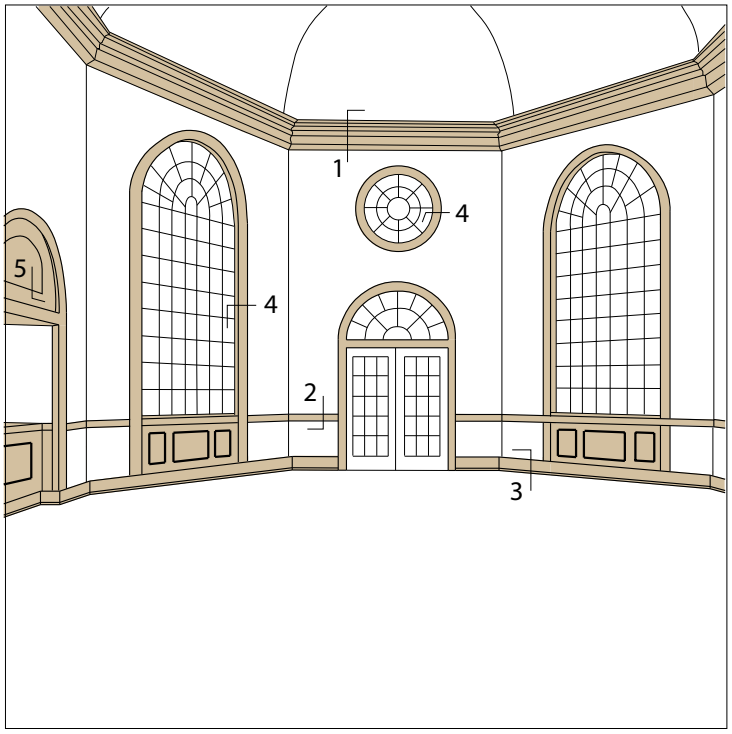
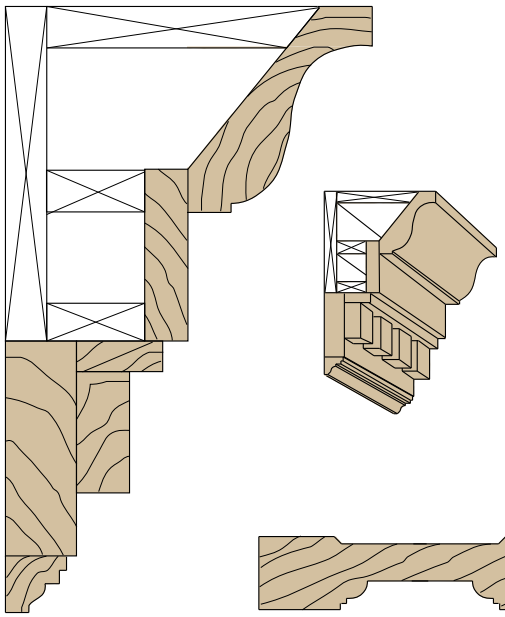
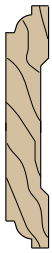
EXAMPLES OF STANDING and RUNNING TRIM





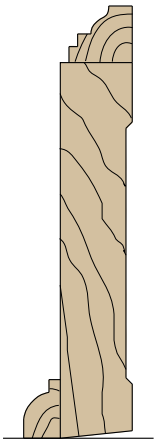
1 Cornice

4 Casing



2 Chair Rail

5 Panel Molding



3 3-piece Base

Figure: RG-079

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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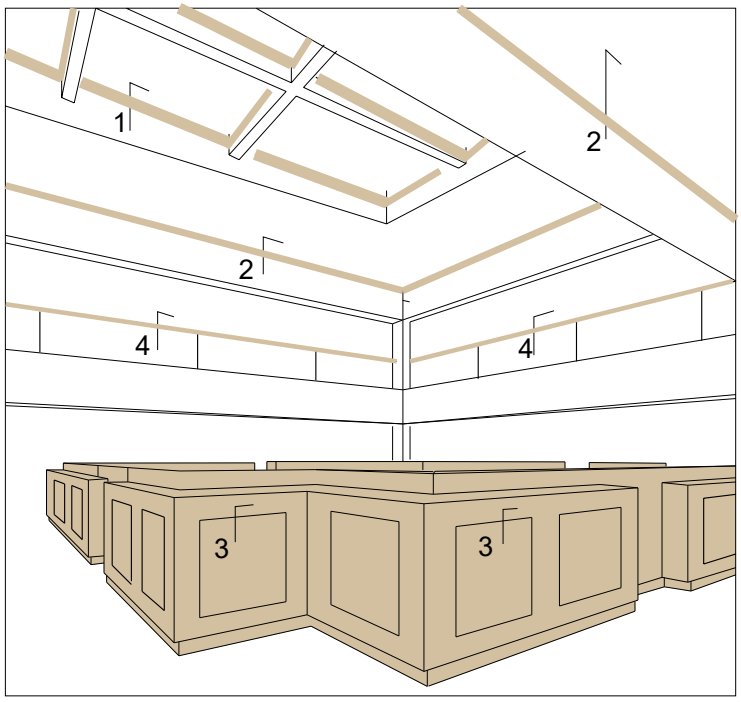
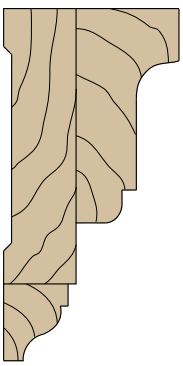
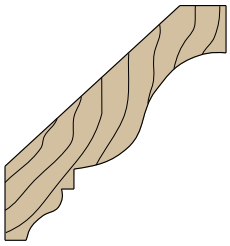
EXAMPLES OF STANDING and RUNNING TRIM and RAIL



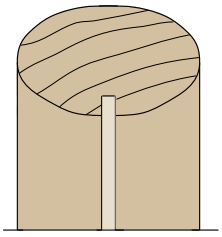


1 Skylight Cornice



2 Crown

3 Panel Molding



4 Handrail

Figure: RG-080

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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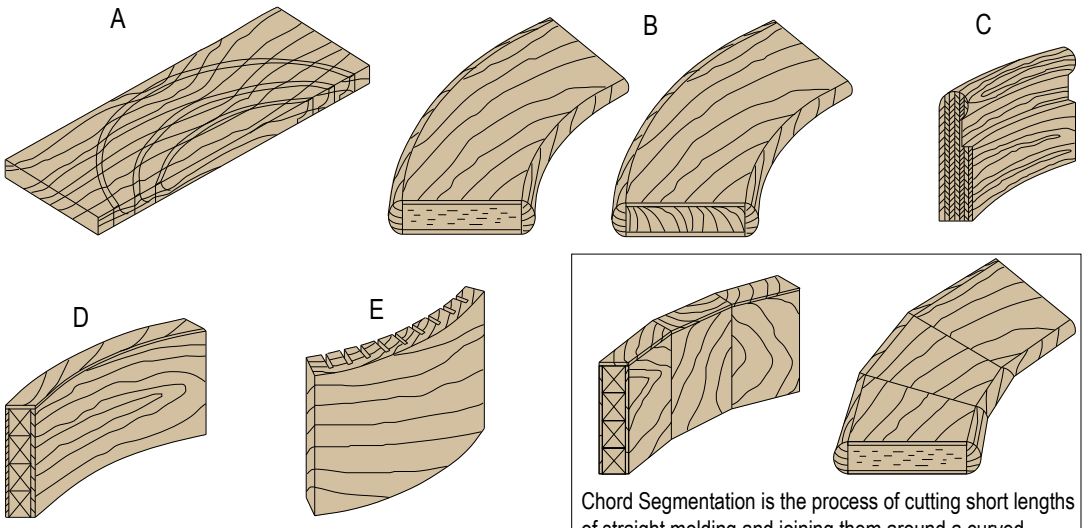
RADIUS MOLDINGS

Both traditional and nontraditional architectural styles often call for radius standing and running trim either in plan, elevation, or both. In situations where the size of the molding and the radius to which it is to be formed is such that a straight molding will not conform to the core, the architectural manufacturer can use several methods to fabricate radius moldings. Moldings applied to radii can be segmented, (typically only by direct specification) bent or steam bent, laminated and formed, pre-shaped, or machined to the radius. Manufacturers will fabricate the moldings in the longest practical lengths, with the purpose of minimizing the field joints:

- **Solid Machined** (Illustration A) woodwork typically starts with a large, often glued up piece of material, from which several nested pieces can be machined. Characteristically, this method limits the length of pieces that can be developed without a joint. It also yields a piece of material with the grain straight on the face, not following the curve. Profiles with a flat face can be machined from sheet products with an edgeband applied, yielding larger pieces with more consistent grain.
- **Core Veneered** (Illustration B) woodwork consists of core machined from lumber or panel product to which finish material is laminated as an exposed face. This technique is limited to certain profiles; however, it offers the ability to minimize glue joints and control grain directions.
- **Laminated Plies** (Illustration C) woodwork consists of thin, bendable plies of lumber in a form that will hold its shape without having to be secured to another surface. The curved piece can then be milled to the desired profile. The glue lines follow the edge grain and the curve, thus minimizing their visibility. The species of wood and the tightness of the radius determine the maximum thickness of each ply.
- **Block Laminated** (Illustration D) woodwork is made of solid machined pieces, glued up typically in a staggered fashion for width and length. When dealing with some cross sections, it can be advantageous to combine band sawing and laminating; however, it must be limited to certain profiles. It does, however, offer the ability to minimize glue joints, is used in radius jambs and often becomes the core for core veneered woodwork.
- **Kerfed** (Illustration E) woodwork consists of lumber with repeated saw cuts on the back face of the piece, perpendicular to the bend. The tightness of the radius determines the spacing and depth of the kerfs. Kerfing allows the piece to be bent to the required radius and then secured in place to hold the bend. Kerfing could result in “flats” on the face, which show in finishing. When dealing with a large radius, it is sometimes possible to stop the kerf prior to going through an exposed edge. In most cases, however, the kerf runs through, and the edge must be concealed.

Cross Grain in band sawn or laminated members and edges in veneer laminated members or where multiple layers are exposed by shaping may cause objectionable color variation when finished.

Unless specifically called out, the architectural manufacturer will have the option of which method to use for fabricating radius molding. Since the fabrication method determines the final appearance of the pieces, especially regarding the direction of grain and visibility of glue joints, the architect or designer may wish to specify the method. It is recommended that an architectural woodwork firm be consulted before making a selection. Mock-ups may be required to visualize the end product.



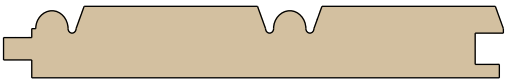
Chord Segmentation is the process of cutting short lengths of straight molding and joining them around a curved substrate and is NOT permitted unless specified.

Figure: RG-081

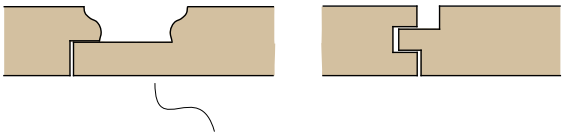
SOLID LUMBER PANELING PATTERNS

The variety of solid lumber paneling is only limited by the imagination of the design professional. Virtually any machinable profile can be custom manufactured. The following profiles are some of the traditional patterns associated with solid board paneling. They are not dimensioned intentionally, allowing the design professional to determine the scale and proportions most appropriate for the project.

Single Bead

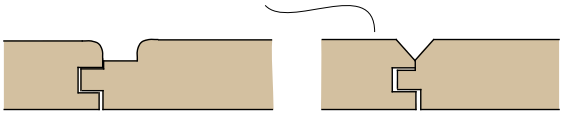


Beaded Ceiling or Wainscot



Reveal Detail Options

Pickwick Paneling

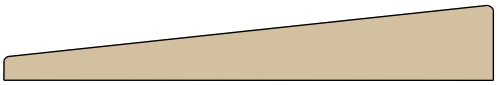


Tongue and Groove “V” Joint

Beaded Siding

Rough Sawn w/ Lap Reveal

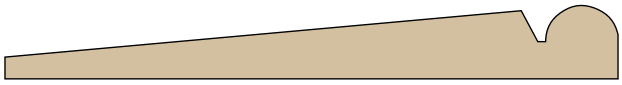
Simulated Lap Siding



Bevel Siding

Drop/Lap Siding

Molded Insert



Beaded Bevel Siding

Coved Paneling

Figure: RG-082

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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BUILT UP MOLDINGS FOR LARGER PROFILES

Used with permission of the Wood Molding and Millwork Producers Association:

- **Ceilings** are the most obvious area for "built up" moldings. This is primarily true of rooms with high ceilings. In low ceiling rooms (96" [2440 mm]), single molding profiles usually work best. A series of "built up" moldings would have a tendency to make a low ceiling appear even lower. But if your ceilings are high 120" (3048 mm) or higher, there is no limit to the rich three-dimensional elegance you can add to the room's appearance with the creative application of moldings. Below are several suggested combinations. Let your imagination create your own combinations and designs.
- **Chair Rails** are a very traditional method of breaking up walls, adding both interest and protection. They prevent the wall from being bumped or scuffed by chairs and can also be used to separate two types of decorating material such as paneling, wallpaper, and paint. Following are some variations of "built up" chair rail combinations.

EXAMPLES OF CEILING PROFILES

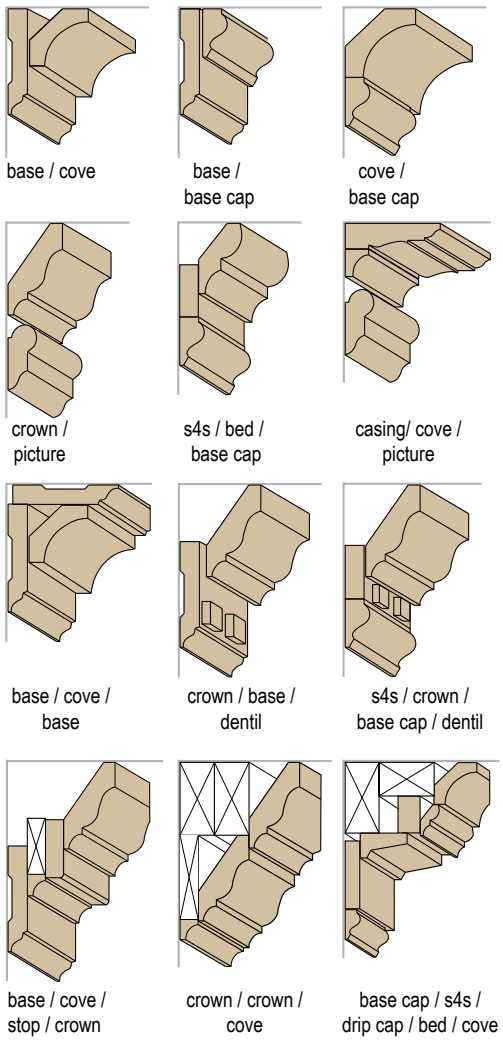

Figure: RG-083

EXAMPLES OF CHAIR RAIL PROFILES

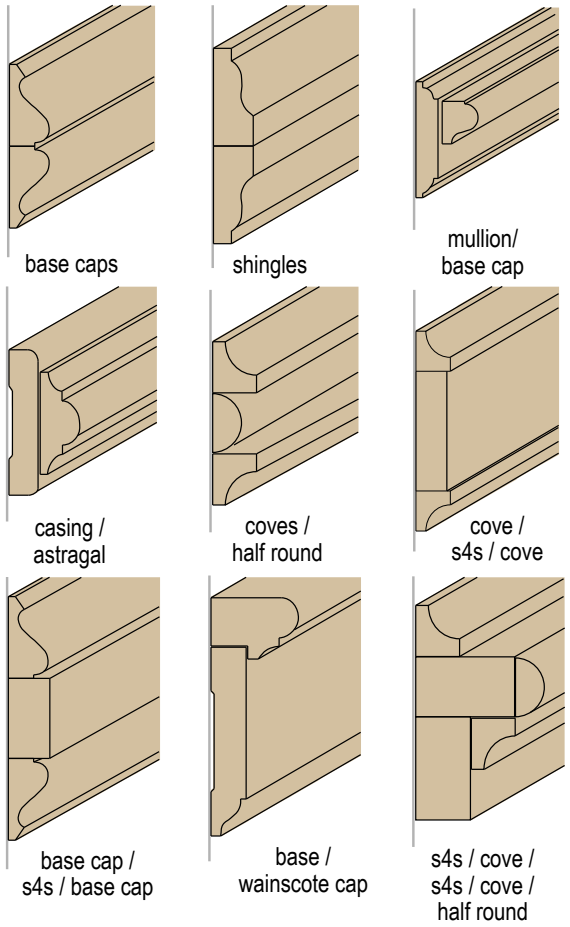

Figure: RG-084

BUILT UP MOLDINGS FOR LARGER PROFILES (continued)

- **Fireplaces** highlighted or framed with "built up" moldings is an excellent way to add depth and richness. Below are a few creative but simple to install profile combinations.

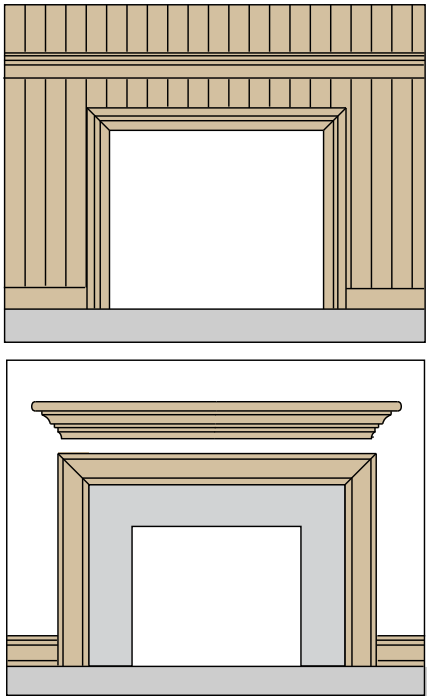

Figure: RG-085

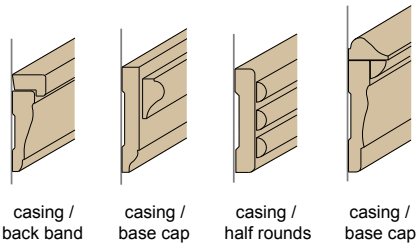

Figure: RG-086

- **Doors** and **Windows** are most commonly done with single molding profiles, but by adding other patterns, the basic trim can easily be transformed into a window or door casing of classical depth and beauty. Installing plinth blocks at the bottom of casing further enhances the traditional look.

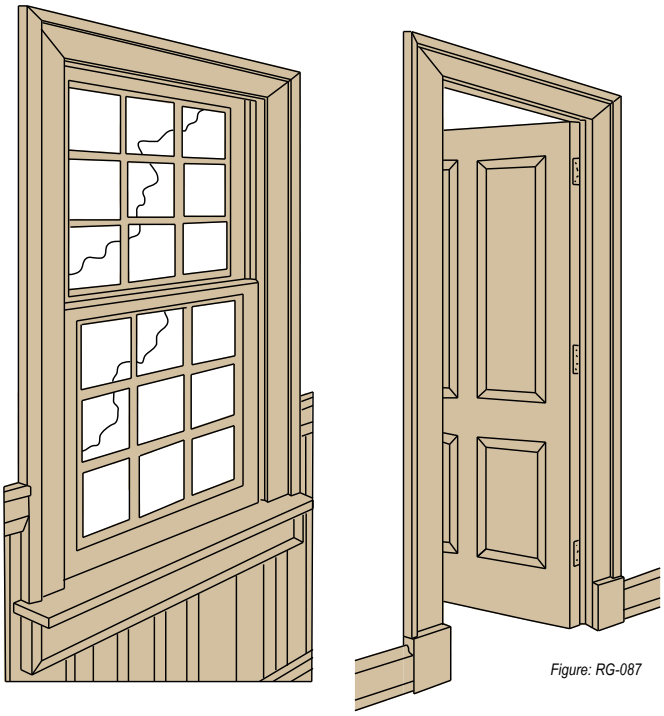

Figure: RG-087

- **Base** the elaborate look of elegance can even be carried through to base moldings where the wall meets the floor, as illustrated in the following variations.

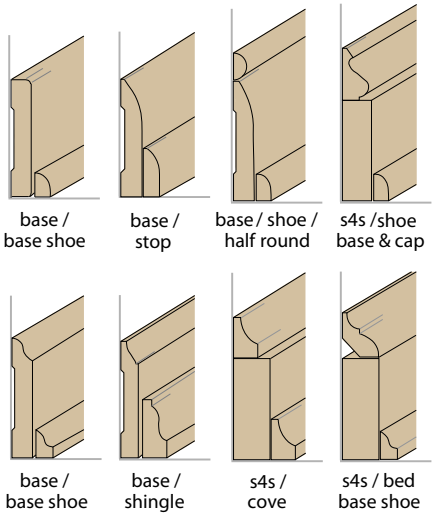

Figure: RG-088

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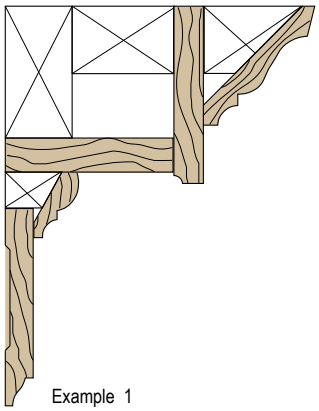
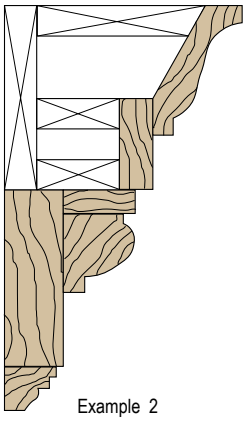
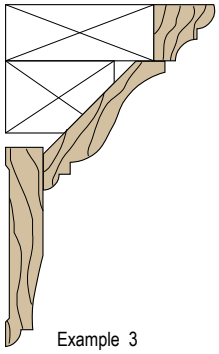
BUILT-UP CORNICE and WALL TRIM EXAMPLES



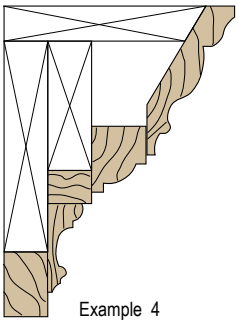
Example 1



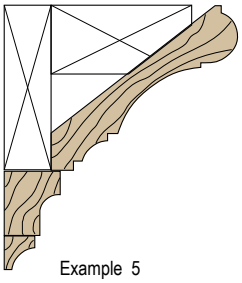
Example 2



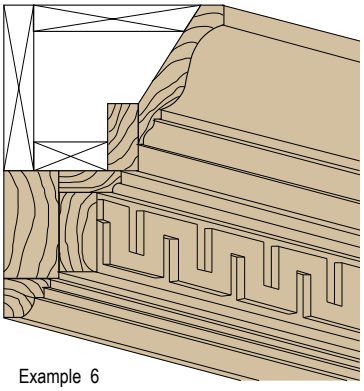
Example 3



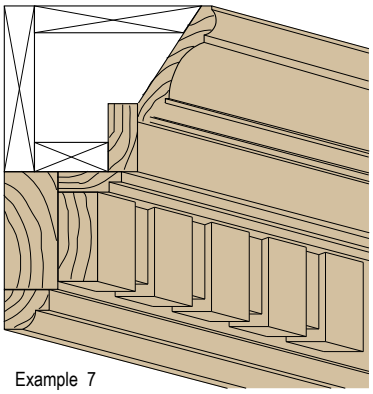
Example 4



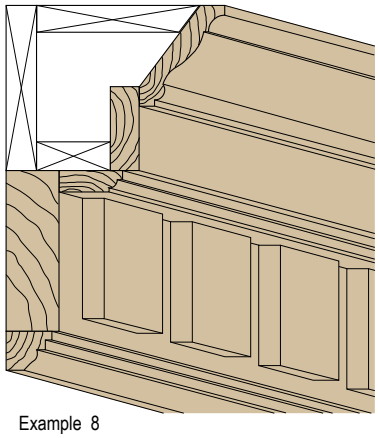
Example 5



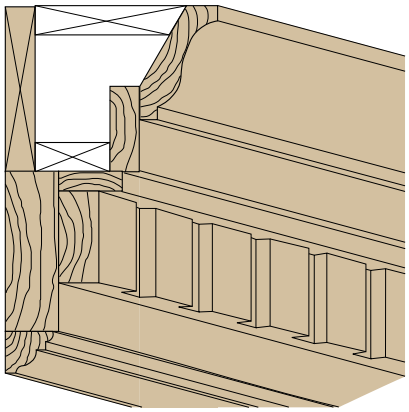
Example 6



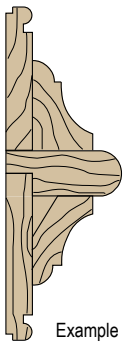
Example 7



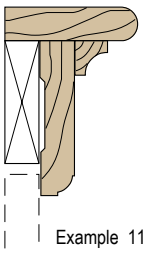
Example 8



Example 9



Example 10



Example 11

Figure: RG-089

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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DOOR FRAME and JAMB EXAMPLES

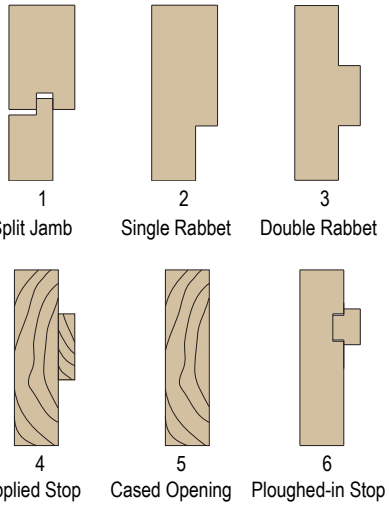

Figure: RG-090

FRAME JOINERY EXAMPLES:

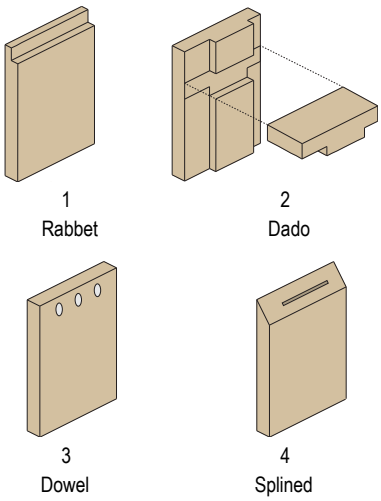

Figure: RG-091

LABELED (flame spread-rated) jamb assemblies are typically available in 20-, 45-, 60-, and 90-minute classifications of limited design / species; however, new designs / ratings are in ongoing development.

ONLY FIRMS RECOGNIZED BY APPLICABLE CODE OFFICIALS are authorized to label a frame assembly. If a label will be required by the applicable code officials, it is the obligation of the design professional to so specify, and the obligation of the manufacturer to assure a properly licensed assembly. These standards do not cover labeled frames.

WINDOW SASH and FRAME EXAMPLES

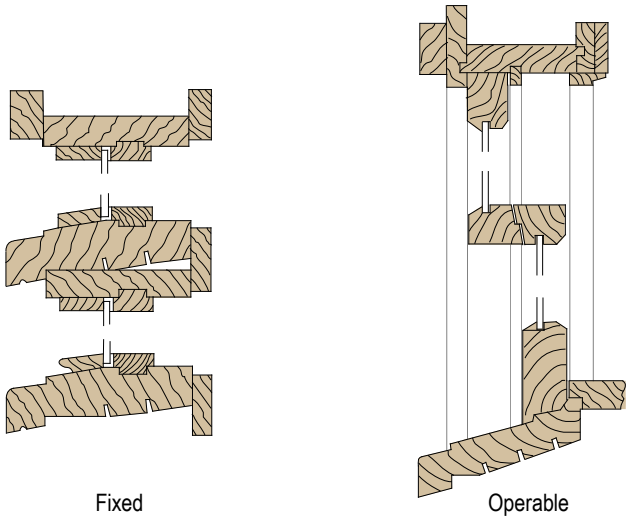

Figure: RG-092 *Figure: RG-093*

SASH JOINERY EXAMPLES

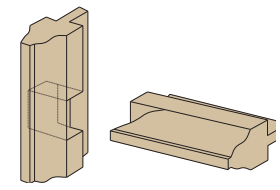

Figure: RG-094

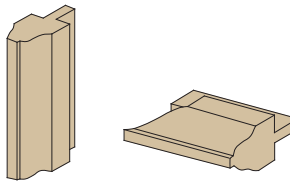

Figure: RG-095

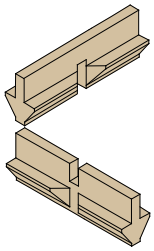

Figure: RG-096

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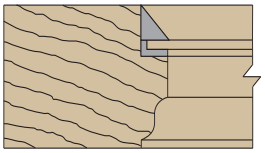
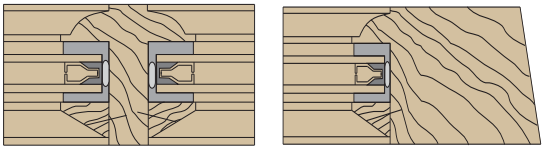
GLAZING EXAMPLES



Single Glaze

Figure: RG-097



Double Glazed

Figure: RG-098

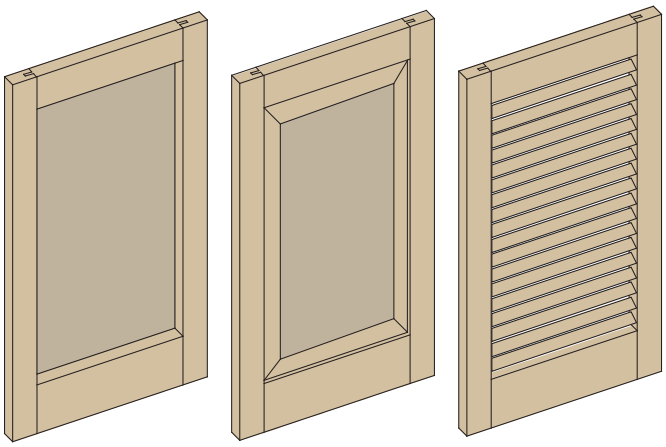
THERMAL INTEGRITY

Wood is a natural insulator that retains heat in winter without a thermal break, resists conductance of cold temperatures 2000 times better than aluminum and is approximately 30% more thermally efficient than comparable aluminum windows. Wood's minimal conduction keeps the inside wood surface of windows warm in the winter and cool in the summer. Wood windows are available in single-, double-, and triple-glazing systems, increasing thermal efficiency.

PERFORMANCE TESTING is applicable only to complete exterior window units and, if required, must be specified and may include all or part of ASTM E 283, Air Infiltration; E 330, Loading; and/or E 547, Water Penetration. ASTM tests must be specified for the current ASTM Grade Level, astm.org.

BLINDS and SHUTTERS

- **HARDWARE** must be specified, as it dictates the details of construction.
- **MANUFACTURER** does not typically supply, machine for, or install operating hardware, locking devices, pulls, lifts, etc.



Flat Panel | Raised Panel | Louvered

Figure: RG-099

SCREENS

- **HARDWARE** must be specified, as it dictates the details of construction.
- **MANUFACTURER** does not typically supply, machine for, or install operating hardware, locking devices, pulls, lifts, etc.

Typical bead detail examples:

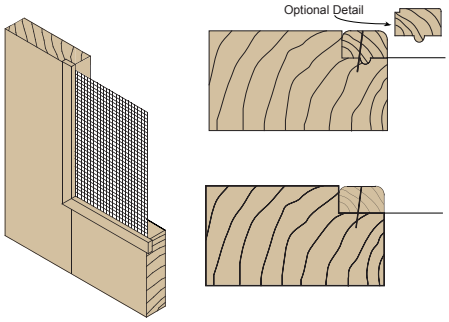


Figure: RG-100

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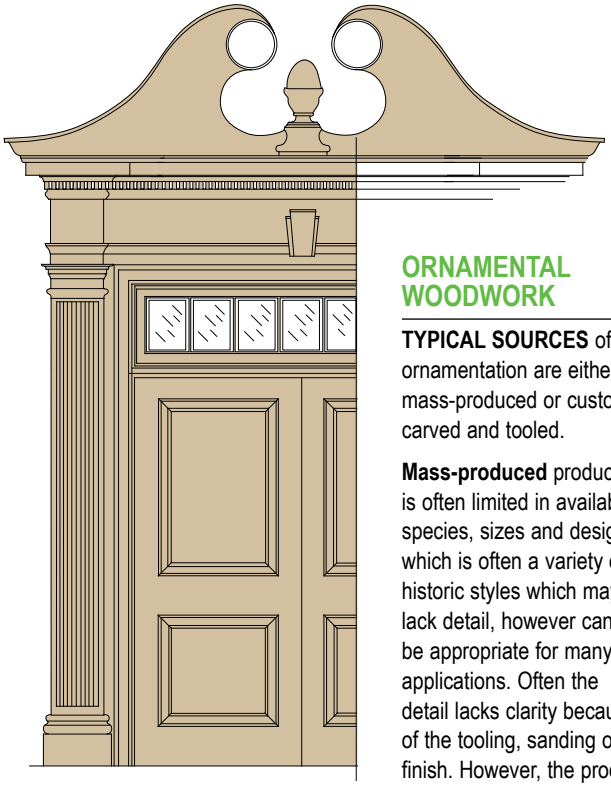

Figure: RG-101

ORNAMENTAL WOODWORK

TYPICAL SOURCES of wood ornamentation are either mass-produced or custom carved and tooled.

Mass-produced product is often limited in available species, sizes and design, which is often a variety of historic styles which may lack detail, however can be appropriate for many applications. Often the detail lacks clarity because of the tooling, sanding or finish. However, the product is relatively inexpensive, consistent in appearance and appropriate for many applications.

Custom carved or **Tooled** work has a special appearance, with depth and clarity or crispness that machine tooling often cannot achieve. Because it is done by a skilled artisan there will be slight irregularities, but this is deemed desirable as it lends character and credence to the work. Whether the surface is sanded smooth or the texture of tool marks is left, is one of the points of discussion between the architectural woodwork company and carver.

Hand tooled and carved work has a special appearance. It has a depth and clarity or crispness which machine tooling often cannot achieve.

There are a number of reasons to contact a custom carver, when:

- Pieces required are impractical or impossible to shape on conventional factory machinery. Examples are tapering profiles as in keystones, acute (interior) corners such as in Gothic tracery and compound curves as in stair handrails.
- Small quantities are specified which are impractical or too expensive to fabricate by computerized methods.
- There is a need to replicate missing (hand carved) elements for restoration or renovation.
- Elements of specified dimensions are required and unavailable otherwise.
- A particular wood species is required.
- Customized logos or lettering is desired.
- Patterns are required for casting in another material such as plaster, metal, or glass.
- Uniqueness is valued by the customer.

WORKING WITH AN ARTISAN - custom carvers usually works by themselves in a studio situation, but this does not necessarily indicate limitations either in quality, production time or fabrication capability. Work is typically done on a commission basis, so it is common to expect reasonable lead times. They will need to know (from the architectural woodwork specifier or customer):

- **Type of element** - molding, capital, bracket, etc.
- **Sizes** - drawings showing elevations and Sections are necessary for accurate cost estimates, whether provided by the architectural woodwork company or drawn by the carver. Often the carver will redraw computer-generated designs or ones not full sized.
- **Species** - of wood and who will supply the “blanks”. Finishes (paint grade, gilding, faux finish) should also be discussed.
- **Context** - and/or installed location should be made clear in order to understand lighting and the degree of detail necessary.
- **Schedule** - or completion date.
- **Budget** - if available as the carver can propose subtle changes in order to oblige a tight budget.

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ORNAMENTAL WOODWORK (continued)

A rudimentary explanation of some carving terms will assist the design professional in communicating with the custom carver:

Moldings have multiple uses but one important one is to visually set apart various elements. For instance, they are transitions between the parts of the entablature. They accentuate the trim (architrave) around doors and windows, and around an arch (archivolt). The various terms depend primarily on the profiles, but there are a few terms which indicate use, location or size.

The curving profiles are often separated or offset by a relatively small flat called a fillet.

The small half round is an astragal, often decorated with beads or bead and billet. A larger half round, usually associated with the base of a column or base of a structure is called a torus (plural tori) molding, sometimes decorated with ribbon bundled Bay Laurel, Oak leaves, or reeds.

The ovolo is a quarter ellipse (Greek) or quarter round (Roman) profile, most often carved with egg and dart design, but many other possibilities make it a very popular molding.

The cyma recta is a double curved molding with the concave curve on the outside of the molding, pointing toward the viewer as if reaching, outward. The cyma reversa is the opposite, the convexity nearer the viewer and seems to support or bolster the element to which it is attached. Both profiles are often carved with foliage, generically termed acanthus leaf. Both of these profiles as well as the ovolo often have the curved portion separated from the fillet by deep valleys or quirks.

Medieval moldings were often made of a number of closely placed profiles, often with deep hollows and repeated rounds.

Romanesque architecture continued many of the same principles of classical architecture, though much of the decoration; such as column capitals became more idiosyncratic and depicted the profusion of natural foliage. The innovation of the pointed arch (loosely called the Gothic arch), ubiquitous in Gothic architecture, allowed buildings to soar to great heights and to redistribute weight. This allowed larger windows and the lacy stonework termed tracery. The designs of this tracery are geometrically derived from, for the most part, overlapping and intersecting circles. The circular voids are called foils and the pointed intersections cusps; thus a three lobbed design is a trefoil, while one of four is a quatrefoil, one of five is a cinquefoil. Tracery was found incorporated into the woodwork of choir stalls, paneling and memorial structures.

Much decoration was derived from nature in depictions of vines and animals. Of course, religious figures and symbols were also a primary motif. Foliage climbing the edges of pinnacles and spires consists of the leaves, called crockets, and the terminating leaves, a finial or (especially on pew ends) poppyhead. Moldings were made of multiple profiles and combined with running vines and crestings, or stylized leaves. Square flowers and ballflowers were often spaced along moldings. At intersections of the ribbed vaults were bosses, which depict foliage (like a rosette), figures, or heraldic devises. The Glossary contains selected and partially illustrated terms related to ornament and architecture.

CARVER should provide skill and knowledge through experience. The majority of the cost may be in the labor. Carving is a unique product which adds immeasurably to the character and attractiveness of the overall project, and:

- Carving that closely resembles what is represented in drawings and verbal descriptions.
- Product that is cleanly carved without distracting irregularities and chips or fuzz in the recesses. The agreed upon surface treatment: sanded, tool textured, primed or gilded, etc. should be consistent throughout.
- Completion in a timely manner as agreed upon.
- Quality in artistic handwork which is often a subjective matter, but proper communication and agreement among parties should reduce variance of interpretation.

ARCHITECTURAL WOODWORKER should make reasonable efforts to provide as much information as possible as to design, and material. If providing blanks, effort should be made to fabricate them as accurately as possible. Material should be straight grained and contain a minimum of glue lines and therefore, grain directional changes. Consultation concerning what should be provided (sizes, species, special fabrication such as turning) with the carver is essential.

There are four methods of depicting a design in wood:

- **Incised**: Designs are simply made by shallow grooves in the surface of the material.
- **Relief**: Most architectural carving is carved in relief. The degree to which the design is lifted off the surface is described as low or high relief.
- **Pierced**: Some voids in the design are literally cut through the material and are termed pierced carvings.
- **Sculpture**: Carving in-the-round or sculptural works are incorporated into architectural surroundings.

ORNAMENTAL WOODWORK (continued)

Unless required by the details and/or woodwork specifications, the manufacturer does not typically:

- **Provide** or **Prepare for** electrical, telephone, mechanical, or plumbing equipment;
- **Install** woodwork or furnish common in wall blocking, furring or hanging devices for the support or attachment of the woodwork;
- **Supply** exposed materials other than wood or HPL;
- **Factory finish**; or
- **Supply** "stock" or specialty products. If they are to be supplied, they must be specified by a brand name or material supplier.

ORNAMENTAL WOODWORK can be considered any addition to the purely functional and may partly rely on context for its aesthetic appeal. Among various definitions, the one pertinent here is: "Something that lends grace or beauty; a manner or quality that adorns." Ornamentation is defined as a decorative device or embellishment. A good example is the molding which can have functional uses such as covering joints, or with a profile, can be a design element. The profile can be further embellished or enriched by decorative carving.

Architectural carving combines the flat surfaces and clearly defined lines of geometry with the interpretive modeling of naturalistic forms.

Historic preservation, conservation and restoration disciplines are extensions of ornamental woodwork. Aspects of this work include, but are not limited to, stripping, repair, reconstruction, reuse of historic material, addition of new material, and special documentation for the work.

The United States Department of the Interior (doi.gov/), the National Park Service (nps.gov/), and the Historic Sites and Monuments Board of Canada (parkscanada.gc.ca) publish documents related to work under their jurisdiction. The most recent publications from these entities will provide valuable information for the design professional and the woodwork fabrication, finishing, and installation.

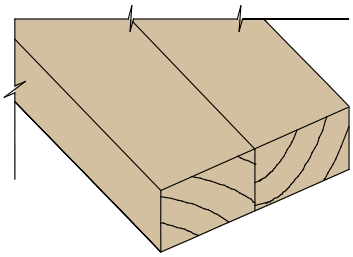
There are a number of related arts which are incorporated into wood constructions, such as stained glass, ceramic tiles, mosaic, fabric, plaster or composition ornament, faux finishes, metal hardware and stone inlays.

Excludes standing and running trim except as incorporated as integral parts of elements.

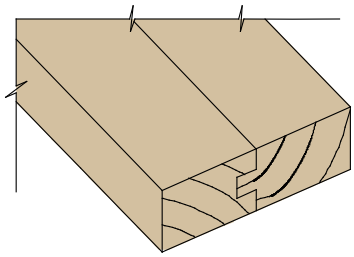
FIRE-RETARDANT SOLID LUMBER

Fire Retardant treatments may affect the finishes intended to be used on the wood, particularly if transparent finishes are planned. The compatibility of finishes should be tested before they are applied.

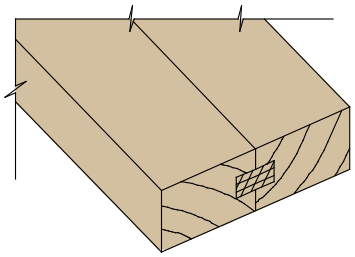
JOINERY DETAILS



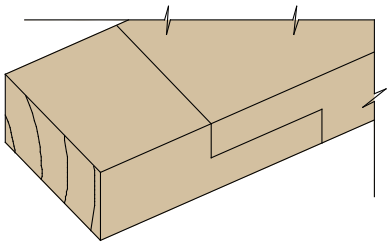
Butt Joint
Figure: RG-102



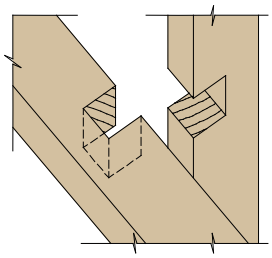
Tongue & Groove Joint
Figure: RG-103



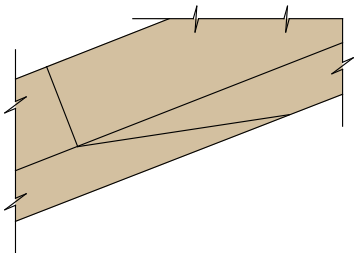
Spline Joint
Figure: RG-104



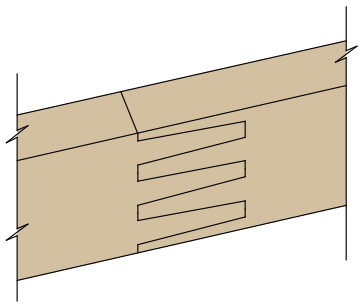
Half Lap Joint
Figure: RG-105



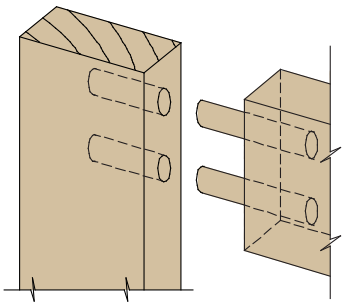
Half Lap Joint
Figure: RG-106



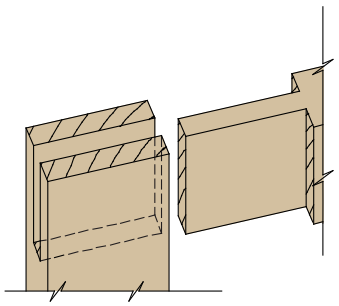
Scarf Joint
Figure: RG-107



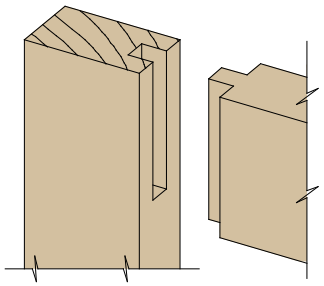
Finger Joint
Figure: RG-108



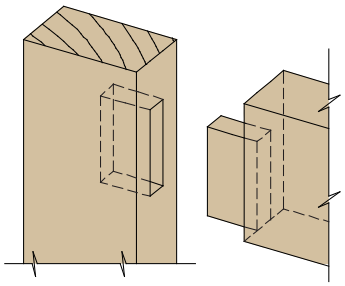
Doweled Joint
Figure: RG-109



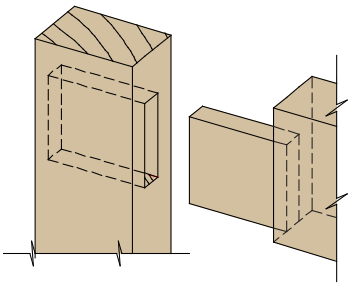
Slotted Mortise & Tenon (Bridle) Joint
Figure: RG-110



Stub Mortise & Tenon Joint
Figure: RG-111



Blind Mortise & Tenon Joint
Figure: RG-112



Through Mortise & Tenon Joint
Figure: RG-113

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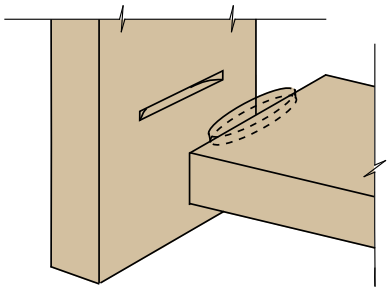
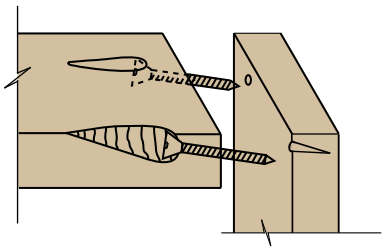
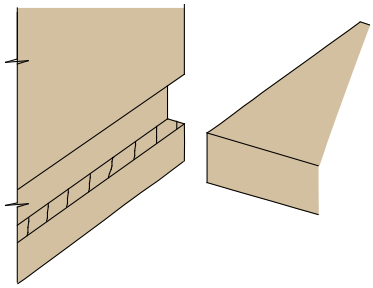
JOINERY DETAILS (continued)



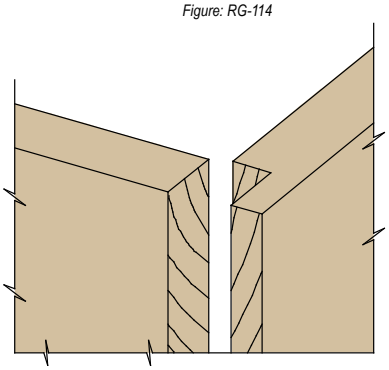
Biscuit Spline Joint
Figure: RG-114



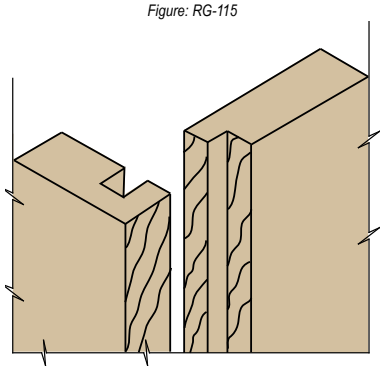
Pocket Screw Joint
Figure: RG-115



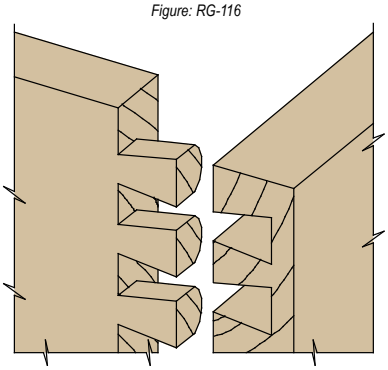
Plowed In Joint
Figure: RG-116



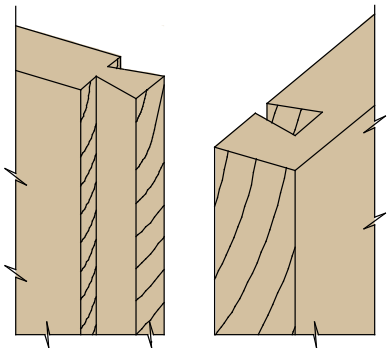
Rabbet Joint
Figure: RG-117



Lock Shoulder Joint
Figure: RG-118



Dovetail Joint
Figure: RG-119



Dovetail (French) Dado Joint
Figure: RG-120

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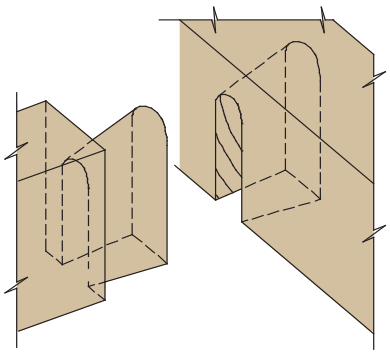
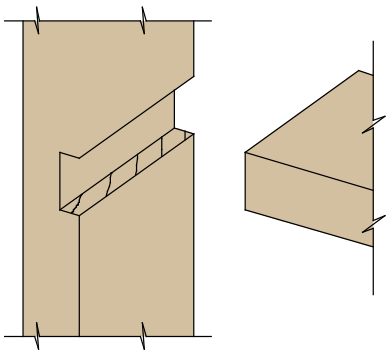
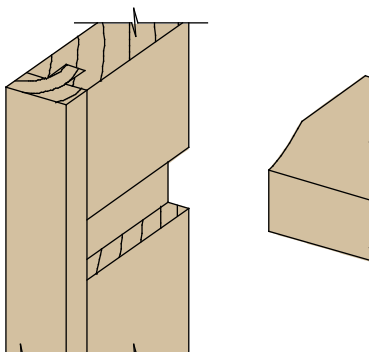


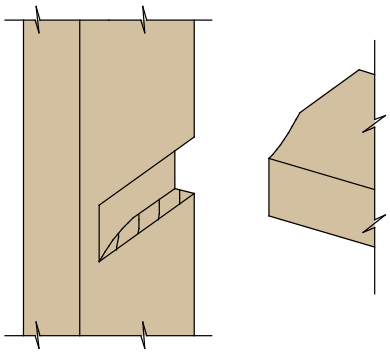
Blind Dovetail Joint
Figure: RG-121



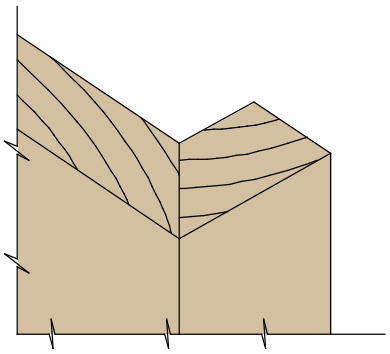
Dado Joint
Figure: RG-122



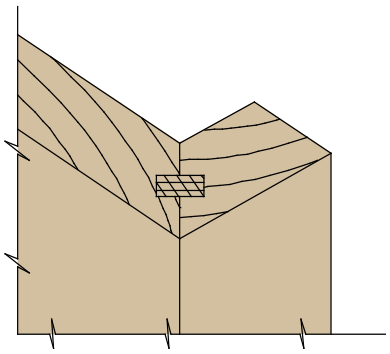
Dado, Blind Or Stopped Joint
Figure: RG-123



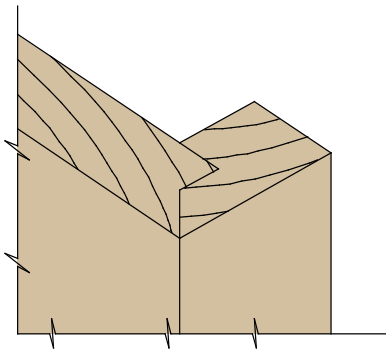
Dado, Blind Or Stopped Joint
Figure: RG-124



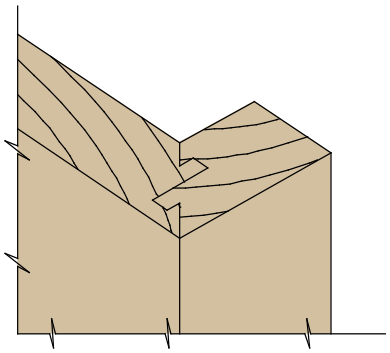
Miter Joint
Figure: RG-125



Splined Miter Joint
Figure: RG-1126



Shoulder Miter Joint
Figure: RG-127



Lock Miter Joint
Figure: RG-128

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INTRODUCTION

Section 07 includes information on wood stairs, integral trim, handrails, and guardrails and their related parts.

DESIGN SUMMARY

This short summary is a collection of options and illustrations about the challenges of designing and building safe stairs. This Standard cannot and does not offer this data as advice on code compliance. Safe stairs and design and engineering to meet local codes remains the responsibility of the design professional.

CRITICAL STEPS IN STAIR DESIGN:

- Check local code.
- Consult with an experienced stair builder to double check your geometry.
- Pre clear your stair design with the local building officials.

CUSTOM DESIGNED STAIRS OFFER:

- **Design flexibility:** The use of custom designed stairs in a building allows the design professional freedom of expression while meeting the functional needs of the client.

  Since custom woodwork is normally produced by a specialty architectural woodwork firm, dimensions can easily be changed prior to actual fabrication, if required by job conditions. Special situations such as designing for the disabled can readily be accommodated by the custom architectural woodwork manufacturer.
- **Cost effective:** Custom woodwork competes favorably with mass produced architectural woodwork and offers practically limitless variations of design and material. Most woodwork lasts the life of the building, quality counts.
- **No restrictions:** Custom architectural woodwork permits complete freedom of selection of the numerous hardwoods and softwoods available for transparent or opaque finish. Other unique materials available from woodwork manufacturers require no further finishing at all, such as HPL and TFL. These materials can be fashioned into a wide variety of profiles, sizes, and configurations. The design professional has the best of both worlds, high quality and freedom of choice.

RUN and RISE DIMENSION POINTS

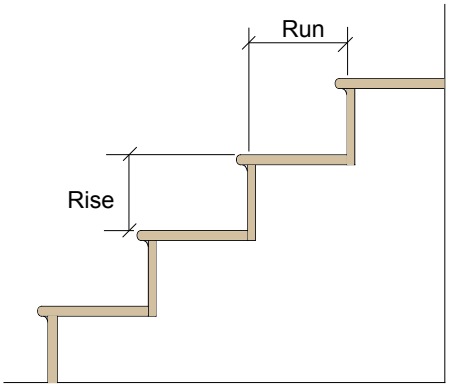

Figure: RG-129

TYPICAL STAIR RUNS

- **STRAIGHT**

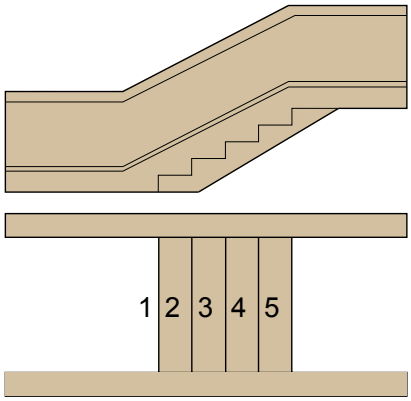

Figure: RG-130

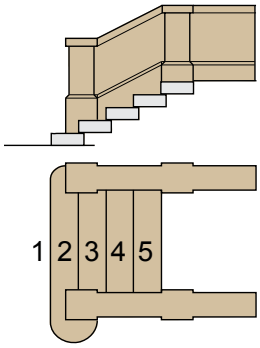

Figure: RG-131

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STAIRWORK & RAILS (continued)

TYPICAL STAIR RUNS (continued)

- **TURNING**

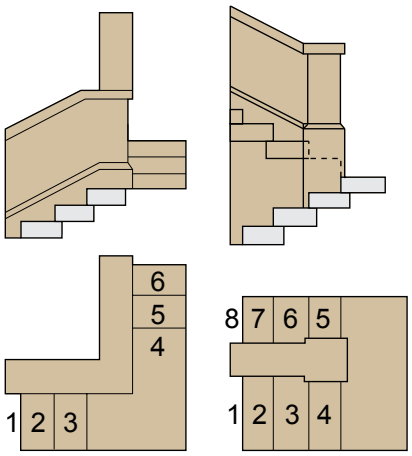

Figure: RG-132

- **WINDING**

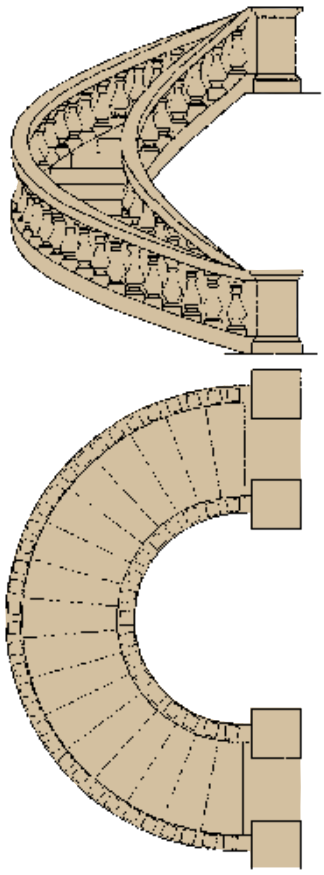

Figure: RG-133

STAIR and HANDRAIL / GUARDRAIL NOMENCLATURE

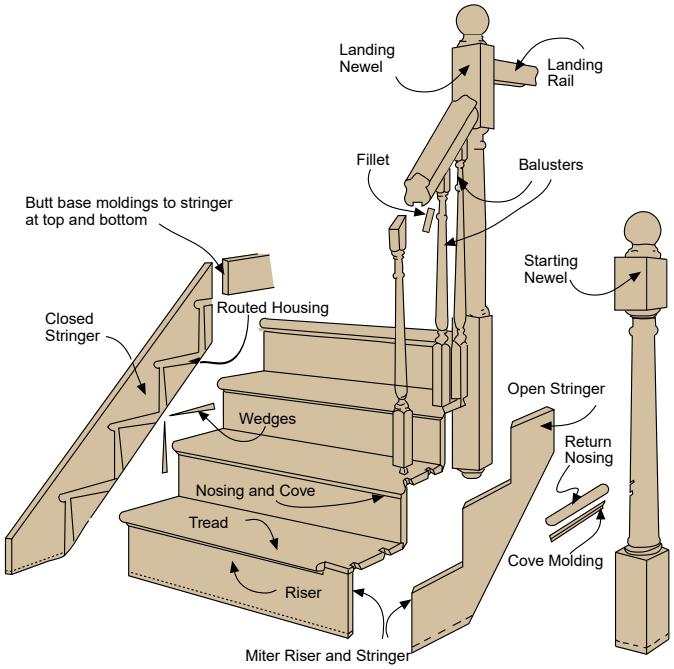

Figure: RG-134

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HANDRAIL / GUARDRAIL COMPONENT NOMENCLATURE

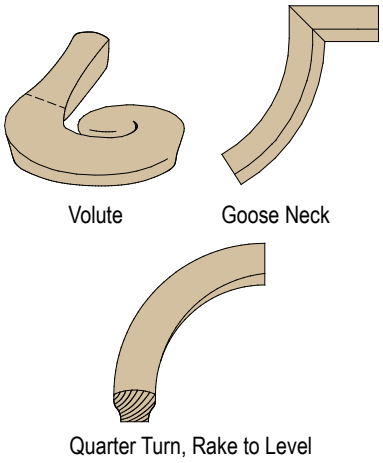

Figure: RG-135

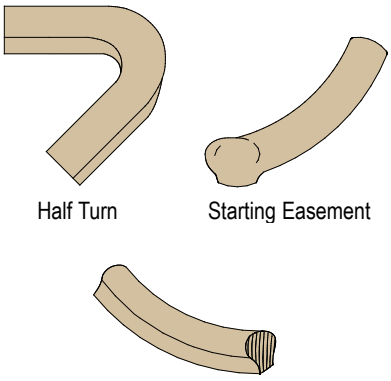

Figure: RG-136

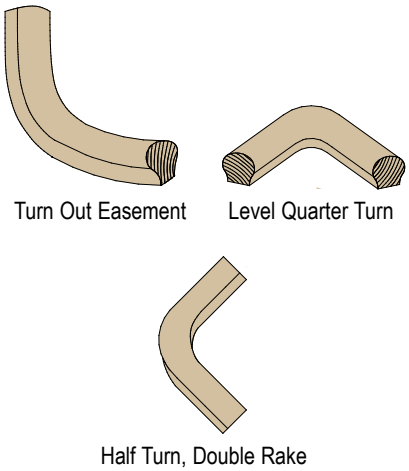

Figure: RG-137

HANDRAIL / GUARDRAIL FABRICATION

Large dimension rail fabrication techniques are typically the option of the manufacturer. Lamination on a radius depends on many factors:

Typical lamination orientations:

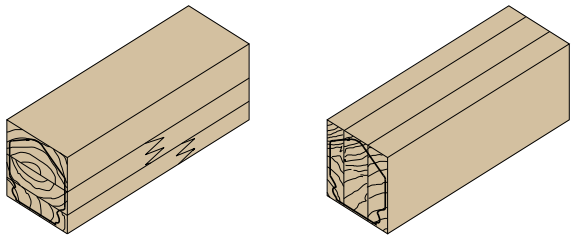

Figure: RG-138

HANDRAIL / GUARDRAIL JOINERY

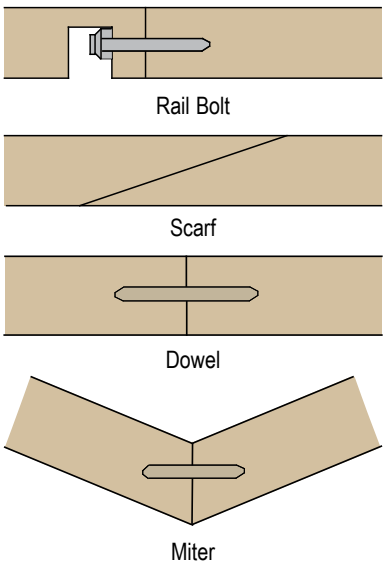

Figure: RG-139

GUARD / HANDRAIL ILLUSTRATIONS may not be compliant with current or applicable codes.

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WALL / CEILING SURFACING & PARTITIONS

INTRODUCTION

Section 8 includes information on wood veneer, solid wood, stile and rail wood, decorative laminate, Solid Surface, CGS (Compact Laminate) and factory-built framing for wall, ceiling and partition surfacing.

MATERIAL SELECTIONS

OPAQUE finishes:

- **Medium Density Fiberboard (MDF)** is suggested for cost savings and an optimum paintable surface.
- **Medium Density Overlay (MDO),** which may be machined and detailed with little loss of quality surface characteristics, requires a seal coat prior to application of finish coats with no sheen limitation providing a paintable surface for panels. The thermosetting resin overlay is designed to take and hold paint. Opaque finish sheens above 40 Satin require special finishing procedures.
- **Close Grain Hardwood** - Although allowed, extra preparation may be required by the finisher as there may be grain show-through, split veneer joints, and other wood characteristics.
- **Manufacturers' option** - Face materials are determined by the manufacturer.

TRANSPARENT finishes:

- **Selection** starts by looking at "hand samples," pieces of veneer or lumber representing a particular species, but not necessarily a particular tree or log.
- **Wood** is a natural material (unlike a manufactured product), which varies from tree to tree in its color and texture. Rather than simply choosing an appropriate wood for its color, consider the size and availability of the species.
- **Species** that grows in smaller diameter, with shorter logs, lends itself to furniture and smaller projects, whereas an abundant species that grows in large diameter lends itself more to larger public spaces. Many projects have run into difficulties because the species availability was not compatible with the project's needs.

SOLID SURFACING:

- Solid surface panel products are a durable, non-porous solution for wall surfacing offering impact and scuff resistance, ease of cleaning, and homogenous appearance. However, many solid surfaces offer random patterns and veining that mimic stone or other materials. In many cases, such materials cannot be pattern matched to the degree HPL or wood veneer can, and care must be exercised when specifying such products. Material Supplier's recommendations and documentation will govern over maximum sizes, joint and seam locations and sizes; allowable mismatch, and installation requirements.

VARIATIONS in NATURAL WOOD PRODUCTS

Wood is a natural material, with variations in color, texture, and figure. These variations are influenced by the natural growing process and are uncontrollable by the manufacturer. The color of wood within a tree varies between the "sapwood" (the outer layers of the tree which continue to transport sap), which is usually lighter in color than the "heartwood" (the inner layers in which the cells have become filled with natural deposits). Various species produce different grain patterns (figures), which influence the selection process. There will be variations of grain patterns within selected species. The architectural woodwork manufacturer cannot select solid lumber cuttings within a species by grain and color in the same manner in which veneers may be selected. Color, texture, and grain variations will occur in architectural woodworking.

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FLITCH SELECTION

The design professional may choose to see samples of veneer flitches to evaluate color and grain characteristics for other than pre-manufactured sets. This must be specified. Unless specified, layup is determined by the manufacturer.

When it is determined that the use of pre-manufactured panel sets is not adequate for the scope of the project, then selecting specific veneer flitches is an option to consider.

When sliced from a log, the individual pieces of veneer are referred to as leaves. These leaves are kept in order as they are sliced and then dried. As the leaves come out of the dryer, the log is literally reassembled. This sliced, dried and reassembled log or partial log is called a flitch. The flitch is given a number and the gross square footage of the flitch is tallied.

To select specific veneer flitches for a project:

- Determine the net square footage of face veneer required for the project. This should include paneling, casework, built-in furniture, and flush doors items when specifying a blueprint sequenced project.
- Multiply the net square footage times three (this is the average ratio. Some species require a higher multiplier).

  Example: 5,000 (net square feet) x 3 = 15,000 square feet; this is the gross square footage that should be sampled for this project.

  While this may sound like a daunting quantity of veneer to look through, there is an established process that simplifies the task. When a numbered flitch is sampled, typically, three leaves of veneer are removed from the flitch and numbered sequentially. Starting from the top of the flitch, a leaf is removed from one-quarter of the way down, then from one-half, and from three quarters in the flitch. These three sequentially numbered leaves of veneer form a representative sample of that flitch.
- Since it will take at least 6 flitches, with a gross square footage of 2,500 square feet each to meet the project needs, give careful consideration to the following key criteria:
  - **Length** - Is the length adequate for the requirements? The flitch needs to be at least 6" (152 mm) longer than the panel requirements.
  - **Width** - What will the net yield for width be from each flitch?
  - **Gross square footage of each flitch** - total yield must be 15,000 square feet.
  - **Color and grain compatibility** - While exact matching is not possible, from flitch to flitch, this is the opportunity to select the range of color and grain compatibility that will enhance the visual continuity of the entire project.

    The reality of this process is that the square footage of individual flitches of veneer will probably range from 1,200 square feet up to 3,000 square feet. This means that one may end up selecting 9 or 10 flitches, instead of just 6. But the goal remains the same as in the example: selecting flitches that will satisfy the aesthetic needs, while fulfilling the face veneer requirements for the project.

    It is recommended that specifications be written with the foregoing objective in mind. Then, when the project has been awarded to a qualified manufacturer, talk directly to the manufacturer and be involved in one of the most exciting aspects of bringing the design concepts to reality.

FINISHING

Site conditions and air quality regulations for finishing are rarely conducive to good results. Poor lighting, dust-laden air, and techniques available are limiting factors. Depending upon local practice, many manufacturers will factory finish, yielding better results than can be achieved from field finishing. Unless specified in the Contract Documents, the manufacturer is not responsible for the appearance of field finished panels or doors.

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STANDING and RUNNING TRIM

Site-applied cornice, chair rail, base, trim, and moldings are governed by the areas of NAAWS covering Standing and Running Trim.

SMOOTHNESS of FLAT and MOLDED SURFACES

- **Planers and Molders:** The smoothness of surfaces that have been machine planed or molded is determined by the closeness of the knife cuts. The closer the cuts to each other (i.e., the more knife cuts per inch [KCPI]), the closer the ridges, and therefore the smoother the resulting appearance.
- **Sanding and Abrasives:** Surfaces can be further smoothed by sanding. Sandpapers come in grits from coarse to fine and are assigned ascending grit numbers. The coarser the grit, the faster the stock removal. The surface will show the striations caused by the grit. Sanding with finer grit papers will produce smoother surfaces.

FIRE RETARDANCE and TREATMENT

The natural fire-retardant qualities and acceptability of treatments vary among the species. Where certain items of architectural woodwork are required to have a flame spread classification to meet applicable building and safety codes, the choice of lumber species must be a consideration. Additional data on various species may be available from U.S. Department of Agriculture Forest Service, usda.gov, Fire Safety of Wood Products Work Unit at (608) 231-9265.

- **Flame Spread Classification:** This is the generally accepted measurement for flame spread rating of materials. It compares the rate of flame spread on a particular species with the rate of flame spread on untreated Oak. Most authorities accept the following classes for flame spread:
  - Class A 0-25
  - Class B 26-75
  - Class C 76-200
- **Fire Retardant Treatments:** Some species may be treated with chemicals to reduce flammability and retard the spread of flame over the surface. This usually involves impregnating the wood, under pressure, with salts suspended in a liquid. The treated wood must be re-dried prior to fabrication. Consult with a material supplier about the appearance and availability of treated woods prior to specification.

  The sizes and species currently being treated (flame spread less than 25), are very limited, and not available in all markets. Fire-retardant treatment does affect the color and finishing characteristics of the wood.

  Subject to the authority having jurisdiction, untreated wood and wood products may be used. The location and quantity to be determined by the design professional.
- **Intumescent Coatings for Wood:** It is possible to reduce flammability by using intumescent coatings in either opaque or transparent finishes. These are formulated to expand or foam when exposed to high heat and create an insulating effect that reduces the speed of spread of flame. Improvements are continually being made on these coatings. Consequently, the specifier must ascertain whether they will be permitted under the code governing the project, the relative durability of the finish, and the effect of the coating on the desired color of the finished product.
- **Finishing Of Fire Retardant Treated Lumber:** Fire-retardant treatments may affect the finishes intended to be used on the wood, particularly if transparent finishes are planned. The compatibility of finishes should be tested before they are applied.

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FIRE RETARDANT PANEL PRODUCTS

- **Core** - The flame spread rating of the core material determines the rating of the assembled panel. Fire-retardant veneered panels must have a fire-retardant core. Particleboard core is available with a Class A rating. Veneer core and MDF (Medium Density Fiberboard) cores are available with a flame spread rating in some markets.
- **Face** - The International Codes, except where locally amended, provide that facing materials less than 0.036" (0.9 mm) or thinner and applied directly to the surface of the walls or ceilings are not required to be tested.

  If a Class A panel assembly is specified with a decorative laminate face, the decorative laminate and the laminate balancing sheet must be applied to a Class A core material, with the laminate material supplier's recommended adhesive. It is the responsibility of the specifier to indicate what flame spread rating, if any, is required for the paneling. In the absence of such a specified rating, the manufacturer shall supply un-rated paneling.

INSTALLATION

The methods and skill involved in the installation of paneling and doors in large measure determine the final appearance of the project. The design, detailing, and fabrication should be directed toward achieving installation with a minimum of exposed face fastening. The use of interlocking wood cleats or metal hanging clips combined with accurate furring and shimming will accomplish this. Such hanging of panels has the additional advantage of permitting panel movement that results from humidity changes or building movement. Depending upon local practice, many manufacturers will perform the wall preparation and installation of the paneling and related doors.

PANEL SEQUENCING

- **Running Match** (cannot be end matched) - Each panel face is assembled from as many veneer leaves as necessary. This often results in a non-symmetrical appearance, with some veneer leaves of unequal width. Often the most economical method at the expense of aesthetics.

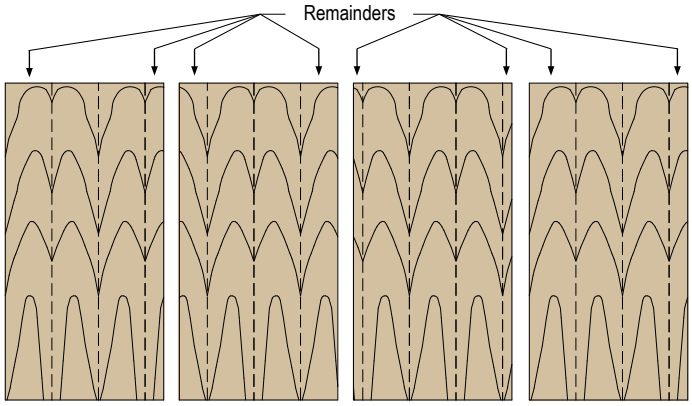
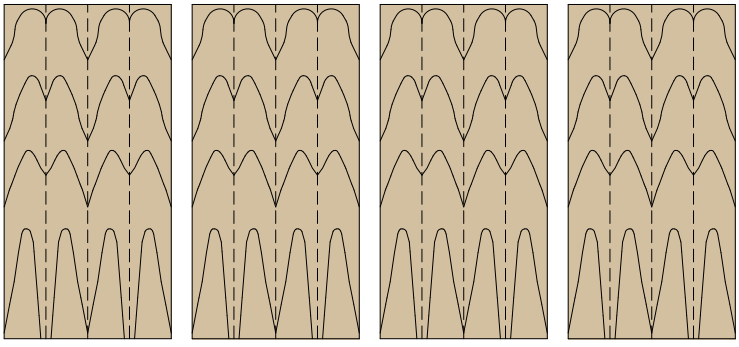


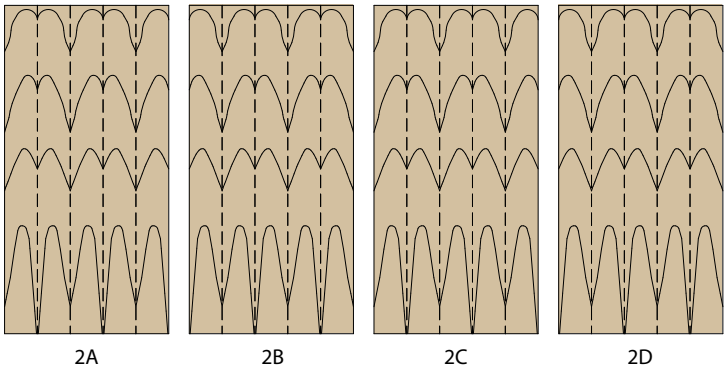
Figure: RG-140

- **Balance Match** - Each panel face is assembled from veneer leaves of uniform width before edge trimming. Panels may contain an even (balance and center) or odd (balanced) number of leaves and may change from panel to panel within a sequenced set.



Balance and Center Matched

Figure: RG-141



Balance Matched

Figure: RG-142

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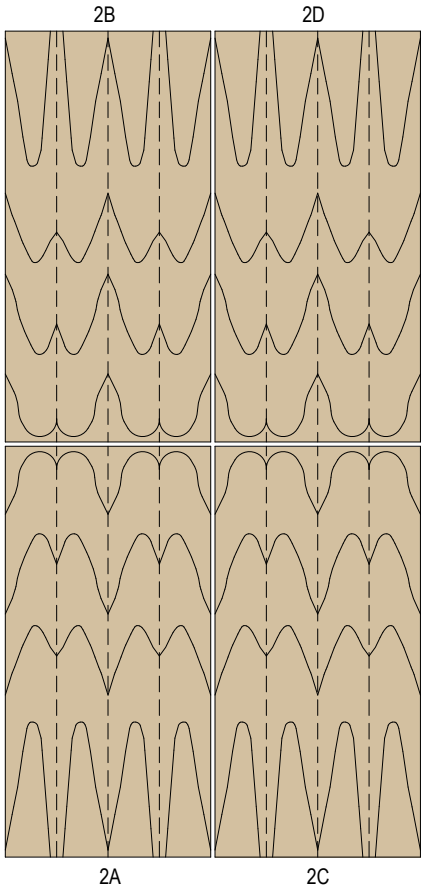
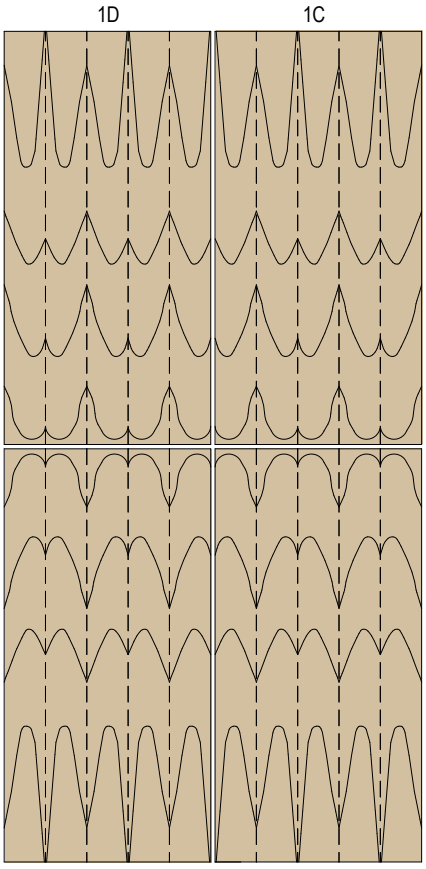
SEQUENCING of PANELS WITHIN A ROOM

- **Balanced End Match**



Balance and Center Matched,
Requires Multiple of 2

Figure: RG-143



Balance Matched,
Requires Multiple of 4

Figure: RG-144

SEQUENCING of PANELS WITHIN A ROOM:

Selections include: no sequence, pre-manufactured sets - full width, pre-manufactured sets - selectively reduced in width (equally sized), sequenced uniform size set(s), or blueprint sequenced panels and components. Although many panel distributors maintain a panel inventory of pre-manufactured sets of different species and grades, only a limited quantity of species, cut and grades will be available.

Sequenced custom sized and blueprint sequenced panels offer variables of veneer leaf match and panel width, therefore pre-manufactured sets shall not be used for sequenced custom sized and blueprint sequenced panels.

Sequenced panels and examples of their room layout are as follows:

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SEQUENCING of PANELS WITHIN A ROOM (continued)

- **PRE-MANUFACTURED SEQUENCED SETS**

Full width utilization is composed of a specific quantity of sequenced and numbered panels based on a per room basis for net footage selected from available inventory. They are usually only available in 48" x 96" or 120" (1220 mm x 2440 mm or 3048 mm) sheets in sets varying from 06-12 panels. If more than one set is required, sequencing between sets cannot be expected. Similarly, doors or components cannot be fabricated from the same set.

- **FULL WIDTH PANEL UTILIZATION** with running matched panels.

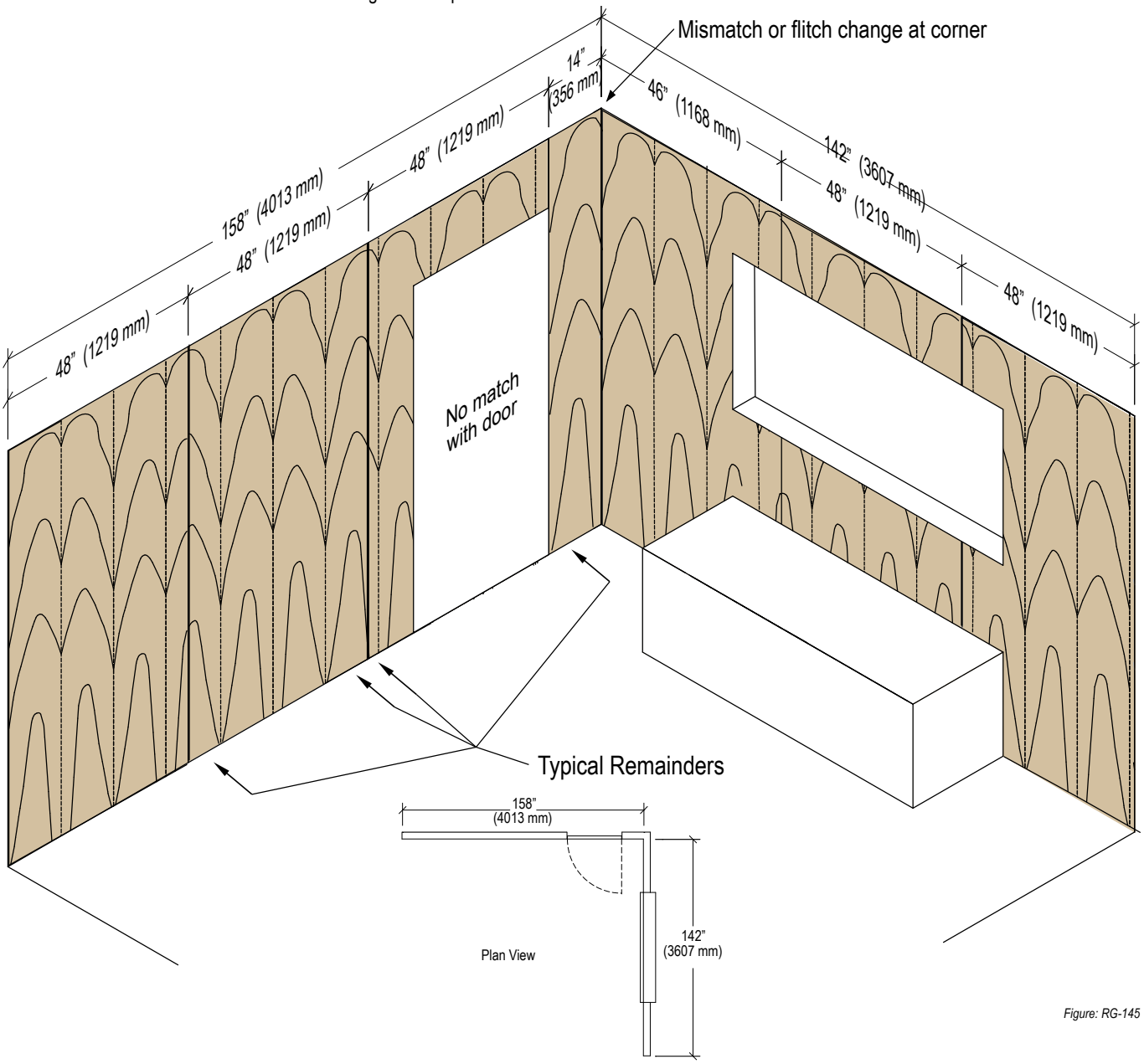

Figure: RG-145

WALL / CEILING SURFACING & PARTITIONS (continued)

SEQUENCING of PANELS WITHIN A ROOM (continued)

- **PRE-MANUFACTURED SEQUENCED SETS** (continued)
  - **FULL WIDTH PANEL UTILIZATION** with balanced matched panels.

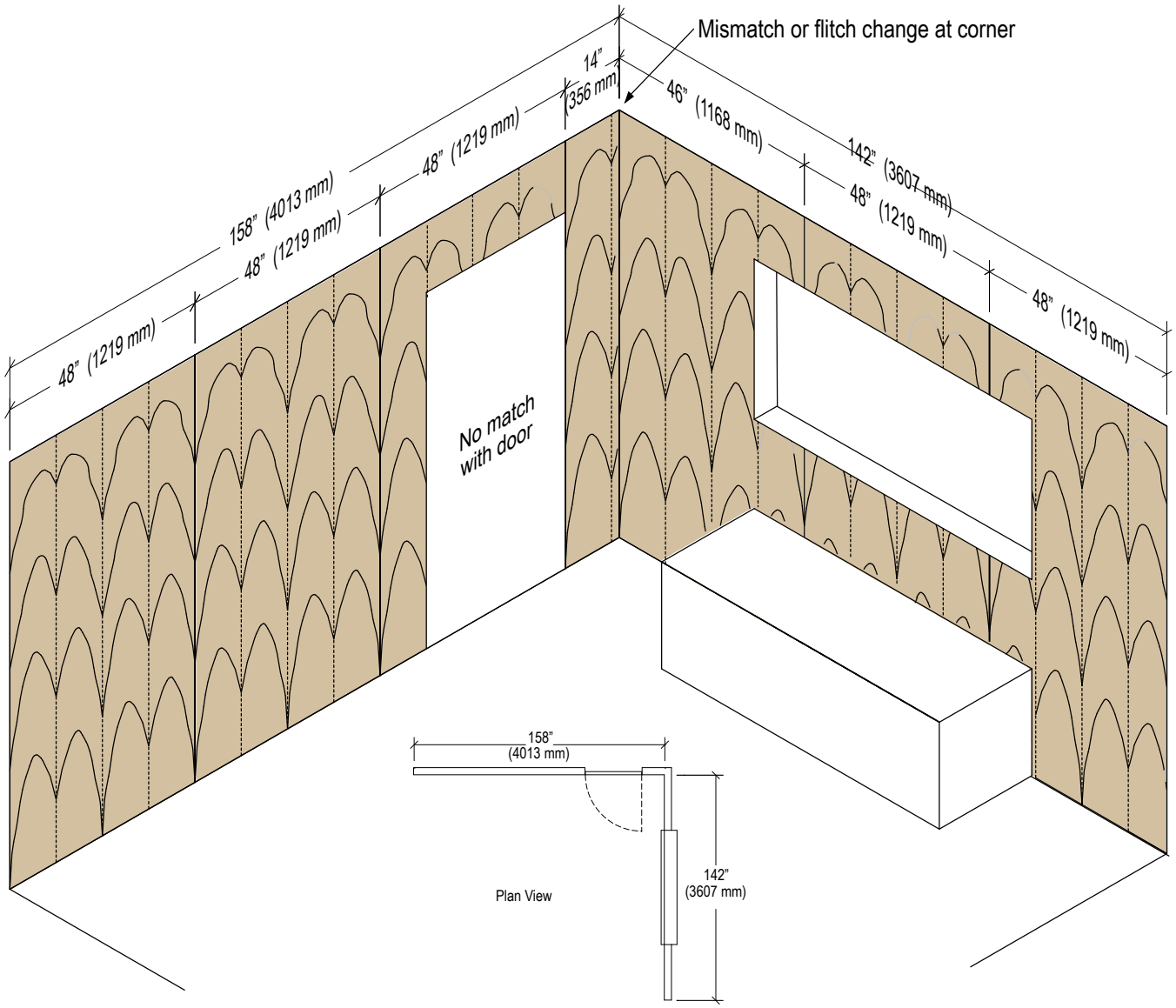

Figure: RG-146

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SEQUENCING of PANELS WITHIN A ROOM (continued)

- **PRE-MANUFACTURED SEQUENCED SETS** (continued)
  - **SELECTIVELY REDUCED PANEL UTILIZATION** with balanced matched panels.

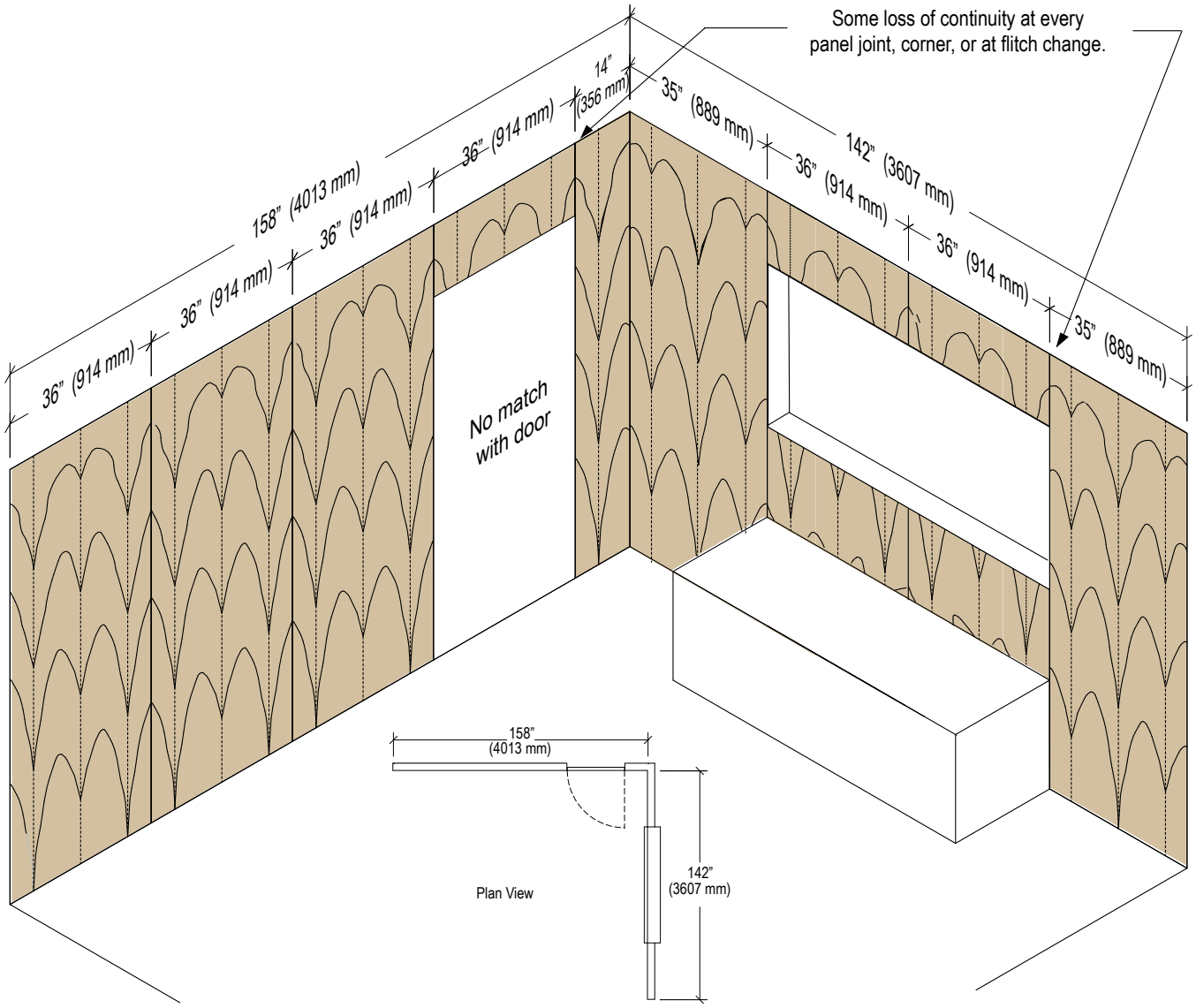

Figure: RG-147

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SEQUENCING of PANELS WITHIN A ROOM (continued)

- **MADE TO ORDER SEQUENCED SETS** (must be specified). Balance matched or balance and center matched panels are manufactured to exact sizes based on the project's net footage and height requirements.

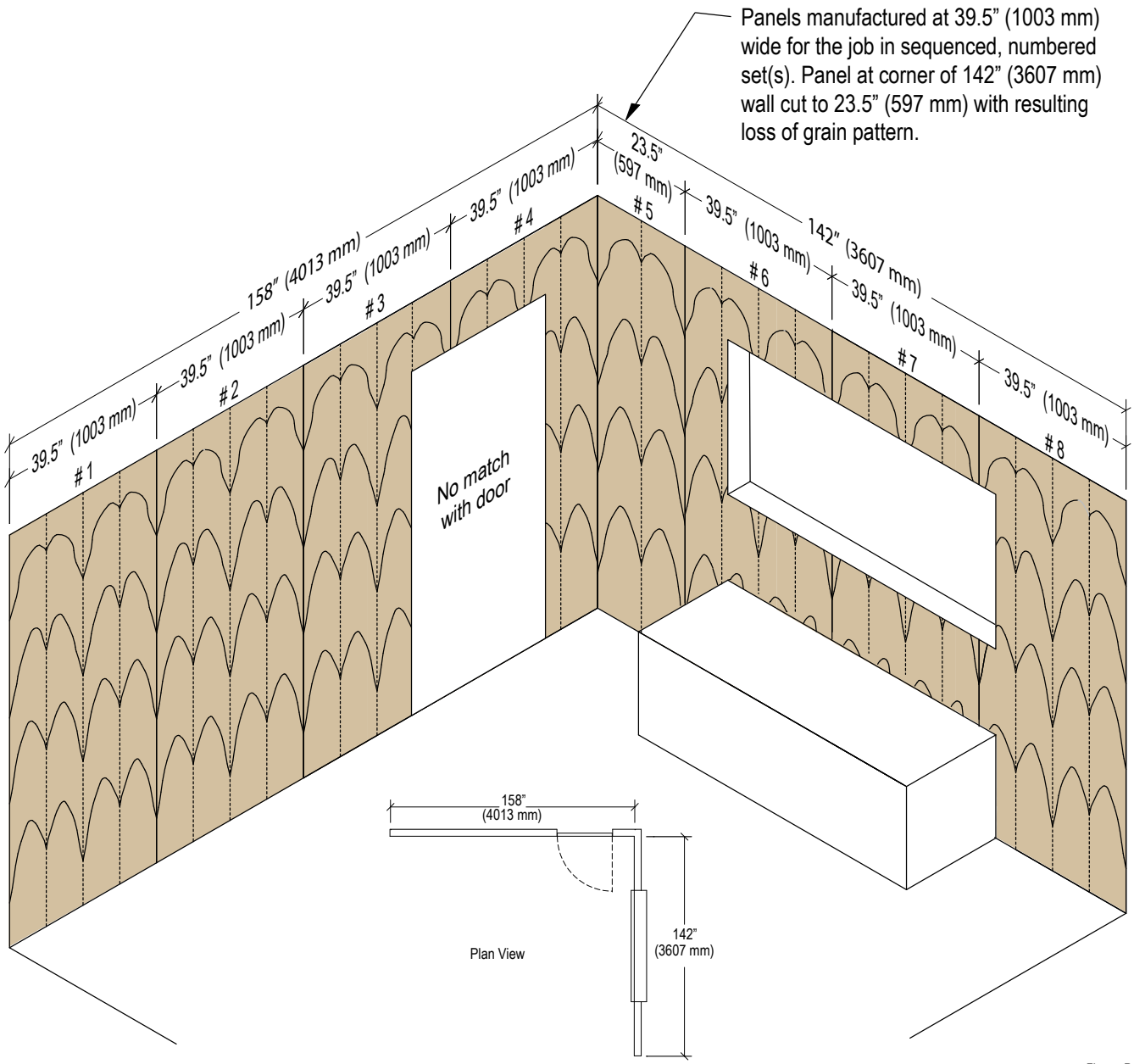

Figure: RG-148

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WALL / CEILING SURFACING & PARTITIONS (continued)

SEQUENCING of PANELS WITHIN A ROOM (continued)

- **MADE TO ORDER SEQUENCED BLUEPRINT SETS** and **COMPONENTS** (must be specified). Balance matched and balance and center matched panels are manufactured to the exact sizes the manufacturer determines from the contract drawings, clipping and matching each individual face to the project's specific needs. Each face will be in sequence with adjacent panels, doors, transoms, and cabinet faces as needed for continuity.
- Components such as doors, windows, openings and cabinets plus overall room dimensions are the variables that determine panel width. Either balance and/or balance and center matched panels may be used in conjunction with one another to achieve a blueprint sequence. Therefore, grain continuity is maximized, which enhances the overall aesthetics.

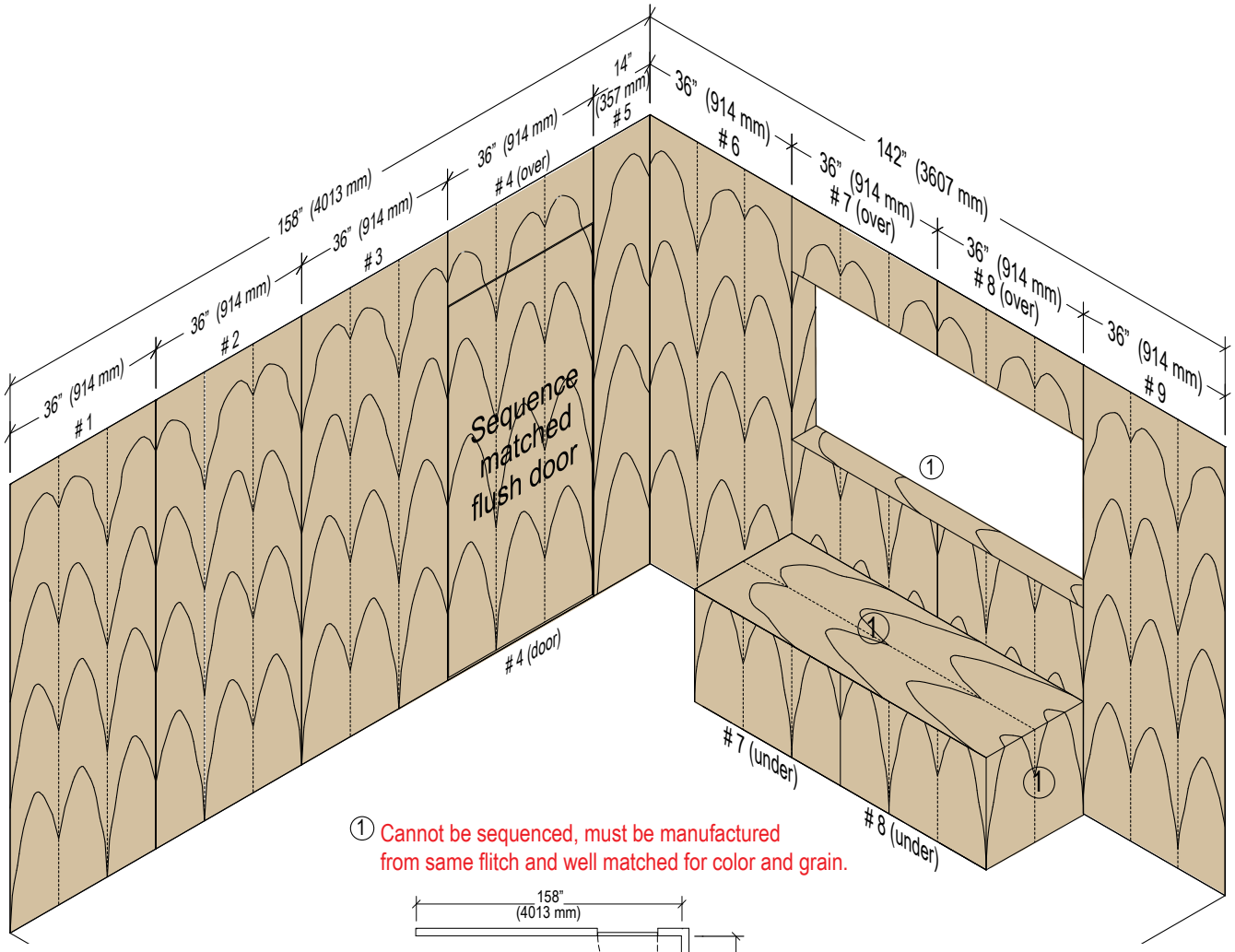

Figure: RG-149

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EDGEBANDING EXAMPLES

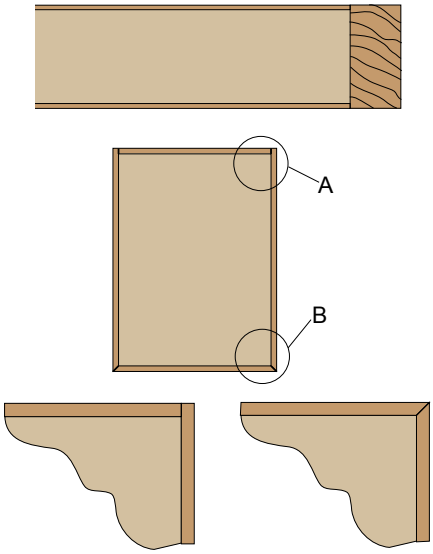
Veneer edgebanded

Figure: RG-150

Inset Solid Wood edgebanding

Figure: RG-151

Applied Solid Wood with corner joint options



A - Lapped B - Mitered

Figure: RG-152

For durability, the bottom edge of wall surfacing is edgebanded.

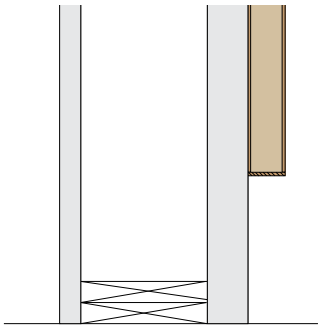


Figure: RG-153

FIELD-CUT CORNER and TRANSITION EXAMPLES

Butt - Outside Corner

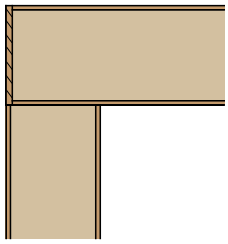


Figure: RG-154

Mitered - Outside Corner

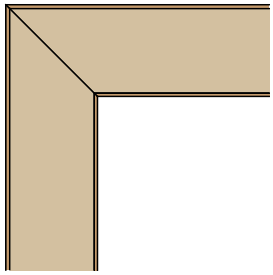


Figure: RG-155

Solid Wood - Outside Corner

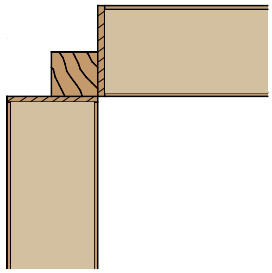


Figure: RG-156

Butt - Inside Corner

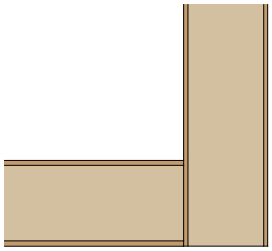


Figure: RG-157

Non-reveal - Transition

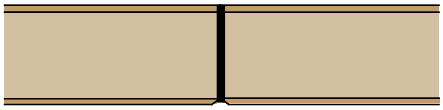


Figure: RG-158

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REVEALS and REVEAL JOINT EXAMPLES

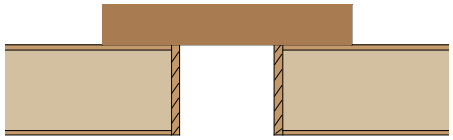

Figure: RG-159

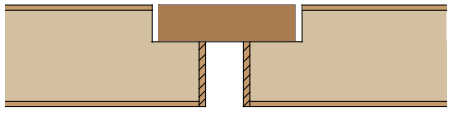

Figure: RG-160

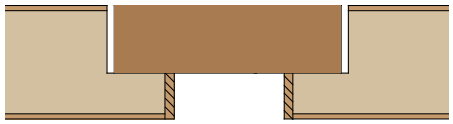

Figure: RG-161

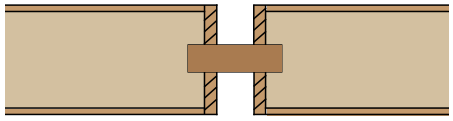

Figure: RG-162

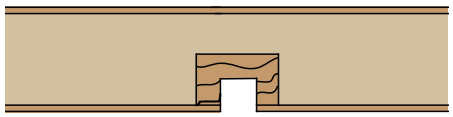

Figure: RG-163

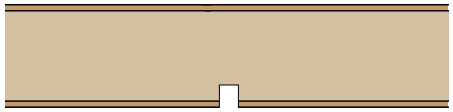

Figure: RG-164

Figure: RG-165

To PREVENT TELEGRAPHING, inset solid wood edging when used must have similar moisture content as panel core, be glued securely and calibrated with panel core thickness prior to being laminated with a wood veneer on both faces.

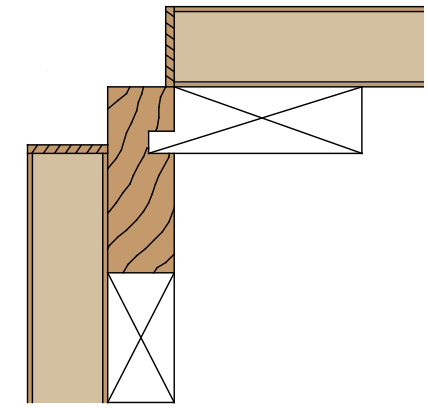

Figure: RG-166

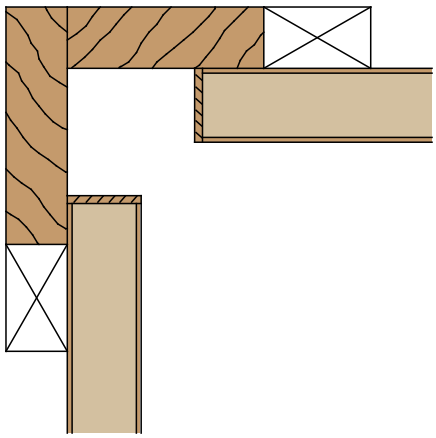

Figure: RG-167

FACTORY-PREPARED CORNER and TRANSITION EXAMPLES

Lock Mitered - Outside Corner

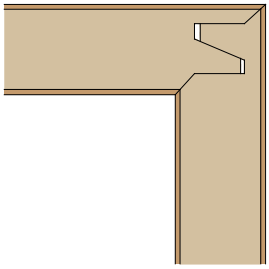

Figure: RG-168

Splined - Outside Corner

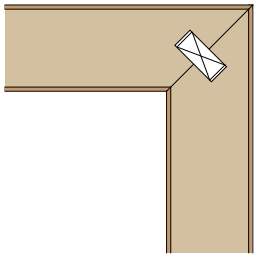

Figure: RG-169

Miter Fold - Outside Corner

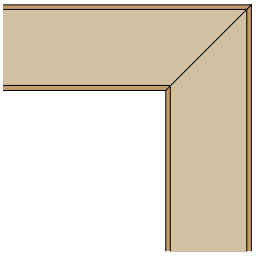

Figure: RG-170

Solid Wood - Outside Corner

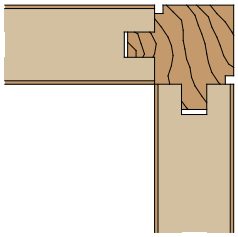

Figure: RG-171

Solid Wood - Outside Corner

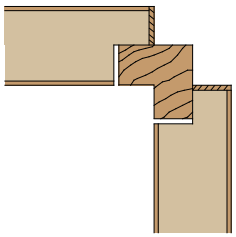

Figure: RG-172

Non-reveal Transition

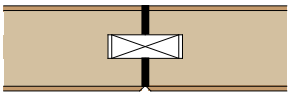

Figure: RG-0173

FACTORY PREPARED TRANSITION EXAMPLE OF BUILT-UP SECTION

Loose joint fit in plant and sanded flush

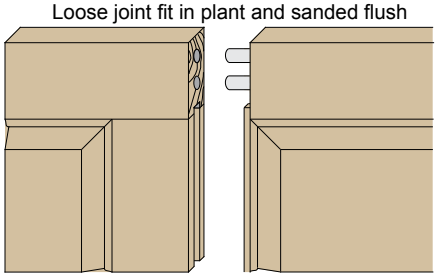

Figure: RG-174

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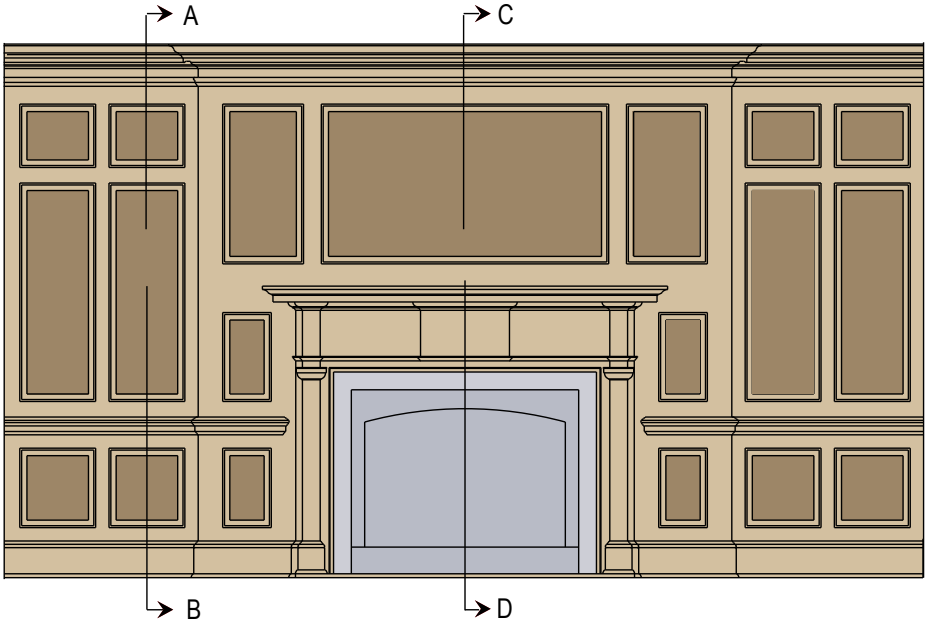
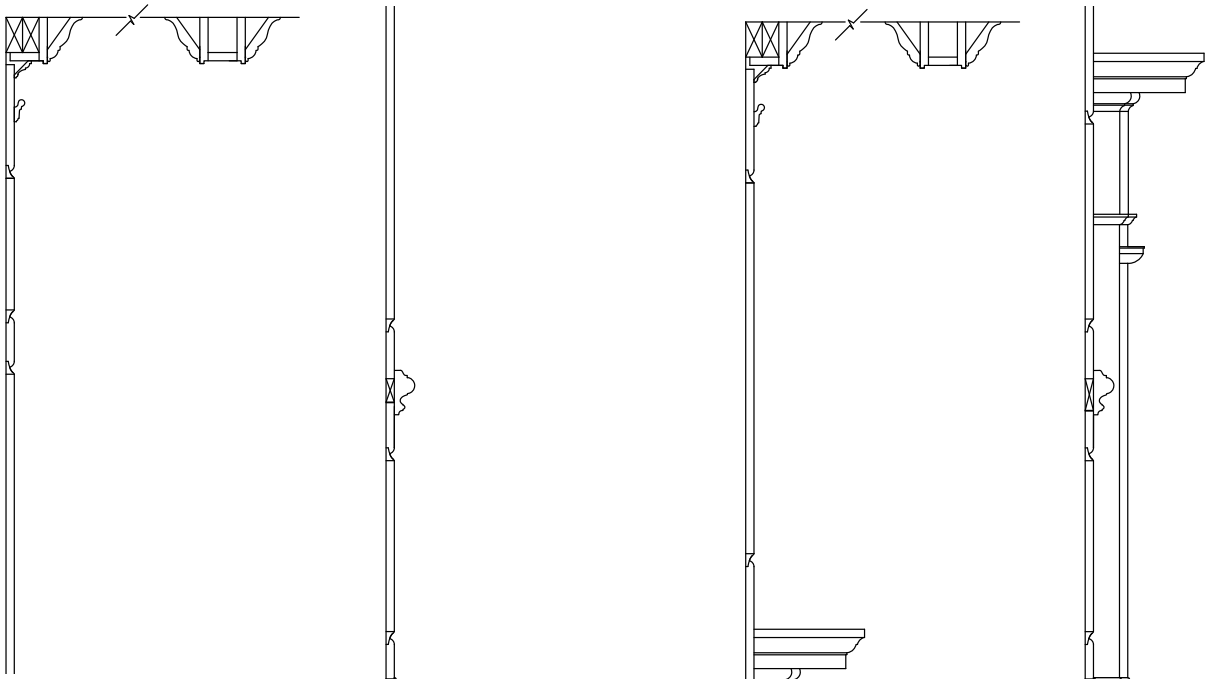
WALL / CEILING SURFACING & PARTITIONS (continued)

STILE and RAIL PANELING

Flat or raised panels with wood veneer faces or of solid lumber, combined with stiles and rails. Design may encompass face application of moldings. Joints between panels, stiles, rails, and other members to be as designed for functional or decorative purposes.





Section A Section B Section C Section D

Figure: RG-175

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EXAMPLES of STILE and RAIL PANELING (continued)

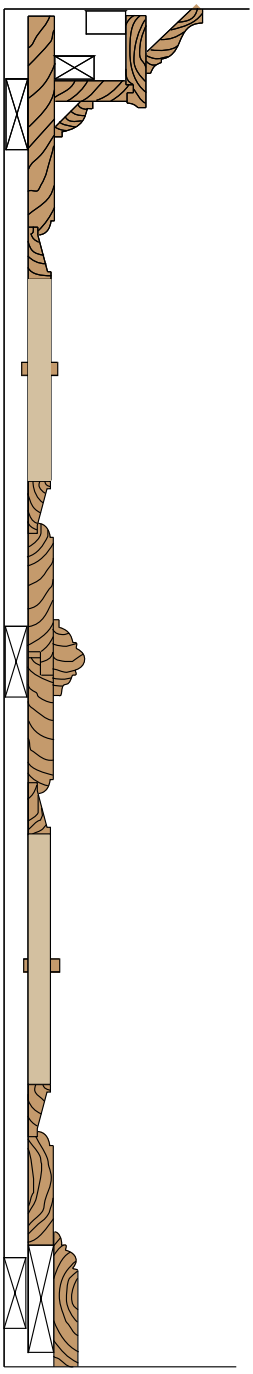
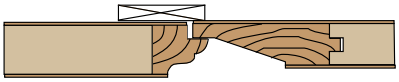


Figure: RG-176

Veneered stile and rail with concealed* stile and rail edges and panel rim



* Likely to cause telegraphing through face veneer

Figure: RG-177

Solid lumber stile and rail with panel products and solid rims

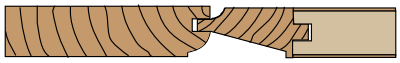


Figure: RG-178

Solid stile and rail with lip moulding and panel product with solid rim

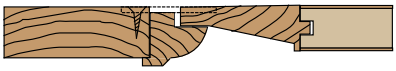


Figure: RG-179

Medium density fiberboard (MDF) for stiles, rails and panels

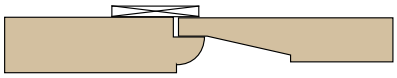
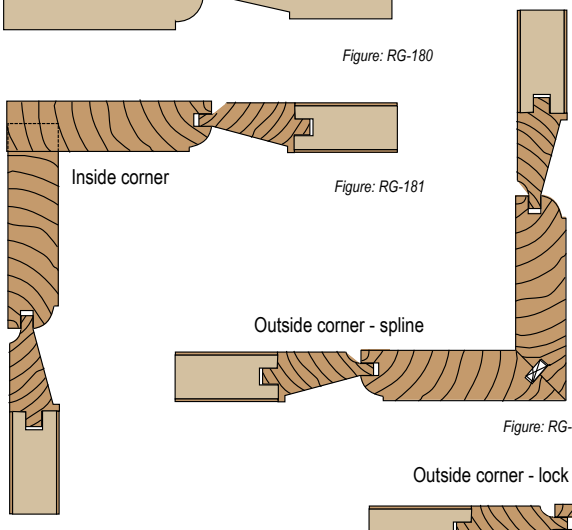


Figure: RG-180

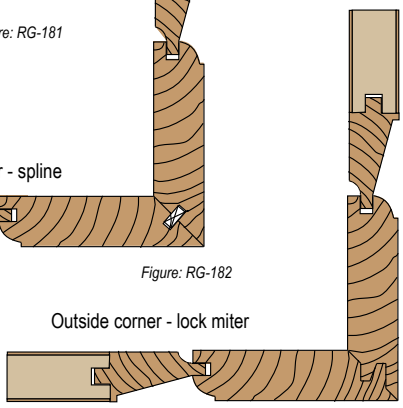
Inside corner

Figure: RG-181



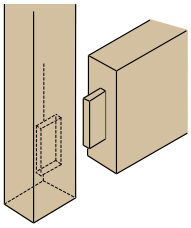
Outside corner - spline

Figure: RG-182



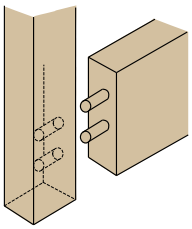
Outside corner - lock miter

Figure: RG-185



Mortise and Tenon construction

Figure: RG-183



Doweled construction

Figure: RG-184

EXAMPLE of FLAT PANELING WITH REVEALS WITHIN a NICHE

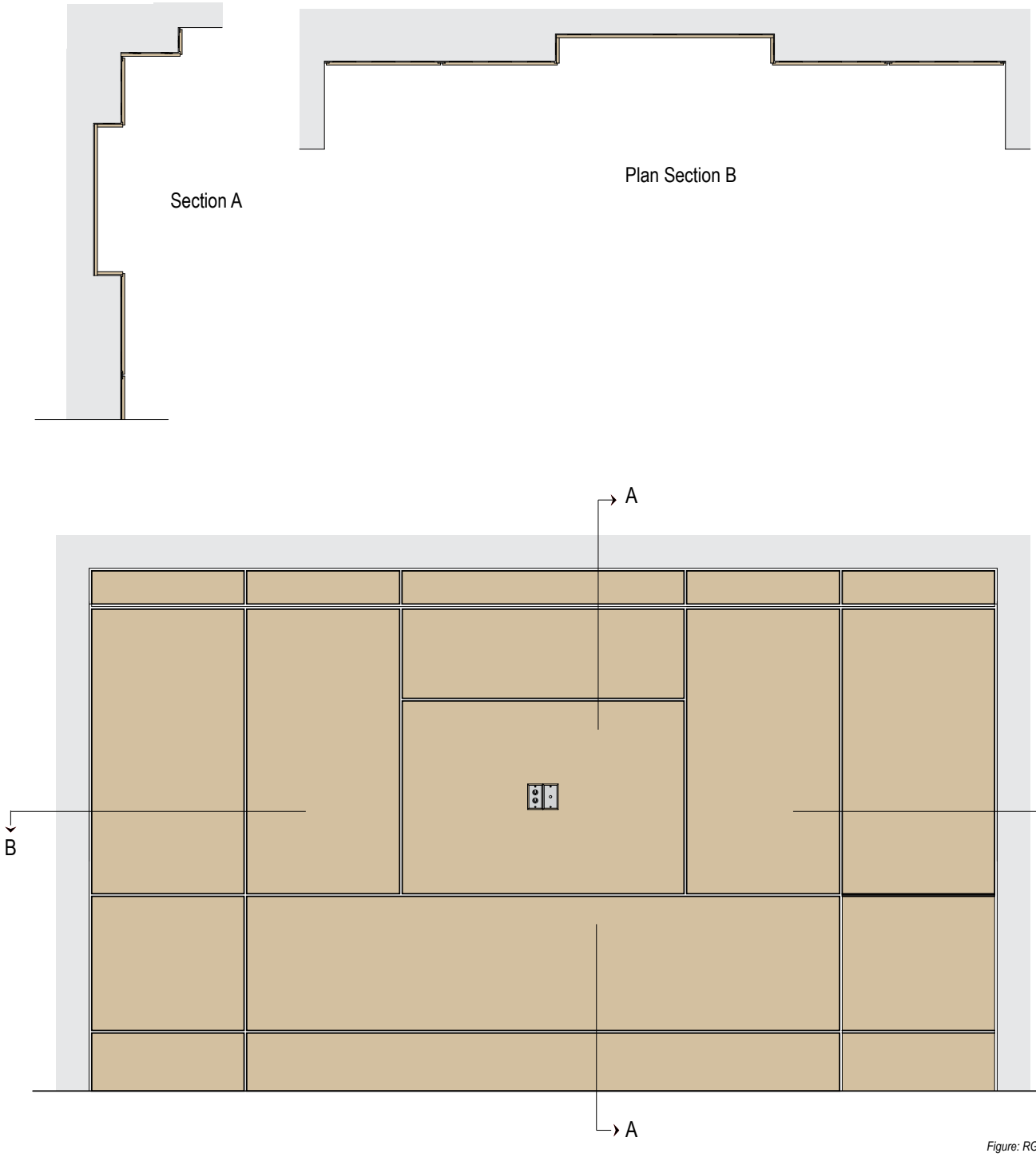


Figure: RG-186

EXAMPLE of PANELING FOR RECEPTION WALLS WITH FACTORY BUILT STRUCTURES

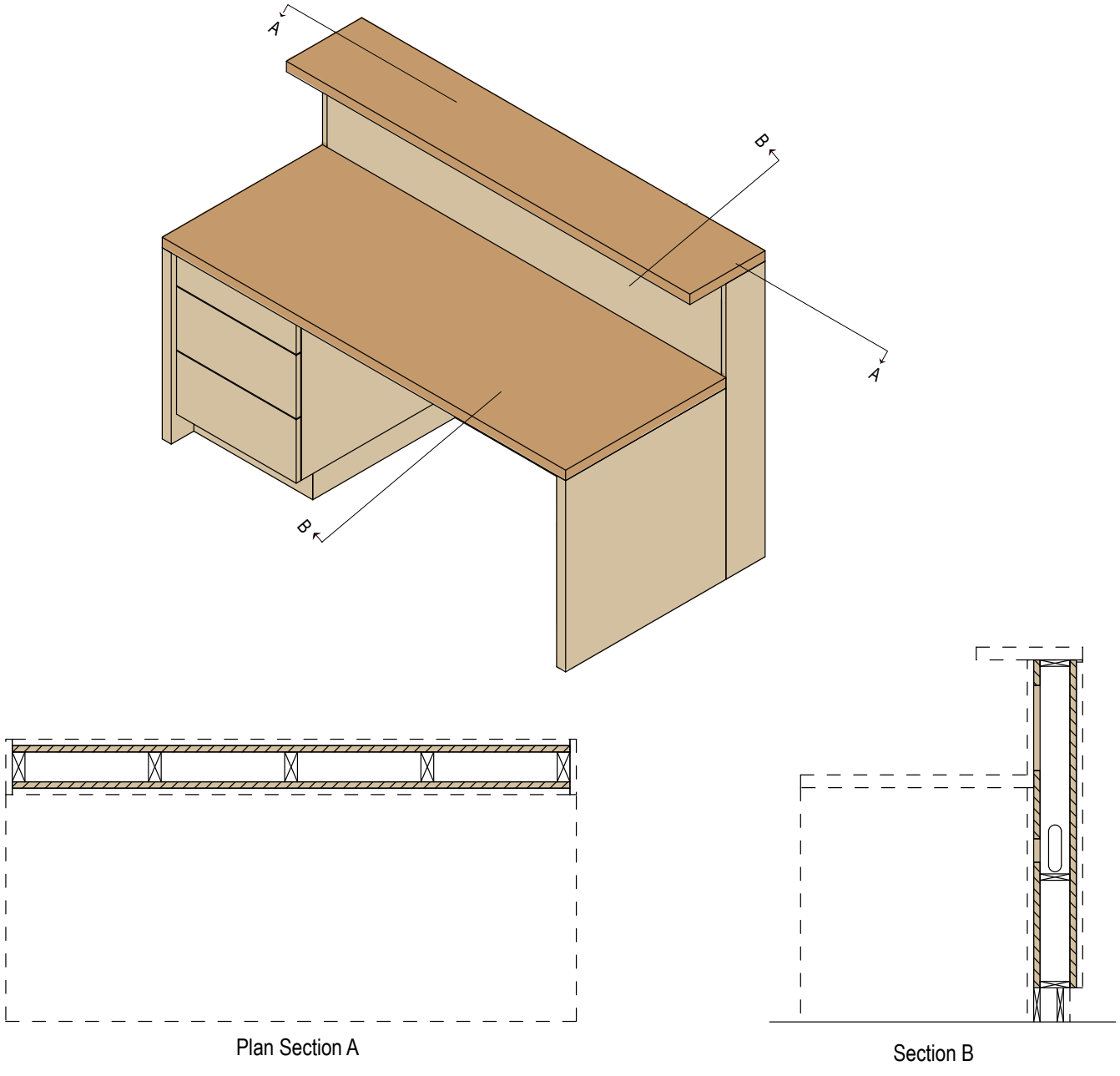


Figure: RG-187

INTRODUCTION

Section 09 includes information on doors using flush and stile & rail construction with wood or HPL faces and their related parts.

In the past material suppliers have relied on the natural strength of hardwood lumber and veneer to assure long term performance. Many new engineered wood products are now replacing traditional hardwoods; allowing cost reductions, improved production efficiency and allowing the material suppliers the ability to provide better doors.

However, there is a risk some nonconforming products will not perform as well. The materials and construction methods used determine how well a door will resist high use and abuse. With the introduction of engineered wood products this becomes more important. Wood products, whether natural or engineered, have a wide range of strength characteristics and it is important that the door material and construction method meets the performance criteria of the project requirements.

CONSTRUCTION DEFINITIONS

- **Wood Face:**
  - **5-Ply** consists of a center core on which is applied to each side a wood veneer or composite cross band with a face veneer applied over the cross band.
  - **7-Ply** consists of a center core on which is applied to each side 3-ply face skins.
- **HPL Face:**
  - **3-Ply** consists of a core with a HPL face applied over both sides of the core.
  - **5-Ply** consists of a wood veneer or composite cross band applied over the core before application of the face laminate.

DOOR CONSTRUCTION CUTAWAY EXAMPLES

Illustrations of grain direction is only applicable to wood veneer.

- **WOOD VENEER FACE** with particleboard, MDF, or agrifiber core (PC-5 /PC-7):

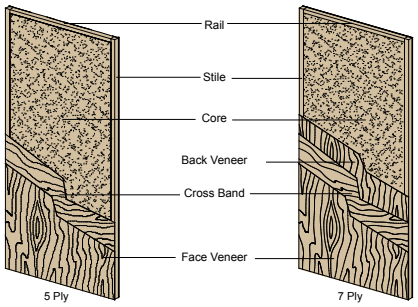


Figure: RG-188

- **HPL FACE** with particleboard, MDF, or agrifiber core (PC-HPL-3 / PC-HPL-5):

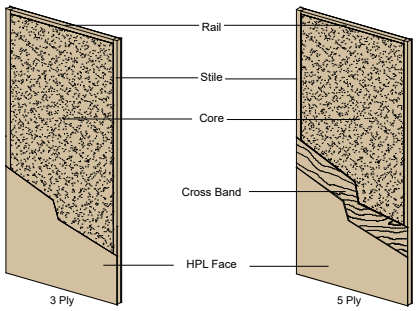


Figure: RG-189

- **WOOD VENEER FACE** with staved lumber core (SLC- / SLC-7):

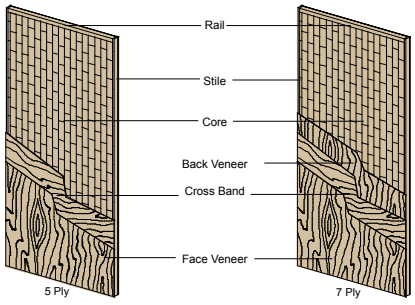


Figure: RG-190

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DOOR CONSTRUCTION CUTAWAY EXAMPLES (continued)

- **WOOD VENEER FACE** with structural composite lumber (SCL) core (SCLC-5 / SCLC-7):

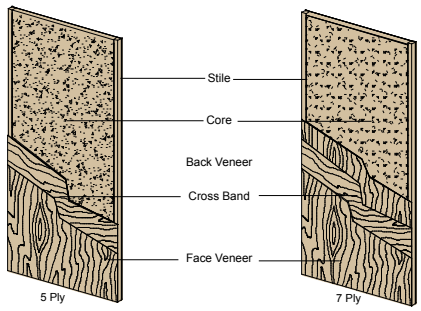

Figure: RG-191

- **WOOD VENEER FACE** with fire resistant composite core (FD-5 / FD-7):

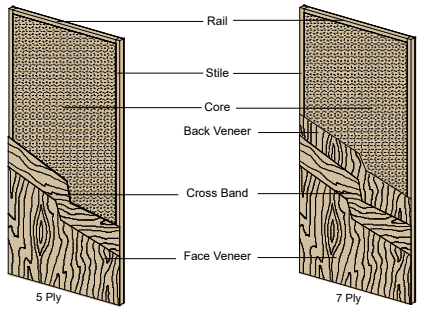

Figure: RG-192

- **HPL** with fire resistant composite core (FD-HPL):

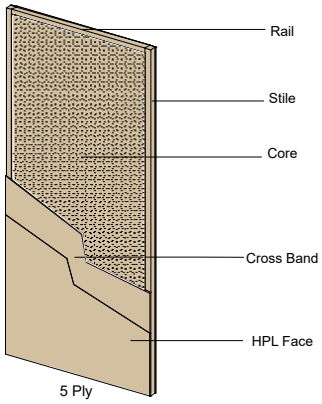

Figure: RG-193

- **WOOD VENEER / HPL FACE** with hollow core (HC-7):

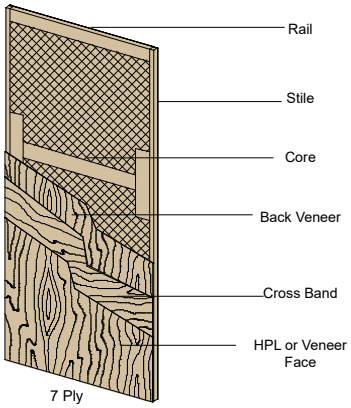

Figure: RG-194

PASSAGE DOORS (continued)

DOOR SYMBOLS and ABBREVIATIONS

Your door material supplier is the best source of specific guidance when writing door specifications. The following short list of abbreviations applies to some door companies:

- **ME = Matching edges**; i.e., vertical edges same as decorative faces.
- **CE = Compatible edges**; i.e., vertical edges selected for compatibility with decorative faces.
- **PC = Particleboard, MDF, or agrifiber core**, solid core door with stiles and rails bonded to the core and abrasive planed flat prior to the application of the faces, including:
  - **PC-5** = Core with 2 layers on each side.
  - **PC-7** = Core with 3 layers on each side.
  - **PC-HPL-3** = Core with laminate to each side.
  - **PC-HPL-5** = Core with cross band and laminate each side.
- **SCLC** = Structural composite lumber core, solid core door with stiles and rails bonded to the core and abrasive planed flat prior to the application of the faces, including:
  - **SCLC-5** = Core with 2 layers on each side.
  - **SCLC-7** = Core with 3 layers on each side.
  - **SCLC-HPL-5** = Core with cross band and laminate each side.
- **SLC** = Staved lumber core, solid core door with stiles and rails bonded to the core and abrasive planed flat prior to the application of the faces.
  - **SLC-5** = Core with 2 layers on each side.
  - **SLC-7** = Core with 3 layers on each side.
  - **SLC-HPL-5** = Core with cross band and laminate each side.
- **FPC** = Floating particleboard core, solid core placed within a stile and rail frame, bonded together by the faces, including:
  - **FPC-5** = Core with 2 layers on each side.
  - **FPC-7** = Core with 3 layers on each side.
- **FSLC** = Floating staved lumber core, solid core placed within a stile and rail frame, bonded together by the faces, including:
  - **FSLC-7** = Core with 3 layers on each side.
- **FD** = Fire resistant core, fire resistant materials assembled to stiles and rails according to methods prescribed by the testing agency based on rigorous smoke, flame, and pressure tests. Labeled fire doors are specified by their resistance ratings:
  - **FD-5** = Core with 2 layers on each side.
  - **FD-7** = Core with 3 layers on each side.
  - **FD-HPL-3** = Core with laminate to each side.
  - **FD-HPL-5** = Core with cross band and laminate each side.
- **IHC-7** = Institutional hollow core, honeycomb, ladder, or grid type cores inside stiles and rails, bonded together by the faces.
- **SHC-7** = Standard hollow core, honeycomb, ladder, or grid type cores inside stiles and rails, bonded together by the faces.
- **SR** = Sound retardant doors, specified by their performance characteristics.
- **LL** = Lead lined doors, designed to resist penetration by radiation of various types, and specified by their performance.
- **ES** = Electrostatic shielded doors.
- **BR** = Ballistic resistant doors.

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PASSAGE DOORS (continued)

BASIC CORE TYPES

The design professional or specification writer has the opportunity to select the door core type. In the absence of specification, PC shall be furnished, complying with particleboard standard ANSI A208.1 Particleboard, Grade LD-1 or LD-2 as published by the Composite Panel Association, compositepanel.org.

The five most common core types are PC, SLC, SCLC, HC, and fire-resistant door core, conforming to the minimum requirements of WDMA - I.S. 1-A (latest edition).

Specify one, or a combination of, solid core, hollow core, or fire-resistant core, and acoustical, ballistic resistant, or lead lining where and when required. The requirements for each core type are illustrated in Section 9. In the absence of clear specifications, the core shall be of the manufacturer's choice. SCLC may be specified in any Grade, for:

- **SOLID CORE,** specify one of the following: PC, SLC, or SCLC. When the weight of the door is a design factor, consult the door manufacturer to determine the differences between PC, SLC, and SCLC core types.
- **HOLLOW CORE**, specify the honey comb, with the minimum cell size required, grid core, or ladder construction.
- **FIRE RESISTANT CORE**, required beyond the 20 minute label level, consult your door manufacturer for code compliant core types, blocking options, metal edges, cut outs, and astragals.
- The use of **SCLC** for top and/or bottom rails, and blocking is acceptable. SCLC is proving to have excellent performance characteristics as a replacement for stave core, as it often minimizes or eliminates telegraphing of the lumber blocks through the face veneers or overlays.

When the edge of an SCL core door will be visible after installation, design professionals may wish to specify a fill and paint treatment, or the application of a veneer edgeband to conceal the coarse texture of the edge of the SCL material. It is the responsibility of the design professional to make a selection in the best interests of the client.

SPECIALITY CORES

Such as fire rated, sound resistant, x-ray, bullet resistant, or electrostatic shielded doors shall be properly specified, including the fire rating, sound class, lead thickness, and/or protection rating:

- At **FIRE RATED** doors, the type of construction, core type, thickness, edgebands, moldings, blocking, and use of intumescent coatings shall be the standard of the door material supplier, conforming to the labeling authority granted to them by their labeling agency.
- At **SOUND RESISTANT** doors, the type of construction, thickness, edgebanding, applied moldings, special stops, stop adjusters, gaskets, and automatic threshold closing devices shall be the standard of the door material supplier conforming to the STC (Sound Transmission Class) specified when tested as an opening unit (rather than sealed in place).
- At **X-RAY DOORS**, construction, thickness, edgebands, and moldings shall be of the material supplier's standard.
- At **BULLET RESISTANT** doors, the type of construction, thickness, edgebands, and moldings shall be of the material supplier's standard.
- At **ELECTROSTATIC SHIELDED** doors, the type of construction, thickness, edgebands, and moldings shall be of the material supplier's standard.

Cores other than those enumerated herein are manufactured to individual specifications and are not dealt with in these standards for that reason.

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PASSAGE DOORS (continued)

CORE TO EDGE ASSEMBLY

These standards provide for multiple types of assembly between the core and the vertical and horizontal edges in doors:

- Stiles and rails securely bonded to core, prior to application of faces.
- Stiles and rails **NOT** bonded to core prior to application of faces.
- Stiles and rails placed (not bonded) around hollow core inserts.

FIRE RATINGS

The Model Codes have established a fire door rating and operating classification system for use in protecting door openings in fire rated wall constructions. Fire doors must meet certain requirements and bear certifying labels of an independent testing agency approved by the building official.

SPECIAL FUNCTION DOORS

Sound retardant (acoustical), lead lined (X-ray), ballistic resistant, and electrostatic shield doors are manufactured by some companies to meet these special needs. Refer to material supplier's literature for details.

Transom panels and special function doors are available and should be specified carefully, with particular attention to the meeting edge details, operational functions and accessories, and veneer match options. In the absence of clear and complete specifications, fabrication details will be of the material supplier's choice.

VENEER FACES

At stand-alone doors with face species of Anigre, Ash, Beech, Birch, Cherry, Hickory, African Mahogany, American Mahogany, Makore, Maple, Red Oak, White Oak, Pecan, Poplar, or Walnut shall conform to the HPVA Door Skin Face tables included within the Materials portion of this section. Doors of a species not listed above shall conform to the HPVA Door Skin Faces as agreed on between buyer and seller.

- Doors adjacent to or that become a component of other architectural woodwork shall conform to the applicable requirements of Section 04.
- Stand alone, Center Balanced Matched doors, shall not have the width of outer leaves after trimming exceed 1" (25.4 mm) less than its adjoining leaf for Custom Grade, or 1/2" (12.7 mm) less than its adjoining leaf for Premium Grade.
- Before specifying, check with the door material supplier for availability.

SPECIAL MATCHING SHALL BE SO SPECIFIED, SUCH AS:

- All doors on the same project are to be manufactured using the same or similar flitches.
- Sequence matched face veneers required at pairs or sets of doors and adjacent panels.

VENEER FACE GRADE SUMMARY

Refer to Section 4 HPVA Panel Grades and Section 9 HPVA Door Skin Grades for the complete description of veneer face grades.

When veneers are specified as "natural," they may contain any amount or combination of sapwood and heartwood, with the resultant contrast in color in many species.

The industry recognizes that cost is an important factor and having lower veneer standards can result in some savings. Specifying Architectural Woodwork Standards Custom Grade meets that need. However, when doors are a part of an overall design scheme and/or are adjacent to other architectural woodwork specified under these standards, the level of quality of those doors must be consistent with other architectural woodwork components.

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PASSAGE DOORS (continued)

ANSI/WDMA PERFORMANCE DUTY LEVELS

ANSI/WDMA HEAVY DUTY PERFORMANCE DUTY LEVEL is required within NAAWS for both Flush and Stile and Rail doors, and if a higher Extra Heavy Duty or lower Standard Duty Performance Duty Level is required, it will be specified.

- **DUTY LEVEL** performance requirements are spelled out within the Machine / Assembly Requirements. Duty Levels other than those required herein, will be so specified from the following:
  - **HEAVY DUTY LEVEL** typically involves doors for moderate usage and requires intermediate minimum performance standards. Typical usage examples include:

Assisted living room entry	Storage
Office - Interior passage stairwell	Apartment / condo entry
Mechanical service	X-ray
Hallway	Acoustic
Medical exam room	Stairwell

  - **EXTRA HEAVY-DUTY** level typically involves doors where use is considered heavy and frequent, and requires the highest minimum performance standards. Typical usage examples include:

Classrooms	Detention / correctional
Patient rooms	Bullet-resistant
Bathrooms - Public	Gym / locker rooms
Dorm rooms	Surgical entry
Assembly areas	Trauma centers
Auditorium entry	Hotel / motel room entry

  - **STANDARD DUTY** level typically involves doors where frequency of use is low and requires the lowest minimum performance. Typical usage examples include:

Closet	Bath - Private
Wardrobe	Small, low-usage office

VENEER USAGE GUIDELINES

The panel face veneer standards of the Decorative Hardwoods Association's ANSI/HPVA HP-1 (latest edition) is adopted as the minimum standard for face veneers. Specifiers need to determine and specify the following:

VENEERS FOR TRANSPARENT FINISHES

- **Species** - There are numerous foreign and domestic species available. Involve your manufacturer early in the design and selection process.
- **Matching** - Many different visual effects can be obtained by face veneer matching:
  - Appearance and layout of individual pieces of veneer.
  - Matching between pieces (leaves) of veneer.
  - Orientation of spliced veneer on a door face.
  - Appearance of doors in pairs or sets.
  - Appearance of doors with transoms.

MATERIALS FOR OPAQUE FINISHES

- **Medium Density Overlay, MDF or Hardboard -** These provide the optimum paintable surface for architectural doors.
- **Close Grain Hardwood -** Extra preparation will be required by the finisher as there will be grain show through, open appearing veneer joints, and other wood characteristics when using this product for a painted finish.
- **Manufacturers' option -** Face materials are determined by the manufacturer.

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PASSAGE DOORS (continued)

VENEER USAGE GUIDELINES (continued)

DOORS IN PAIRS OR SETS

- **Pair Match -** Two doors hung adjacent may be (and in some Grades, must be) specified as a Pair Match. Note to specifying authority: Specifying Pair Matched only means the two doors are to be considered Pair Matched as per the Grade specified, it does not mean the veneer is sequenced, nor does it designate the veneer cut or layup. The Grade specified will determine the type of Match required. Sequencing, veneer cut and layup if different from the Grade Rules must be specified. The illustration shows flat or plain cut, book matched, center matched faces.

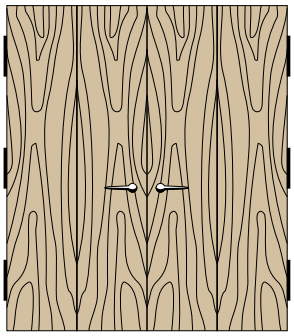

Figure: RG-195

- **Set Match -** Three or more doors or two or more Pair Matched doors hung adjacent may be (and in some Grades, must be) specified as a Set Match. Note to specifying authority: Specifying Set Matched only means the three or more doors are to be considered Set Matched as per the Grade specified, it does not mean the veneer is sequenced, nor does it designate the veneer cut or layup. The Grade specified will determine the type of Match required. Sequencing, veneer cut and layup if different from the Grade Rules must be specified. The illustration in shows flat or plain cut, book matched, center matched faces.

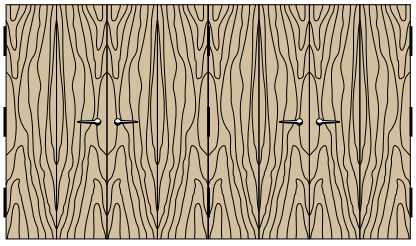

Figure: RG-196

- **Doors with Transoms**

  The use of the transom increases the apparent height of the door and often enhances the appearance of the opening. The type of match should be specified, and a slight misalignment of veneer grain may occur between the transom and the door. Industry practice allows a variation in grain alignment from side to side. If tighter tolerances are desired, they must be specified.

  Grain pattern alignment between the door and transom, even when cut from the same panel, will vary to some extent. This is due to the natural progression of the annual rings which create the figure in the wood. Misalignment will be more apparent in doors veneered with open grain species than with close grain.

  - **Continuous Match -** Provides optimum veneer utilization as each single piece of veneer extends from the top of the transom to the bottom of the door. Available veneer length in the species may limit this option.

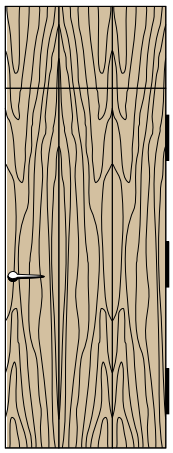

Figure: RG-197

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PASSAGE DOORS (continued)

VENEER USAGE GUIDELINES (continued)

- **Doors with Transoms** (continued)
  - **End Match -** A single piece of veneer extends from the bottom to the top of the door with a mirror image at the transom.

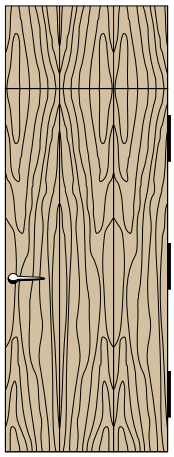

Figure: RG-198

- **No Match**

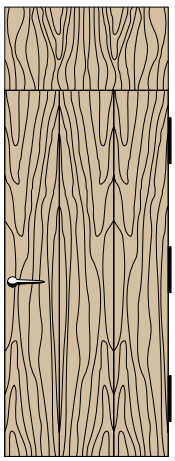

Figure: RG-199

DOOR EDGE CONSTRUCTION and TYPES

Edge construction is the manufacturer's choice unless specified otherwise.

To **PREVENT TELEGRAPHING**, inset solid wood edging when used must have similar moisture content as panel core, be glued securely and calibrated with panel core thickness prior to being laminated with a wood veneer on both faces.

- **Type - A** - Solid Wood edgeband, face, and cross band edges show.

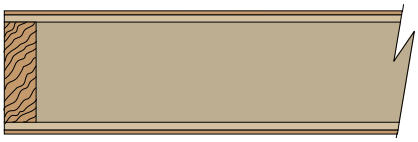

Figure: RG-200

- **Type - B** - Wood Veneer edgeband, face, and cross band edges covered.

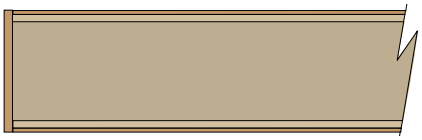

Figure: RG-201

- **Type - C** - HPL or PVC edgeband, face, and cross band edges covered.

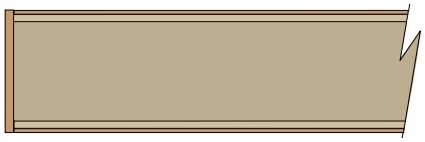

Figure: RG-202

- **Type - D** - Solid Wood edgeband, veneer face edge shows.

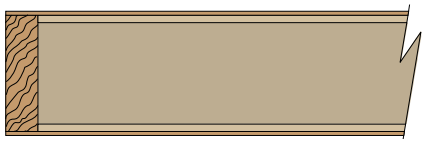

Figure: RG-203

- **Type - E** - Solid Wood edgeband, veneer face edge shows.

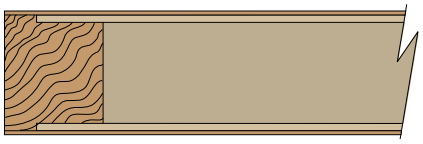

Figure: RG-204

- **Type - F** - Solid Wood edgeband, face, and cross band edges covered.

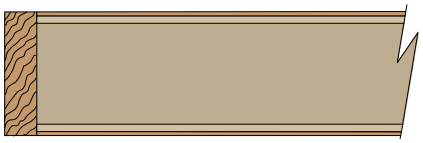

Figure: RG-205

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PASSAGE DOORS (continued)

CONSTRUCTION DETAILS

- **GENERAL MOLDING REQUIREMENTS:**
  - **SPECIES** shall match or be compatible with face veneer or laminate.
  - **SPECIFY** transparent or opaque finish.
  - **FREE** of open defects, shake, splits, or doze.
  - **SMOOTH** and **FREE** of visible knife, saw, or sanding marks.
- **HORIZONTAL** or **TRANSOM MEETING EDGE OPTIONS**

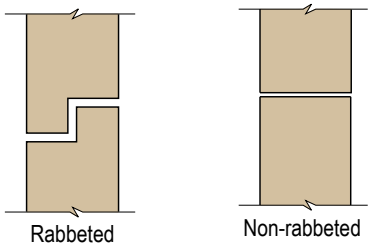

Figure: RG-206

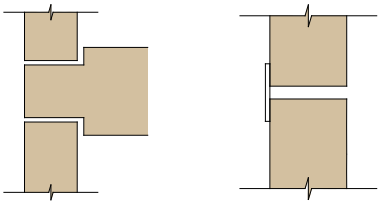

Figure: RG-207

- **MEETING EDGE OPTIONS**

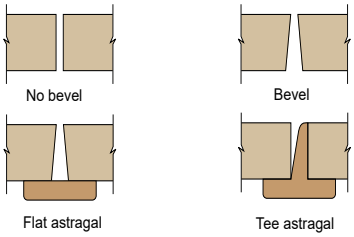

Figure: RG-208

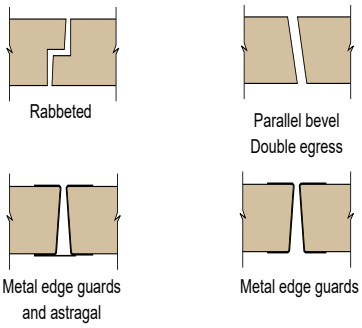

Figure: RG-209

- **GLAZING OPTIONS**

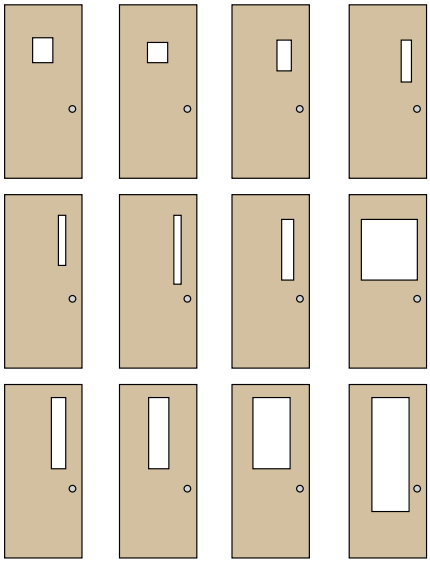

Figure: RG-210

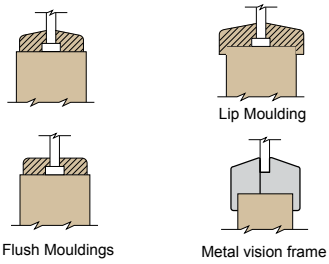

Figure: RG-211

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PASSAGE DOORS (continued)

CONSTRUCTION DETAILS (continued)

- **LOUVER OPTIONS**

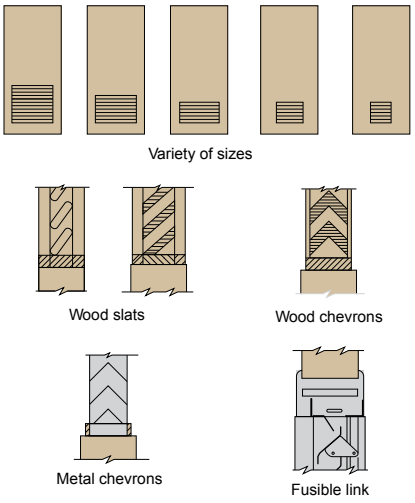

Figure: RG-212

- **FLASHING OPTIONS**

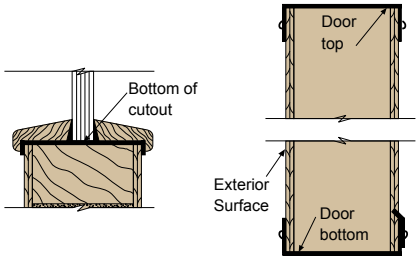

Figure: RG-213

If the manufacturer is to flash the top of the door or the bottom edge of cutouts for exterior doors, it must be specified.

- **DUTCH DOOR OPTIONS**

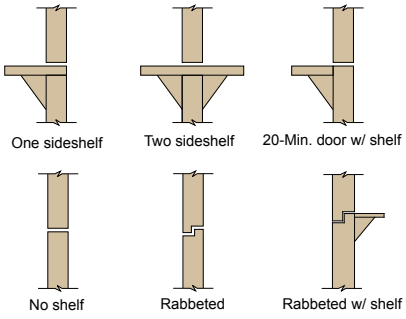

Figure: RG-214

- **BLOCKING OPTIONS**

For undercutting flexibility and specialized hardware applications, a number of internal blocking options are available from most material suppliers. When blocking is required it is typically at particle core and fire-resistant core doors. There are many options available, consult your manufacturer early in the design process to determine your requirements.

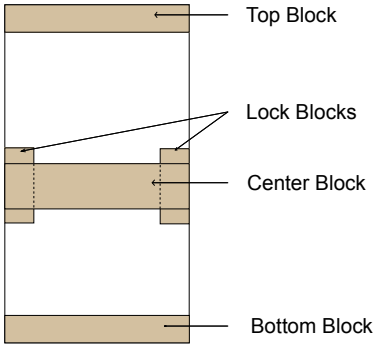

Figure: RG-215

Hardware Blocking, if desired, shall be specified from the following typical options:

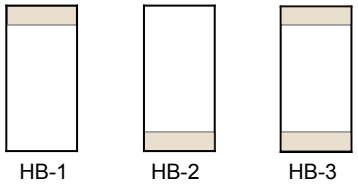

Figure: RG-216

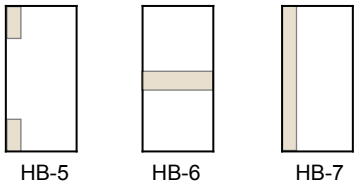

Figure: RG-117

Top Blocking may be full or partial width as required by its application.

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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PASSAGE DOORS (continued)

HAND and BEVEL OF DOORS

The "hand" of a door is always determined from the outside. The outside of an exterior door is the street or entrance (key) side. The outside of an interior room or auditorium door is the corridor or hall (key or imaginary key) side. The outside of a closet door is the side opposite the closet; the room, corridor or hall side. The outside of a single communicating door is the side from which the butts are invisible when the door is closed. The outside of twin communicating doors is the space between the two doors.

Standard handed doors push away from the person standing on the outside / key side. Reverse handed doors pull toward the person standing on the outside / key side.

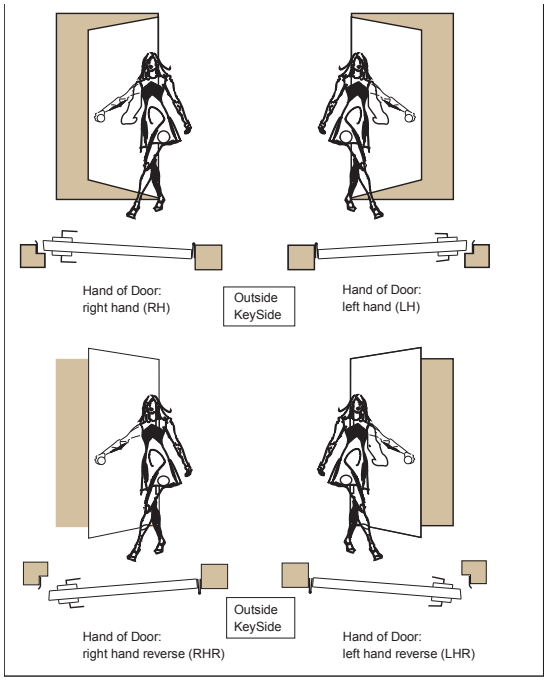

Figure: RG-218

FACTORY FINISHING (when specified)

Firms differ in the variety of factory finishes offered. Some finishes may not be available from all material suppliers. Finishes protect wood from moisture, handling, or harsh chemicals. The sooner moisture is restricted from entering or leaving, the longer wood lasts and the finer it looks. Transparent finishes without stain provide a protective coating for the wood, maintaining its natural look. Transparent finishes with stain provide the architect or designer an opportunity to create a striking visual effect by modifying color, texture, and sheen.

Section 05 defines the finishing systems and performance characteristics.

Carefully studying Section 05 with your manufacturer early in the design phase can result in both high quality and cost savings.

Factory finishing is generally specified when a project requires high quality performance and superior appearance.

Factory finishing offers many benefits, including:

- State of the art equipment in a well-lighted, dust free environment (conditions normally not available in the field), which provides uniform color, texture, and sheen.
- Proper sanding prior to the application of stains and finishes. Field conditions often hinder surface preparation resulting in a lack of clarity and uniformity in finish and color.
- Protection from unfavorable relative humidity conditions at the earliest possible time.
- Cost savings (in most cases) over the total cost of field applied finishes by a separate contractor.
- Shorter installation time on the job site, resulting in faster project completion.

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PASSAGE DOORS (continued)

STILE and RAIL DOOR COMPONENTS

- **STILES** - are the vertical outside members. They may be solid wood or veneered. Stiles usually have solid sticking (solid stuck, solid molded). Sticking is usually of three profiles: "ovolo", "ogee" or "quarter round". Other profiles may be used. The stiles are ploughed or grooved along the edge to receive the panels, rails, and/or glass. If the door is to be assembled by dowelled construction, the stiles are bored to receive the dowels. If the door is to be assembled by lag screw construction, the stiles shall be solid hardwood lumber. The stiles will contain much of the hardware for the door and must be sized and fabricated to fit the intended hardware, locks, and latches.
- **RAILS** - are the cross or horizontal members of the door. They may be solid wood or veneered. Rails are coped on both ends to fit the sticking of the stile. Tenons or dowels are machined into the rails to fit mortises or dowel boring in the stiles.
  - **Top** and **bottom rails** are required, with the addition of intermediate cross rails or lock rails as appropriate. The bottom rail is usually the widest of the members, made of edge glued lumber or veneered, depending on the door construction. The top rail is often the same face dimension as the stiles.
  - **Lock rail**, if there is one, is usually a wide member located at lock height. In the case of narrow stiles or large hardware, this rail serves to house the lock and latch mechanisms.
- **MULLIONS** - an upright or vertical member between panels. It is similar to a cross rail in the way it is fit and machined.
- **PANELS** - are either solid lumber or panel products that fill the frame formed by the stiles, rails, and mullions. When the figure of the wood is visible in the finished product, the grain direction of the panels usually runs vertically.
- **MUNTINS** and **BARS** - Stile and rail door with glass panels often utilize muntins and bars, which are smaller in section than mullions. A bar is a rabbeted molding, which extends the total height or width of the glass opening. A muntin is a short bar, either horizontal or vertical, extending from a full bar to a stile, rail, or another bar. Muntins and bars are traditionally coped and mortised joinery.

STILE and RAIL DOOR DESIGN

Custom stile and rail door design offer many opportunities for creativity and choice. Some of the variables include:

- Panel layout, grain patterns and relationships.
- Stile and rail and/or Panel construction.
- Molding details, Joinery techniques.

Selection among these variables requires some knowledge of their relative performance characteristics. The following drawings illustrate some of the options. Many manufacturers feel veneered and laminated constructions offer the lowest risk of warp for most species of wood. Consult your manufacturer early in the design process for assistance in making selections.

The strength of a stile and rail door is primarily dependent on the shoulders and joints between the stiles and rails. A wide bottom rail will increase significantly the strength and stability of a door far beyond that of a narrow rail.

Care should be taken to ensure that the design of a door's stiles and rails is large enough to structurally accommodate the intended hardware, provide a strong and stable door, and accommodate the usage and size of the opening.

Door panels of either flush / flat or raised design are typically of the same species as the stiles and rails.

TEMPORARY DISTORTIONS (warp) will usually disappear when humidity is equalized, and doors seldom need to be replaced.

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PASSAGE DOORS (continued)

STILE and RAIL DOOR JOINERY EXAMPLES

- **Haunched Mortise and Tenon**

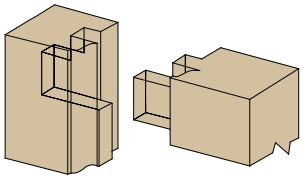

Figure: RG-219

- **Slot Mortise and Tenon**

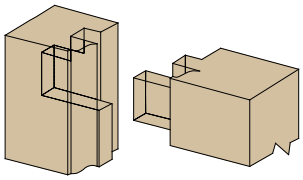

Figure: RG-220

- **Loose Tenon**

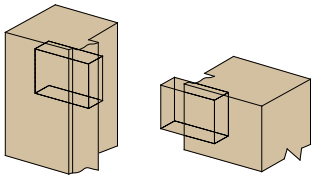

Figure: RG-221

- **Dowel**

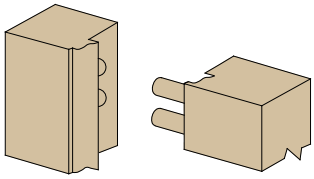

Figure: RG-222

STICKING PROFILES EXAMPLE

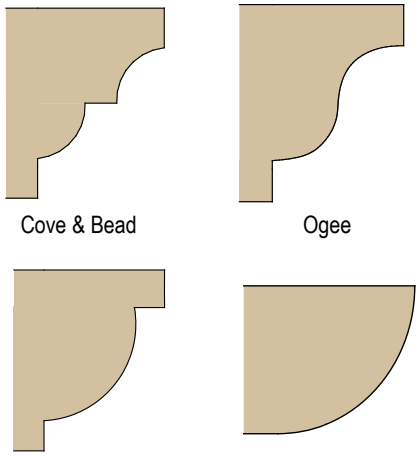

Figure: RG-223

THICKNESS

Stile and rail doors are usually 1-3/4" (44.5 mm) thick. For doors over 42" (1067 mm) in width or 96" (2440 mm) in height, it is recommended they be 2 1/4" (57.2 mm) minimum thickness.

GRAIN DIRECTION and LAYOUT

Traditionally, the grain direction flows with the longest dimension of the stile or rail. Panel grain typically runs vertical: however, it can be altered for design purposes. If raised panels are to be rim raised veneered construction, the grain of the rims will flow around the panel with the long dimension of the rim material.

There are a variety of methods of stile and rail fabrication. It is possible to fabricate stile and rail doors that will perform within the tests established in this Standard using any of the illustrated techniques and others. The illustrations are intended as guidelines for the design professional and should not limit the potential for creative solutions. Glass cannot always be centered on stiles and rails, depending on the thickness. Moldings and stop are usually applied with small brads or finish nails.

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PASSAGE DOORS (continued)

STILE and RAIL DOOR PANEL LAYOUT and GRAIN PATTERN EXAMPLES

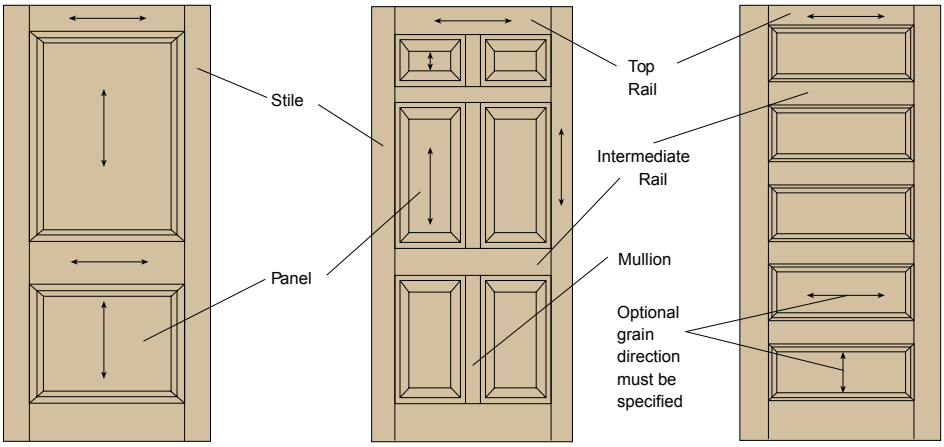

Figure: RG-224

STILE and RAIL DOOR CONSTRUCTION EXAMPLES

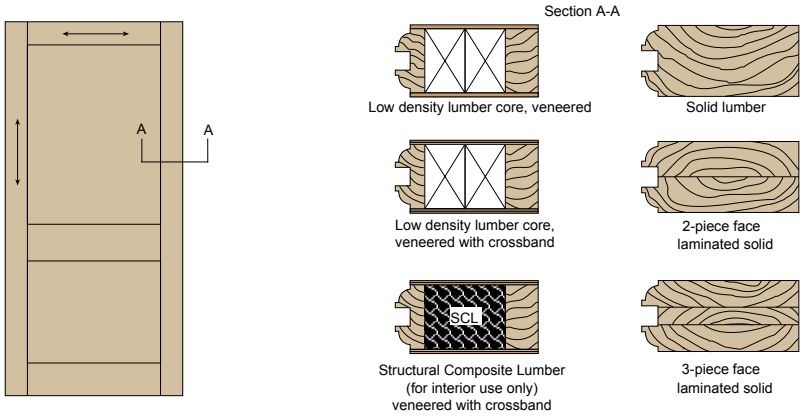

Figure: RG-225

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PASSAGE DOORS (continued)

STILE and RAIL PANEL CONSTRUCTION EXAMPLES

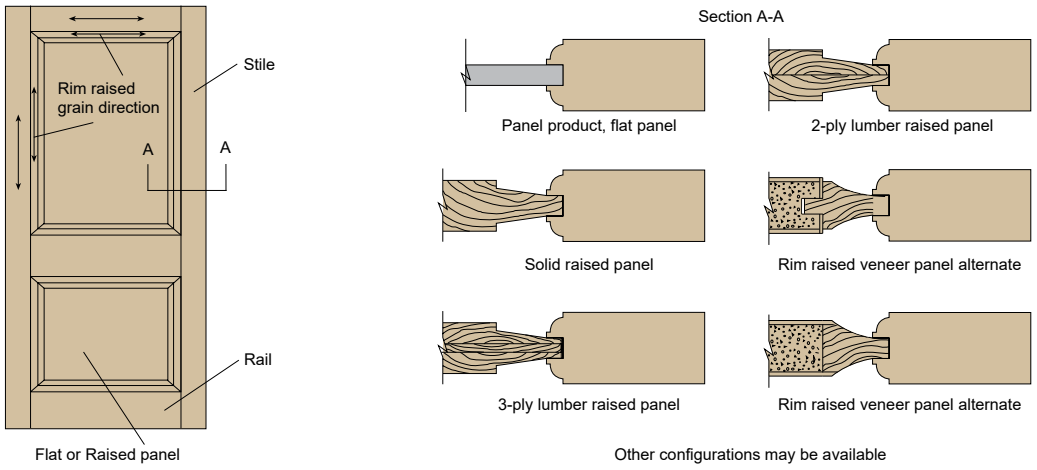

Figure: RG-226

STILE and RAIL PANEL and GLASS RETENTION EXAMPLES

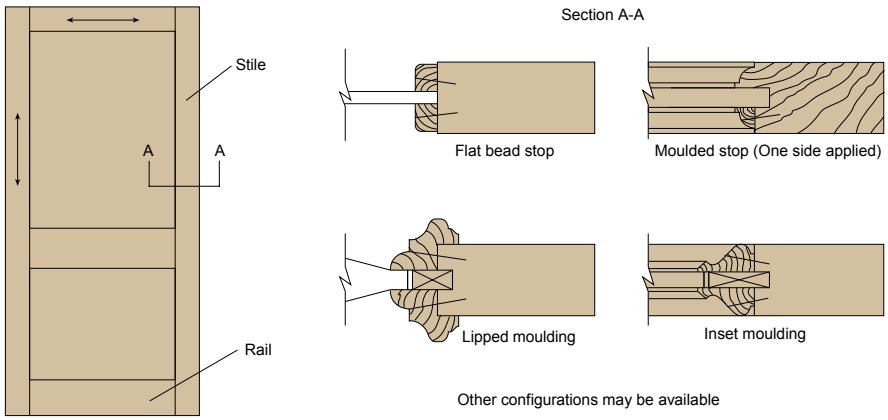

Figure: RG-227

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INTRODUCTION

Section 10 includes information on Wood, Decorative Laminate, and CGS (Compact Laminate) Faced Casework and their related parts.

SURFACE TERMINOLOGIES

Cabinet surfaces are defined in four distinct categories, three for exposed surfaces with very specific minimum surface requirements and one for concealed surfaces subject to manufacturer's choice, as follows:

- **EXPOSED EXTERIOR SURFACES**, defined as all exterior surfaces exposed to view, including:
  - All surfaces visible when doors and drawers are closed, including knee spaces.
  - Underside of cabinet bottoms over 42" (1067 mm) above the finished floor, including cabinet bottoms behind light valances and the bottom edge of light valances.
  - Cabinet tops under 80" (2032 mm) above the finished floor, or if 80" (2032 mm) and over and visible from an upper building level or floor.
  - Front edgeband of stretchers, ends, divisions, partitions, fixed shelves, tops, and bottoms.
  - Front edgeband of adjustable shelves exposed to view in open casework or behind transparent doors.
  - Sloping tops of cabinets that are visible.
- **EXPOSED INTERIOR SURFACES,** defined as all interior surfaces exposed to view in open casework or behind transparent doors, include:
  - Interior faces of shelves (both fixed and adjustable), divisions and partitions (edgeband is an Exposed Exterior Surface).
  - Interior face of ends (sides), backs, and bottoms (including pull outs).
  - Interior face of cabinet top members 36" (914 mm) or more above the finished floor.
  - Interior face of doors and applied drawer fronts.

SURFACE TERMINOLOGY BY ILLUSTRATION

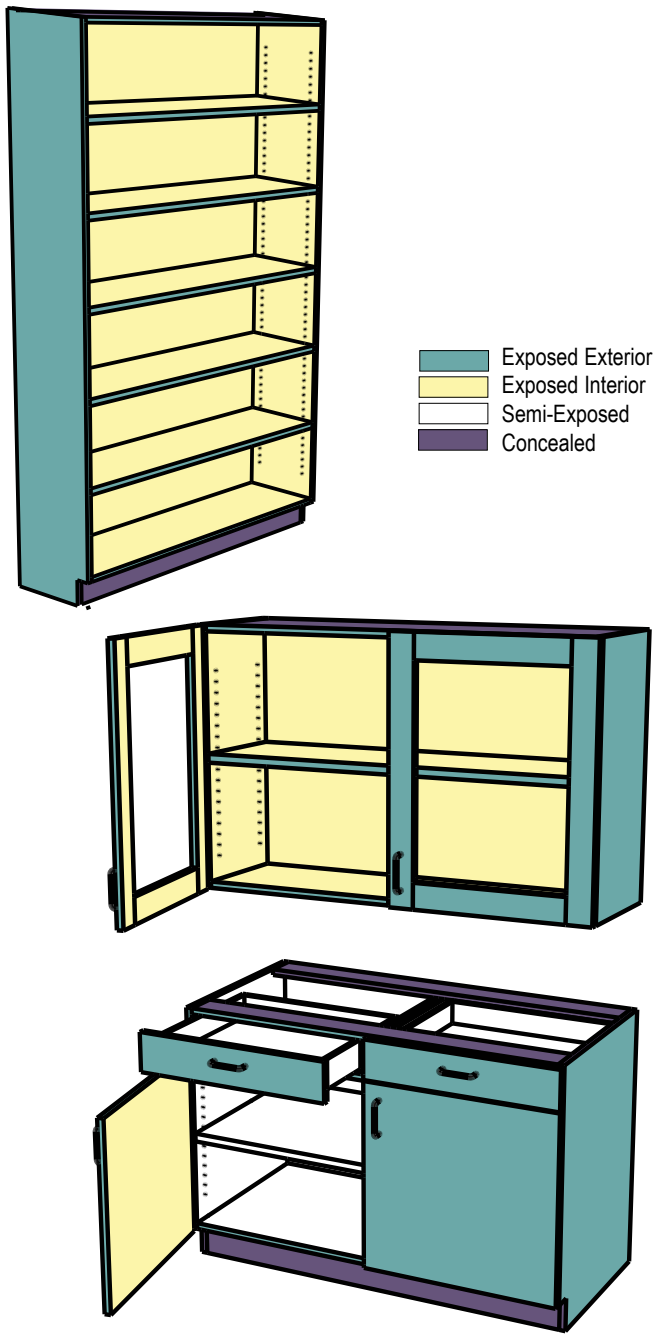

Figure: RG-228

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CASEWORK (continued)

SURFACE TERMINOLOGIES (continued)

- **SEMI-EXPOSED SURFACES**, defined as those interior surfaces only exposed to view when doors or drawers are opened, include:
  - Interior faces and edgeband of adjustable shelves, except at Premium Grade where edgeband will match Exposed Exterior surface.
  - Divisions and partitions (edgeband is an Exposed Exterior Surface).
  - Interior face of ends (sides), backs, and bottoms (including a bank of drawers).
  - Interior face of cabinet top members 36" (914 mm) or more above the finished floor.
  - Drawer box sides, sub fronts, backs, edgebanding, and bottoms.
  - The underside of cabinet bottoms between 24" (610 mm) and 42" (1067 mm) above the finished floor.
  - Security and dust panels or drawer stretchers.
- **CONCEALED SURFACES**, defined as those exterior or interior surfaces that are covered or not normally exposed to view including:
  - Toe space unless otherwise specified.
  - Sleepers, stretchers, and solid sub tops.
  - The underside of cabinet bottoms less than 24" (610 mm) above the finished floor.
  - The underside of countertops, knee spaces, and drawer aprons.
  - The flat tops of cabinets 80" (2032 mm) or more above the finished floor, except if visible from an upper floor or building level.
  - The three non-visible edges of adjustable shelves.
  - The underside of countertops, knee spaces, aprons and drawer boxes that are less than 36" (914 mm) above the finished floor.
  - The faces of cabinet ends of adjoining units that butt together.

SURFACE FINISH REQUIREMENTS

- **EXPOSED EXTERIOR SURFACES** for:
  - **WOOD** casework requires:
    - For **TRANSPARENT** finish, wood of specified species, cut, and match.
    - For **OPAQUE** finish at:
      - **CUSTOM GRADE**, MDF, MDO, close grain hardwood plywood, or solid stock.
      - **PREMIUM GRADE**, MDF and MDO.
  - **DECORATIVE LAMINATE** casework requires at:
    - **CUSTOM** and **PREMIUM GRADE**, HPL of specified color or pattern.
  - **CGS** (Compact Laminate) casework requires for **PREMIUM GRADE**, CGS of specified color or pattern.
- **EXPOSED INTERIOR SURFACES** for:
  - **CUSTOM GRADE** at:
    - **WOOD** casework requires:
      - For **TRANSPARENT** finish, wood of the same species as the exposed exterior surface.
      - For **OPAQUE** finish at, MDF, MDO, close grain hardwood plywood, or solid stock of manufacturer's choice.
    - **DECORATIVE LAMINATE** casework requires HPL or TFL compatible to exposed exterior surface in color, grain, or pattern of manufacturer's choice.
  - **PREMIUM GRADE** at:
    - **WOOD** casework requires:
      - For **TRANSPARENT** finish, wood of same the species and cut as the exposed exterior surface.
      - For **OPAQUE** finish, use of MDF and MDO of manufacturer's choice.
    - **DECORATIVE LAMINATE** casework requires, HPL, the same as the exposed exterior surface.
    - **CGS** (Compact Laminate) casework requires, CGS, the same as the exposed exterior surface.

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CASEWORK (continued)

SURFACE FINISH REQUIREMENTS

- **SEMI-EXPOSED SURFACES** for:
  - **WOOD** casework requires for both **TRANSPARENT** and **OPAQUE** finish at:
    - **CUSTOM GRADE**, wood of the manufacturer's choice of species, or TFL of the manufacturer's choice of color.
    - **PREMIUM GRADE**, wood of a compatible species to the exposed.
  - **DECORATIVE LAMINATE** casework at all grades requires, TFL of the manufacturer's choice of color.
  - **CGS** (Compact Laminate) casework requires, CGS of the manufacturer's choice of color.
- **CONCEALED SURFACES** for all grades at, decorative laminate, wood, and CGS (Compact Laminate) casework require the manufacturer's choice.

CABINET CONSTRUCTION TERMINOLOGY / OPTIONS

FRAMELESS construction where the front edge of the cabinet body components are edgebanded.

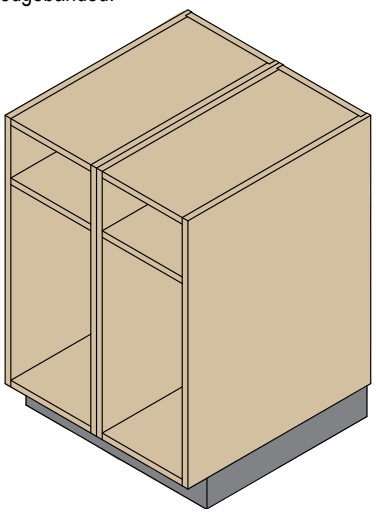

Figure: RG-229

FACE FRAME construction where the front edge of the cabinet body components are overlaid with a frame.

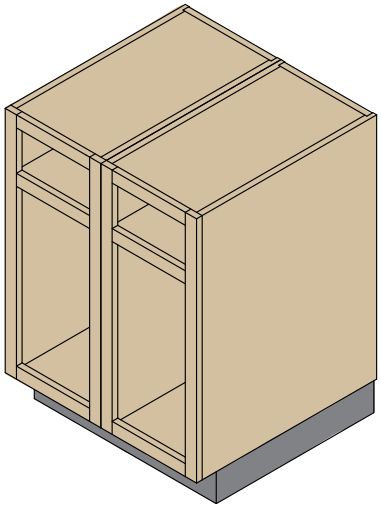

Figure: RG-230

SELECTION shall be manufacturer's choice, unless specified otherwise.

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CABINET and DOOR INTERFACE TERMINOLOGY / OPTIONS

FRAMELESS construction options include:

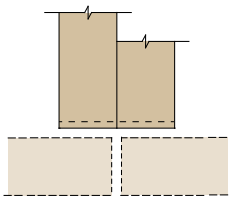

Figure: RG-231

Flush Overlay

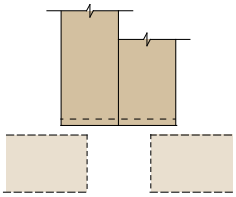

Figure: RG-232

Reveal Overlay

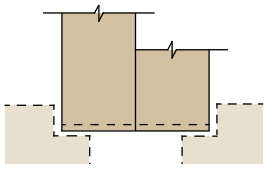

Figure: RG-233

Lipped

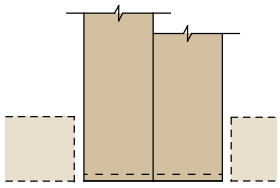

Figure: RG-234

Flush Inset

FACE FRAME construction options include:

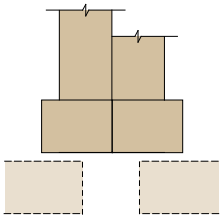

Figure: RG-235

Reveal Overlay

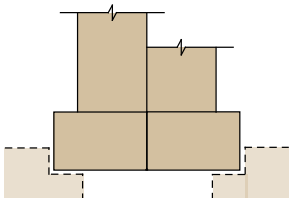

Figure: RG-236

Lipped

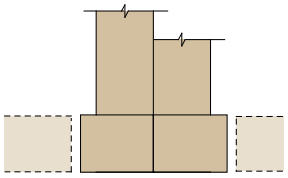

Figure: RG-237

Flush Inset

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LAYOUT REQUIREMENTS OF GRAINED OR PATTERNED FACES BY GRADE

- **STILE** and **RAIL** doors and drawer fronts for all Grades, drawer fronts shall run either vertically or horizontally at the manufacturer's choice for the entire project. Doors shall be vertical.

Figure: RG-238

Figure: RG-239

- **FLUSH PANEL** doors and drawer fronts:
  - **CUSTOM GRADE** - doors, drawer fronts, and false fronts shall run and match vertically within each cabinet unit.

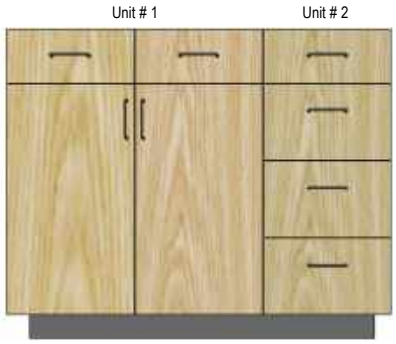

Figure: RG-240

  - **PREMIUM GRADE** - doors, drawer fronts, and false fronts shall run and match vertically and be sequenced horizontally within each cabinet unit; and at cathedral grain, the crown shall be pointing up and run in the same direction for the entire project. Doors, drawer fronts, and false fronts shall be well matched for color and grain across multiple cabinet faces in one elevation. Requirement for blueprint or sequencing between cabinet units must be so specified.

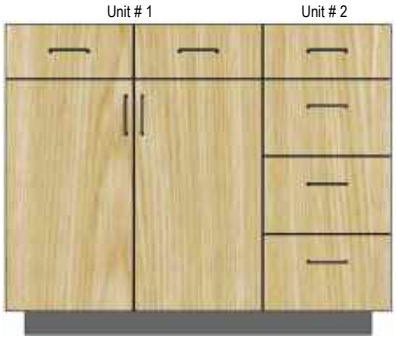

Figure: RG-241

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CASEWORK JOINERY REQUIREMENTS

TESTING - All methods of casework and drawer joinery provided for within NAAWS 4.0 have been tested and proven compliant to the unique NAAWS requirements outlined in the **APPENDIX**. These tests are unique to NAAWS and were created specifically for the needs of architectural woodwork casework, and drawers. The test procedures and their success establish the minimum acceptable level of integrity and performance for casework / drawer joinery and in wall blocking requirements incorporated within NAAWS 4.0.

These testing requirements meet or exceed the highest and most demanding performance levels of ANSI/AWI 0641-2019.

CASEWORK DIMENSION RANGES

These ranges have developed over time with consideration of materials, ergonomics, construction techniques, and general intended usage. The following are guidelines from historical experience. It is the responsibility of the design professional to coordinate accessibility requirements, appliance and equipment sizes, and/or storage requirements with the casework manufacturer and adjust their required dimensions accordingly. Please note that illustrations are not to scale and are provided only to show dimension reference point:

- **BASE**:
  - **HEIGHT** - from the finished floor to the top of the countertop deck ranges from:
    - **34" (864 mm) to 36" (914 mm)** at stand-up counters.
    - **31" (787 mm) to 38" (965 mm)** at vanities.
    - **28" (711 mm) to 32" (812 mm)** at sit down counters, providing a clear knee space height of 24-1/2" (622 mm).
    - **25-1/4" (641 mm) to 28" (711 mm)** at keyboard recesses, providing a clear knee space height of 24-1/2" (622 mm).
  - **DEPTH** - from the front of the cabinet door / drawer to the face of the wall ranges from 22" (559 mm) to 30" (762 mm).

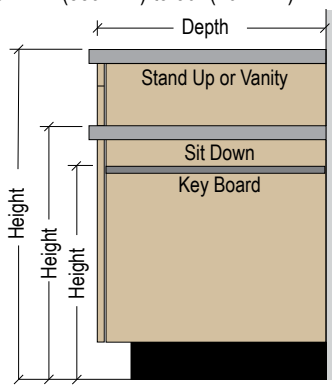

Figure: RG-242

CASEWORK DIMENSION RANGES (continued)

- **WALL HUNG:**
  - **HEIGHT** - including the light apron ranges from 12" (305 mm) to 48" (1220 mm).
  - **DEPTH** - from the front of the cabinet door to the face of the wall ranges from 12-1/2" (318 mm) to 14" (356 mm).

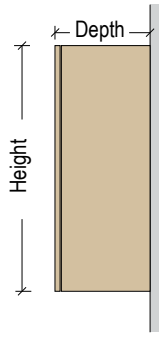

Figure: RG-243

- **TALL STORAGE:**
  - **HEIGHT** - from the finished floor to the cabinet top ranges from 72" (1829 mm) to 96" (2440 mm).
  - **DEPTH** - from the front of the cabinet door to the face of the wall ranges from 12-1/2" (318 mm) to 30" (762 mm).

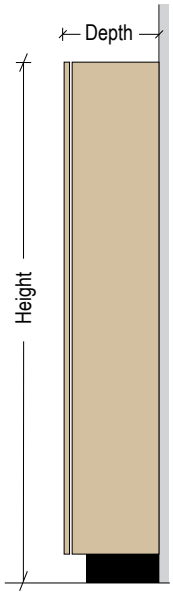

Figure: RG-244

- **RECEPTION COUNTER:**
  - **HEIGHT** - from the finished floor to the top of the countertop deck ranges from:
    - **34" (864 mm) to 42" (1067 mm)** at the standing side.
    - **28" (711 mm) to 32" (812 mm)** at the sit down-side, providing a clear knee space height of 24-1/2" (622 mm).
    - **25-1/4" (641 mm) to 28" (711 mm)** at the sit-down keyboard recesses, providing a clear knee space height of 24-1/2" (622 mm).
  - **DEPTH**:
    - **24" (610 mm) to 30" (762 mm)** overall countertop on the sit down-side, plus an additional 8" (203 mm) of countertop at the stand-up side.

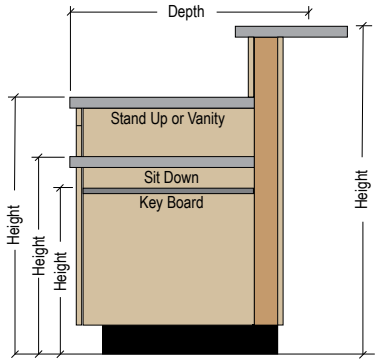

Figure: RG-245

- **TELLER COUNTER:**
  - **HEIGHT** - from the finished floor ranges from:
    - **50" (1270 mm) to 54" (1372 mm)** on the customer side at the security hood.
    - **40" (1016 mm) to 42" (1067 mm)** on the teller's side transaction countertop.
  - **DEPTH**:
    - **24" (610 mm) to 32" (813 mm)** at the countertop on the teller side, plus an additional 8" (203 mm) of countertop at the customer side.

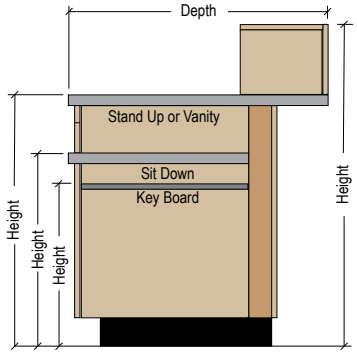

Figure: RG-246

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DOOR AND APPLIED DRAWER FRONT PROFILES

For illustration purposes only and are not intended to be duplicated exactly:

- Common **EDGE PROFILES:**
  - Square edge with thin applied edgeband.

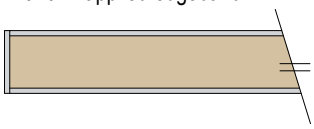

Figure: RG-247

  - Radius edge with thick applied edgeband.

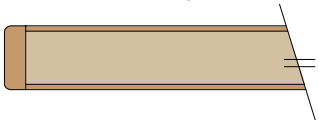

Figure: RG-248

  - Square edge with thick applied edgeband.

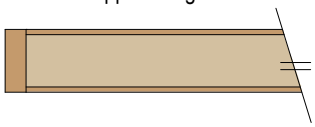

Figure: RG-249

  - Square edge with inset edgeband.

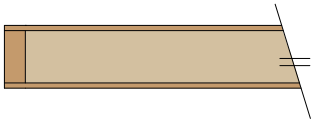

Figure: RG-250

  - Lipped edge with inset edgeband:

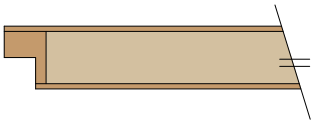

Figure: RG-251

To **PREVENT TELEGRAPHING**, inset solid wood edging when used must have similar moisture content as panel core, be glued securely and calibrated with panel core thickness prior to being laminated with a wood veneer on both faces.

- Common **RETENTION PROFILES**:
  - Fixed panel.

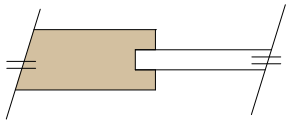

Figure: RG-252

  - Removable stop.

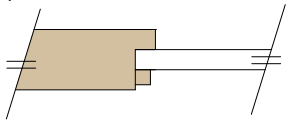

Figure: RG-253

  - Removable stop at HPL face.

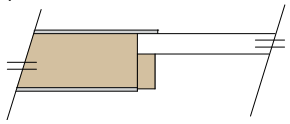

Figure: RG-254

  - Removable stop, synthetic.

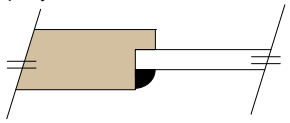

Figure: RG-255

  - Removable retainer, synthetic.

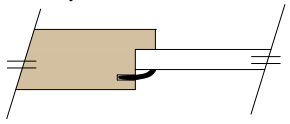

Figure: RG-256

  - Removable clips.

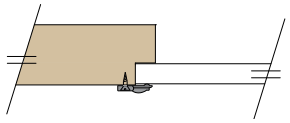

Figure: RG-257

CASEWORK (continued)

CABINET DESIGN SERIES (CDS)

Details were developed by the industry and represent a series of numbered cabinet designs that are available for ease of specification and drawing. A numerical / elevation key to the CDS may be found in the **APPENDIX.** CAD details are available in both Autodesk Revit Families and AutoCAD ".dwg / .dxf" files and may be found at naaws.com.

These cabinets may be specified by number to a specific size requirement on the plan view drawings without having to draw elevations. They are drawn as Frameless Construction, flush overlay Interface', with integral finished ends and scribes at wall to wall installations not exceeding 1-1/2" (38.1 mm) in width.

CASEWORK INTEGRITY

These standards have adopted several requirements methods of testing and acceptable results as the minimum acceptable level of integrity for casework, as found in the **APPENDIX**.

CABINET HARDWARE

These standards have adopted ANSI/BHMA Standards (latest editions) buildershardware.com, Grade 2, as the basic minimum requirement. For more specific details, see the **PRODUCT** portion of this Section. Choice of product should be based on utility, aesthetics, security objectives, and the end use desired. As a general guide:

- **GRADE 1** is the highest and is suitable for most institutional applications.
- **GRADE 2** is used in most other applications.

DRAWER SLIDE SELECTION GUIDE

The following serves as both a checklist and a starting point for the discussion of a wide variety of drawer slide systems. While by no means exhaustive, the characteristics described below are often considered the most important by the client, the design professional, and the woodwork manufacturer. The selection of the slide characteristics will affect the usefulness of the cabinets. Careful consideration should be given to avoid "over specifying" for the purpose intended:

- **DEGREE OF EXTENSION:**
  - **Standard Extension**, all but 4" - 6" (102 - 152 mm) of drawer body extends out of the cabinet.
  - **Full Extension**, entire drawer body extends out to the face of cabinet.
  - **Full Extension** with over travel, entire drawer body extends beyond the face of cabinet.
- **STATIC LOAD CAPACITY**:
  - **50 pounds - R**esidential and light commercial.
  - **75 pounds** - Commercial.
  - **100 pounds** - Heavy duty.
  - **Over 100 pounds** - Special conditions, extra heavy duty.
- **DYNAMIC LOAD CAPACITY**:
  - **30 pounds/35,000 cycles** - Residential and light commercial.
  - **50 pounds/50,000 cycles** - Commercial.
  - **75 pounds/100,000 cycles** - Heavy duty.
- **REMOVAL:**
  - **Passive disconnect** - A means of drawer removal that does not require active disconnecting.
  - **Positive disconnect** - A means of removing a drawer that requires active disconnection or removal of hardware.
- **CLOSING:**
  - **Self-closing / stay closed** - Drawer slides will self-close with the related dynamic load when the drawer is 2" (50.8 mm) from the fully closed position and not bounce open when properly adjusted.
- **METAL SIDED DRAWER SYSTEMS** must be specified and should require:
  - **Positive stop** - Drawer must stop within itself and not rely on the drawer front to stop it.
  - **Pullout strength** - System must demonstrate sufficient strength of attachment of front to sides, design professional should evaluate and approve individually.

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HINGE SELECTION GUIDE

Architectural cabinet hinges will usually be furnished from the manufacturer's stock unless otherwise specified. The three most common hinge types are illustrated below.

European hinges with the screws set in synthetic inserts are an established industry standard. These hinges have been found to be cost effective alternatives to the more traditional hinges shown below. Follow hinge material suppliers' recommendations on number and spacing of hinges. There are conditions, however, in which the use of butt or wraparound hinges will continue to be the best solution. Pivot hinges often require a cut in center hinge. Consult material supplier's recommendations:

- **European style hinge**, typically used in conventional flush without face frame and reveal or flush overlay application offering moderate strength, full concealment, moderate cost, ease of installation and adjustment.

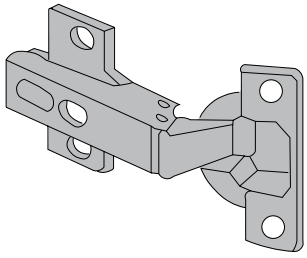

Figure: RG-258

- **Wraparound hinge (3 & 5 knuckle)**, typically used in flush and reveal overlay applications offering very high strength; however, can require mortising and shows an exposed knuckle and hinge body. Field adjustment is difficult.

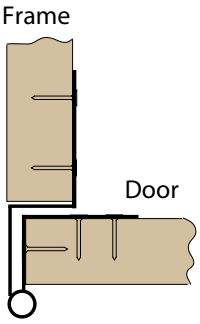

Figure: RG-259

- **Butt hinge**, typically used in conventional flush with face frame application, offering high strength, low cost, moderate ease of installation and adjustment; however, can require mortising and shows an exposed knuckle.

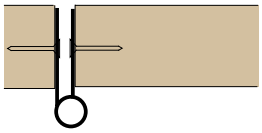

Figure: RG-260

ADJUSTABLE SHELF LOADING and DEFLECTION

Proper specification can balance aesthetic needs with load requirements.

Load is the total applied weight, uniformly dispersed on an individual shelf, not to exceed 200 lbs. (90.7 Kg) on any one shelf. These standards have adopted the following load capacities:

- **50 lbs. per sq. ft (244.1 kg/m2)** - School, hospital, library or book shelving.
- **40 lbs. per sq. ft (195.3 kg/m2)** - All other shelving.

Shelving specification requires consideration of deflection, the measured distance from a straight line that a shelf will deflect under load. L/144 (the length of the shelf divided by 144) is the industry standard for the maximum acceptable deflection of a shelf, which permits 1/4" (6.4 mm) deflection in a 36" (914 mm) shelf.

Creep is the increase in deflection over time, which fluctuates with temperature, humidity, and load stress. Creep is not considered a defect; if it is a concern, it can be reduced by:

- Reduced loading of shelves.
- Use of material with a higher (stiffer) modulus of elasticity (MOE).
- Use of alternate construction (support) techniques.
- Use of a decreased factor of acceptable deflection.

CONSTRUCTION DETAIL NOMENCLATURE

Familiarity with the labeled details on this and following pages will facilitate communication between architects, designers, specifiers, and woodwork manufacturers by establishing common technical language:

- **Stub Tenon** - Joinery method for assembling stile and rail type frames that are additionally supported, such as web or skeleton case frames.

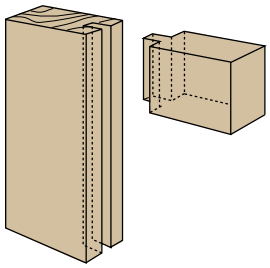

Figure: RG-261

- **Haunch Mortise and Tenon Joint** - Joinery method for assembling paneled doors or stile and rail type paneling.

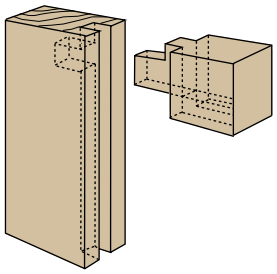

Figure: RG-262

- **Conventional Mortise and Tenon Joint** - Joinery method for assembling square edged surfaces such as case face frames.

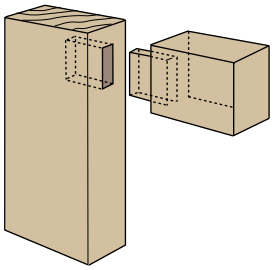

Figure: RG-263

- **Dowel Joint** - Alternative joinery method serving same function as Conventional Mortise and Tenon.

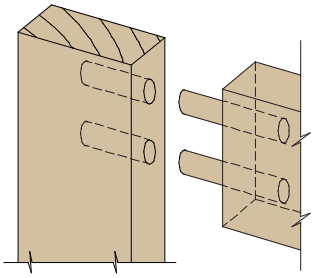

Figure: RG-264

- **French Dovetail Joint** - Method for joining drawer sides to fronts when fronts conceal metal extension slides or overlay the case faces.

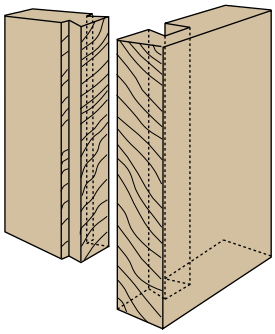

Figure: RG-265

- **Conventional Dovetail Joint** - Traditional method for joining drawer sides to fronts or backs. Usually limited to flush or lipped type drawers.

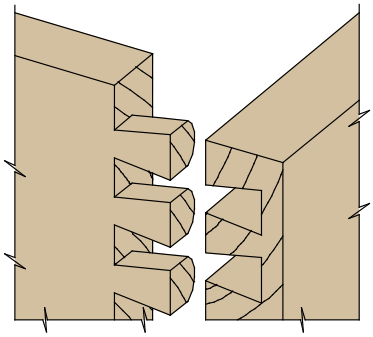

Figure: RG-266

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CONSTRUCTION DETAIL NOMENCLATURE (continued)

- **Drawer Lock Joint** - Another joinery method for joining drawer sides to fronts. Usually used for flush type installation but can be adapted to lip or overlay type drawers.

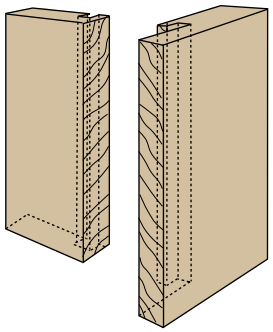

Figure: RG-267

- **Exposed End Details** - Illustrates attachment of finished end of case body to front frame using:
  - **Butt Joint**

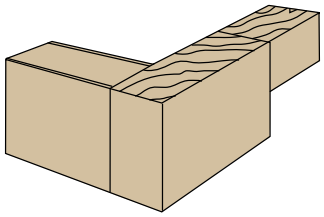

Figure: RG-268

  - **Shoulder mitered joint.**

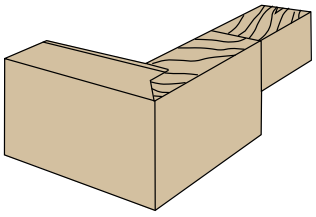

Figure: RG-269

- **Pocket Screw Joint.**

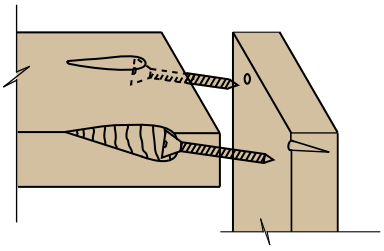

Figure: RG-270

- **Through Dado -** Conventional joint used for assembly of case body members. Dado not concealed by application of case face frame.

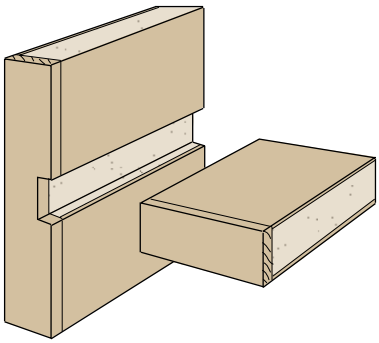

Figure: RG-271

- **Blind Dado** - Variation of Through Dado with applied edge "stopping" or concealing dado groove.

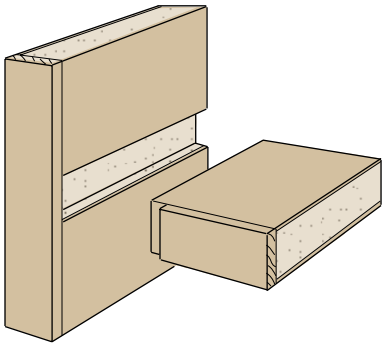

Figure: RG-272

- **Stop Dado** - Another method of concealing dado exposure. Applicable when veneer edging or solid lumber is used. Exposed end detail illustrates attachment of finished end of case body to front frame using butt joint.

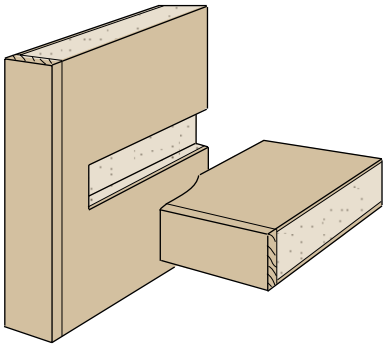

Figure: RG-273

SUGGESTION

RESOURCE GUIDE

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A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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CONSTRUCTION DETAIL NOMENCLATURE (continued)

- **Dowel Joint** - An established industry standard assembly method, this versatile joinery technique is often based on 1-1/4" (31.8 mm) spacing of dowels.

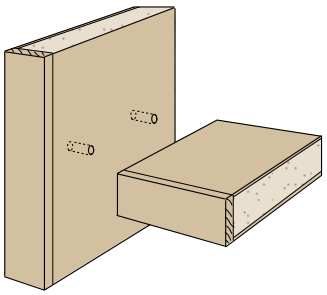

Figure: RG-274

- **Dowel Screw Joint** - An alternative to the dowel joint above.

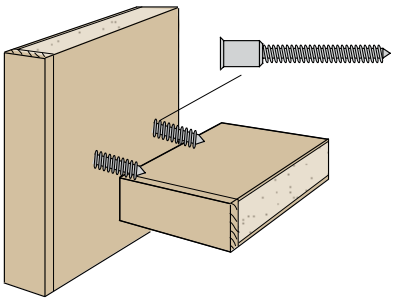

Figure: RG-275

- **Edgebanding** - Method of concealing plies or inner cores of plywood or particleboard when edges are exposed. Thickness or configuration will vary with manufacturers' practices.

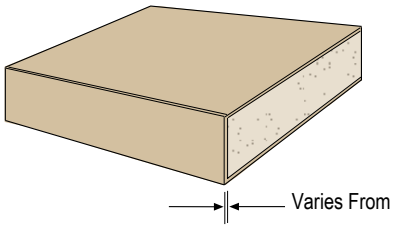

Figure: RG-276

- **Miter / Miter Fold Joint.**

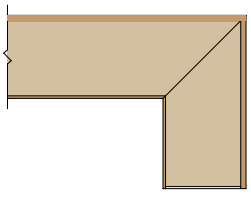

Figure: RG-277

- **Spline Joint:** Used to strengthen and align faces when gluing panels in width or length, including items requiring site assembly.

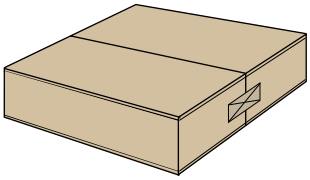

Figure: RG-278

- **Paneled Door Details** - Joinery techniques when paneled effect is desired. Profiles are optional as is the use of flat or raised panels. Solid lumber raised panels may be used when width does not exceed Custom Grade standard. Rim raised panels are required for Premium Grade or when widths exceed Custom Grade or when transparent finish is used.

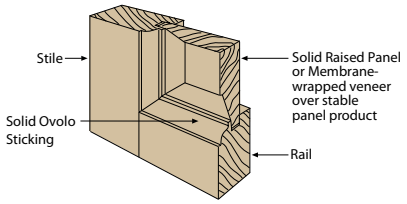

Figure: RG-279

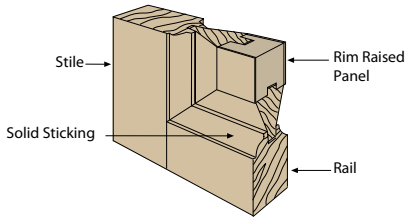

Figure: RG-280

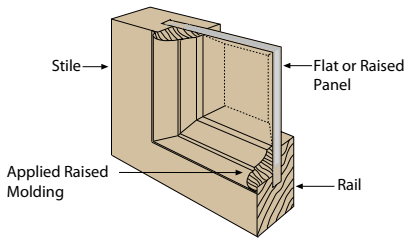

Figure: RG-281

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CASEWORK REFURBISHING

RE-FINISH, RE-FACE or RE-FURBISH IN GENERAL

THIS TYPE OF WORK IS TYPICALLY REQUIRED TO BE DONE IN THE FIELD AND WITHOUT SPECIFIC CONTRACT DOCUMENT REQUIREMENTS TO THE CONTRARY:

- Will not update any seismic fabrication and/or installation deficiencies.
- Lead and/or toxic material abatement will not be the responsibility of the woodwork manufacturer / installer.

SPECIFICATIONS

Shall clearly indicate whether refinishing, refacing, refurbishing, or a combination thereof is required.

ARCHITECTURAL PLANS

Shall clearly indicate all casework to be refinished, refaced, and/or refurbished. The casework elevations shall also indicate any unusual or special requirements (such as structural repair or component replacement).

It is the design professional's responsibility to specify any and all modifications required for code compliance.

Including the means, methods, and materials required to retrofit casework for IBC Title 24 or other national compliance code(s).

The requirement for reinstallation of existing casework (if needed to be removed), in a manner other than the original, shall be so specified.

If new or additional wall blocking is required, it shall be so specified and be the responsibility of the contractor.

All refinishing, refacing, and/or refurbishing of casework governed by these standards shall generally be in accordance with these standards as applicable, with the following exception:

- Repair or modification of existing casework shall be in compliance with accepted methods of joinery as contained in these standards.

The method of repair used shall be optional with the manufacturer / installer.

REFINISHING

Can be as simple as the application of a new finish over the existing cabinet surfaces or as extensive as the removal of the existing finish, repair or patch of all physical defects, and the application of a new finish; however: does not include the replacement of hardware, unless so specified.

REFACING

Is usually more involved and very field labor intensive. Exposed surfaces to be refaced include doors, drawer fronts, cabinet face, and finished ends:

- **IF HPL**, shall be removed with any damaged core areas repaired and core surface suitably prepared for proper adhesion of the new surface material. Or resurfaced with a laminate with a peel and stick adhesive especially formulated for resurfacing existing HPL or TFL surfaces.
- **IF PAINT**, shall be stripped to the original surface with any damaged areas repaired and resurfaced with the specified material.

Does not include the refacing of cabinet interiors (semi-exposed surfaces) or replacement of hardware, unless so specified.

REFURBISHING

Includes either the refinishing or refacing of the exterior cabinet body, replacement of the cabinet doors and drawer fronts, and replacement of all exposed cabinet hardware, including hinges, pulls, catches, and locks; however:

- It does not include the repair or replacement of interior components such as shelves, drawer boxes, or drawer slides unless so specified.

New components, such as doors, drawer fronts, drawer boxes, and shelves, shall be compliant to these standards.

Gaps and tolerances shall match that of the existing casework within an elevation and within a room.

Hardware replacement for refurbished casework, or when specified to be included with refinishing or refacing, shall include door hinges, door and drawer pulls, and locks (keying requirement to be as specified).

Drawer slide replacement is not included unless specifically required in the contract documents.

Match of existing hardware is contingent on the availability of such from a manufacturer's current stock.

The method of repair or patching of tear outs used for proper hardware replacement shall be optional with the manufacturer / installer.

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INTRODUCTION

Section 11 includes information on Countertops and Windowsills manufactured of Wood, HPL, Solid Surface, Engineered Stone, Epoxy Resin, CGS (Compact Laminate) and Natural Stone Products and their related parts.

TYPICAL COUNTERTOP CONFIGURATIONS

- **HPL edged HPL** - This type of top consists of HPL over a stable core, with an applied HPL edge.

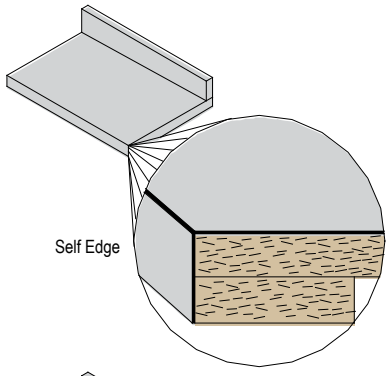

Figure: RG-282

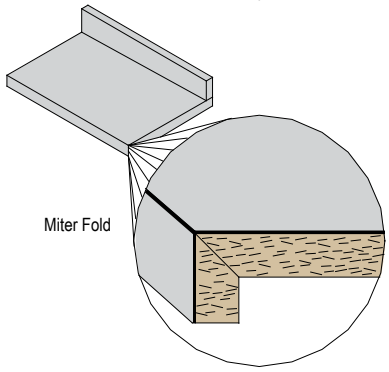

Figure: RG-283

- **Post formed HPL** - This type of top consists of HPL formed with heat and pressure over a stable core typically with a coved integral backsplash and must be specified.

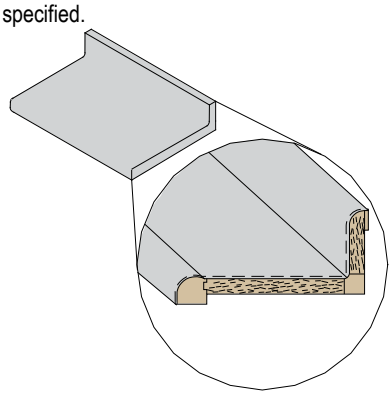

Figure: RG-284

- **Mixed Material** - This type of top may consist of a mixture of materials, such as wood, HPL, inlays, etc.

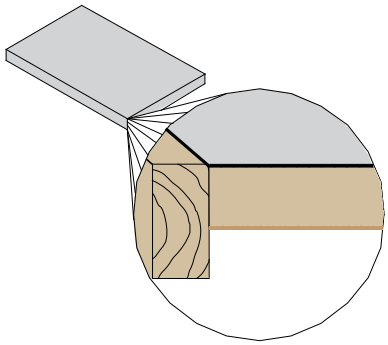

Figure: RG-285

- **Solid Surface** - This type of top requires special fabrication techniques, depending upon the composition of the product: however, its ability to produce inconspicuous seams allows for a variety of edge detail and thicknesses. Veined / swirled solid surface may have random patterns that cannot be matched at seams. Pattern breaks, changes and color variations may occur, and will not be considered a defect in materials or workmanship. Many manufacturers fabricate and install the product which must be specified by brand name, color / pattern and thickness. Typically, only available in 1/2" (12.7 mm) nominal thickness.

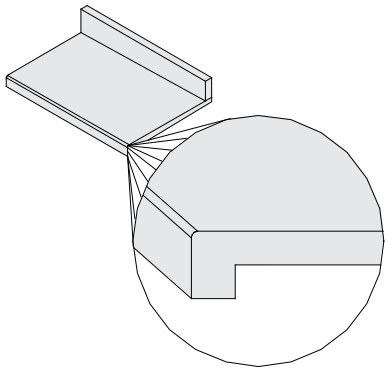

Figure: RG-286

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

TYPICAL COUNTERTOP CONFIGURATIONS (continued)

- **CGS (Compact Laminate) -** This type of top is a thick HPL, typically 1/4" to 1" in thickness, CGS features higher impact, moisture, scratch and abrasion resistance. Brand, color/pattern, and thickness must be specified.

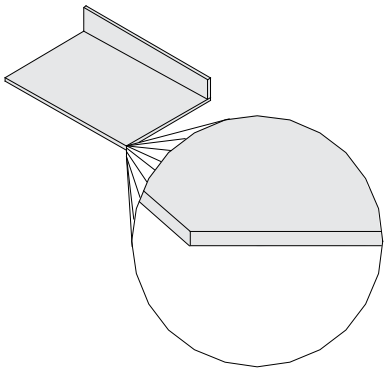

Figure: RG-287

- **Stone** - This type of top requires special fabrication techniques, depending upon the composition of the product. **Veined / swirled** stone may have random patterns that cannot be matched at seams. Pattern breaks, changes and color variations may occur, and will not be considered a defect in materials or workmanship. Many manufacturers fabricate and install the product which must be specified by brand name, color / pattern and thickness.
  - **Engineered** stone (Quartz) - Is non-porous and does not typically require sealing.
  - **Natural** stone - Is porous and requires sealing.

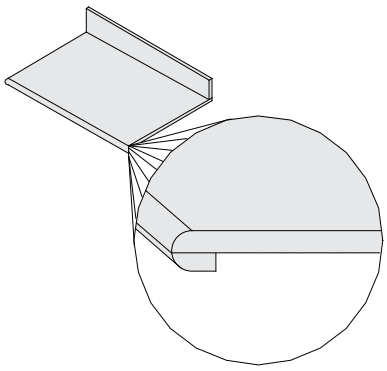

Figure: RG-288

- **Solid Laminated Wood** - This type of top consists of narrow strips of wood, face glued together, like "butcher block," but custom manufactured to contract documents.

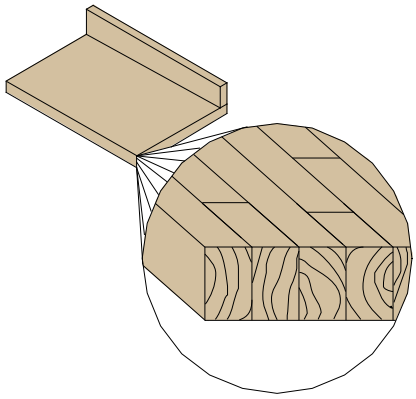

Figure: RG-289

- **Solid Wood** - This type of top consists of boards edge glued to a desired width. In this kind of top there is no assurance of matching grain or color at the edges or individual ends of the boards.

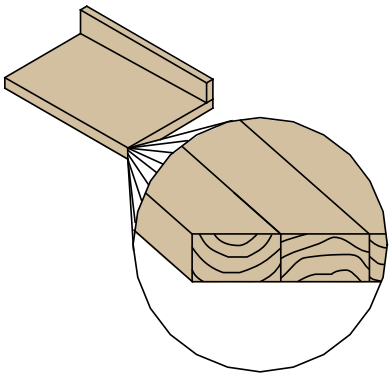

Figure: RG-290

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TYPICAL COUNTERTOP CONFIGURATIONS (continued)

- **Wood Veneer** - This type of top consists of wood veneer laid up over a stable core, veneer edged, solid wood edged or with an applied decorative edge of another material as specified.

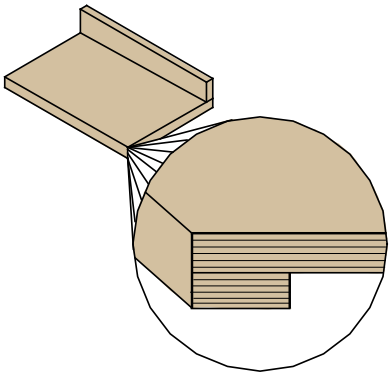


Figure: RG-291

- **Epoxy Resin** - Specially formulated resin tops designed to resist harsh chemicals. Must be specified by brand name and material supplier.

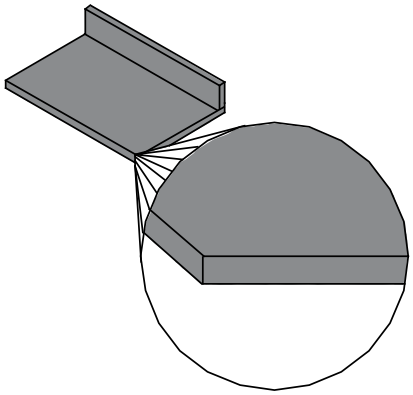
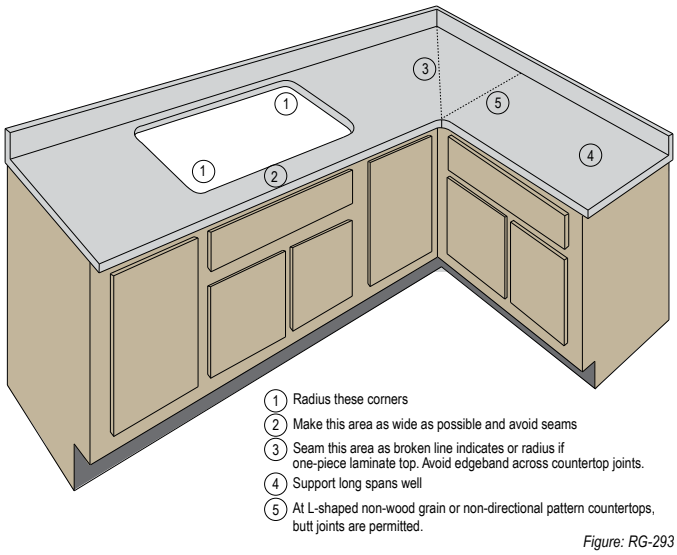


Figure: RG-292

GUIDELINES FOR FABRICATION / INSTALLATION OF HPL COUNTERTOPS

The following was taken in part from the National Electrical Manufacturers Association (NEMA), nema.org.

- When making a cutout (as for electrical receptacles, ranges, sinks, grills, windows, chopping blocks, L shaped counter tops, and so forth), inside corners should be smoothly rounded using a minimum comer radius of 1/8" (3.2 mm). A router is an ideal tool for making cutouts.
- When removing large areas from a sheet of laminate (e.g., a sink cutout), the connecting strips between the remaining areas should be left as wide as possible.
- Factory-trimmed sheet edges and saw-cut edges should be routed and filed. Original edges on factory cut laminates are not finished edges since oversized laminates are supplied to allow for proper fabrication.



1. Radius these corners
2. Make this area as wide as possible and avoid seams
3. Seam this area as broken line indicates or radius if one-piece laminate top. Avoid edgeband across countertop joints.
4. Support long spans well
5. At L-shaped non-wood grain or non-directional pattern countertops, butt joints are permitted.

Figure: RG-293

- All chips, saw marks, and hairline cracks should be removed from cuts by filing, sanding, or routing.
- Backsplash seam areas on countertops which are exposed to spilled water or other fluids should be sealed with caulking to ensure a tight seal.
- When laminate is bonded to a core, precaution should be taken to prevent warping of the assembly. Laminates used on shelves or in long unsupported spans should make use of a backer. A thick backer (approximately the same thickness as the face sheet), can provide more stability than a thin backer. Thicker laminates can offer better dimensional stability and resistance to stress (corner) cracking.
- Paint, varnish, vinyl film, and fiber backers will not balance HPL.
- Before using nails or screws, oversized holes should be drilled through the laminate with a sharp drill bit.

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TYPICAL PROBLEMS AT HPL COUNTERTOPS - CAUSES AND PREVENTION

Some of the problems that may arise after laminates have been fabricated and installed are the following:

- **Cracking of the laminate at corners and around cutouts** may be caused by improper climate control, improper bonding and, sometimes, poor planning, or combination of these reasons. Cracking may be caused by shrinkage; proper climate control helps to prevent it. Rough edges, inside corners that have not been rounded, binding and/or forced fits can contribute to cracking. If the seams are properly placed in the layout of the laminate, stresses can be minimized.

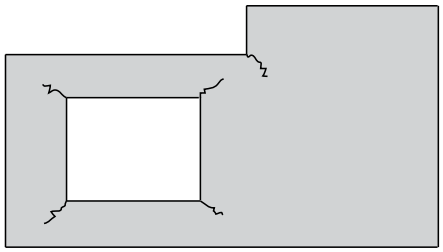

Figure: RG-294

- **Separation of the laminate** from the core may generally be caused by a poor adhesive bond. The bonding procedure should be reviewed with close attention to uniform glue line, uniform pressure and cleanliness of mating surfaces. If the edges fail to bond, extra adhesive may be applied and the product re-clamped.

  Some cleaning agents, excess heat, and moisture can contribute to bond failure at joints and edges.

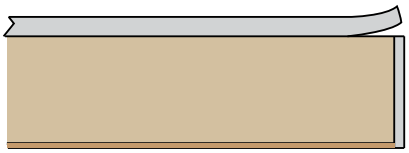

Figure: RG-295

- **Warping of the assembly** may be generally caused by unbalanced construction or unbalanced glue lines. Proper HPL backer sheets should be chosen and aligned so that their grain direction is parallel to that of the face laminate. Proper gluing is also important. If the core is secured to a framework, the framework should be designed to hold the assembly to a flat plane. Conditioning is also helpful.

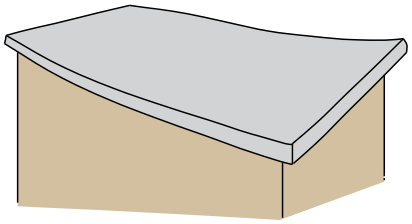

Figure: RG-296

- **Blistering or Bubbling** of the laminate surface away from the core can be caused by excessive heat, starved glue line, improper conditioning, and inadequate pressure or drying. Use of a PVA glue line and pressure over clean, conditioned laminates and core might have prevented the problem.

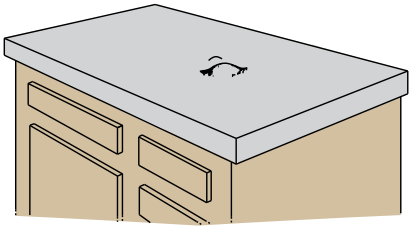

Figure: RG-297

  The forming of a blister or bubble over a small area, often accompanied by a darkening of the laminate can be caused by continual exposure to a source of heat. Electrical appliances which produce heat and light bulbs should not be placed in contact with or close proximity to laminate surfaces.

- **Repeated Heating** may cause the laminate and adhesive to react and finally deteriorate after continual exposure to temperatures above 150˚ F (66° C).

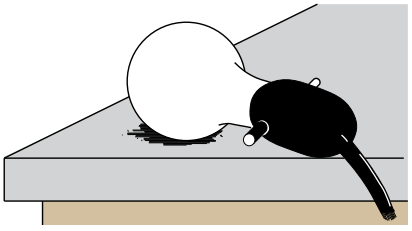

Figure: RG-298

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TYPICAL PROBLEMS AT HPL COUNTERTOPS - CAUSES AND PREVENTION (continued)

- **Cracking of the laminate in the center of the sheet** may be caused by flexing of the core when it covers a wide span or by spot gluing. Wide spans call for sturdy framework, and special attention should be given to the uniformity of glue lines and gluing pressures. Also, care should be taken to avoid trapping foreign objects between the laminate and the core.

  Cantilevered overhangs should be designed with appropriate supports.

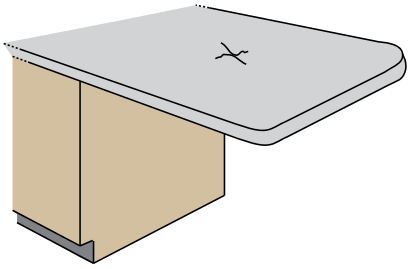

Figure: RG-299

  Long, unsupported spans should be avoided. A wide variety of engineering solutions are available.

CHEMICAL or STAIN RESISTANCE

Requirements must be specified. Consider the chemical and staining agents that might be used on or near the surfaces. Chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping, and other factors; it is recommended that actual samples are tested in a similar environment with those agents. Common guidelines can be found by referring to:

- ISO 4586 (latest edition) for chemical resistance.
- ASTM D3023 and C1378 (latest editions) for stain resistance.
- SEFA #3 - Recommendations for work surfaces.
- SEFA #8 - PH, PL and W - Recommendations for CGS Compact Laminate, HPL and wood casework.

ABRASION RESISTANCE

Requirements must be specified. When abrasion resistance requirements are a concern, users should consider the abrasive elements that might be used on or near the countertop surfaces. Common guidelines can be found in:

- ASTM C501 (latest edition)
- ISO-4586 (latest edition)

CLEANING

For typical cleaning:

- Use a clean, damp, nonabrasive cotton cloth and a mild liquid detergent or household cleaner. Clean the soiled area using a rotating motion.
- Next, rinse with clean water, using a clean, non-abrasive cotton cloth. Please take care not to flood laminate, especially near seams, since water can penetrate and cause the substrate to swell.
- Dry the surface with a soft, clean, non-abrasive cotton cloth

Persistent or **tougher stains** may require a solvent or abrasive cleaner – consult the supplier's documentation specific to the surface to avoid damage.

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HPL COUNTERTOPS

- **WHITE BACKGROUND PAPER** is utilized in some HPLs to achieve the high fidelity, contrast, and depth of color of their printed pattern, leaving a white line at exposed edges that is extremely noticeable with darker colors.
- **FLAME SPREAD RATED** - Class A Flame Spread Architectural HPL countertops are available. Countertops desired to be certified as a flame spread rated assembly (versus simply having been built with a flame spread rated laminate surface) shall be specified as a "Class A Flame spread Rated HPL Countertop."

  The term "Class A Flame spread Rated HPL Countertop" shall mean that the entire countertop assembly, including surface HPL, backer, core, and adhesive, has been tested and certified as to its Class A Flame spread Rating by an authorized organization, such as Underwriters Laboratories, and must be manufactured by an approved company of the certifying agency.

  Manufacturers of "Class A Flame Spread Rated Countertop Assemblies" require specific methods of installation and trimming in order to label and certify their product. Design professionals desiring to use a "Class A Flame Spread Countertop Assembly" should coordinate with an approved manufacturer during the design stage.

- **COUNTERTOP CONFIGURATION OPTIONS:**
  - **Matching Edge with No Splash**

Figure: RG-300

  - **Matching Edge with Butt Splash**

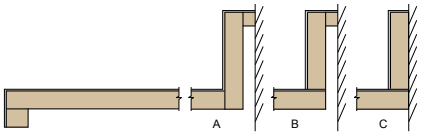

Figure: RG-301

  - **Matching Edge with Coved Splash**

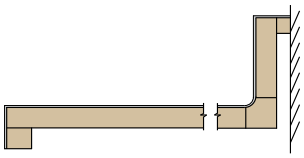

Figure: RG-302

  - **Post Formed Edge with No Splash**

Figure: RG-303

  - **Post Formed Edge with Butt Splash**

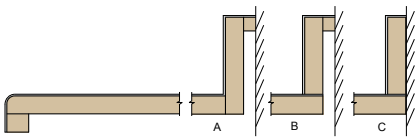

Figure: RG-304

  - **Post Formed Edge with Coved Splash**

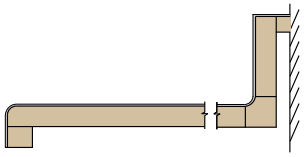

Figure: RG-305

  - **Fully Formed with Coved Splash**

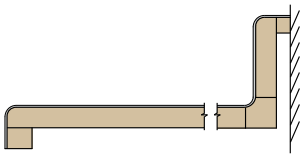

Figure: RG-306

  - **No-drip / Lipped Edge with Coved Splash**

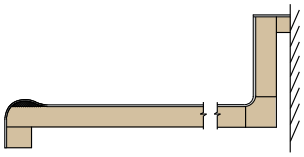

Figure: RG-307

  - **Wood Edge with No Splash**

Figure: RG-308

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HPL COUNTERTOPS (continued)

- **OPTIONS AT TOP OF SPLASH:**
  - **Waterfall with Scribe**

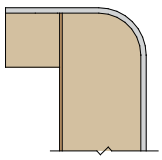

Figure: RG-309

  - **Square with Scribe**

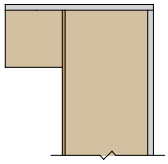

Figure: RG-310

  - **Square**

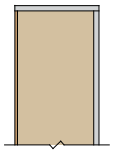

Figure: RG-311

- **DECK OPTIONS AT SPLASH:**
  - **Horizontal Butt**

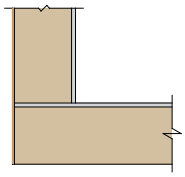

Figure: RG-312

  - **Vertical Butt**

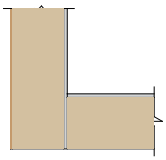

Figure: RG-313

  - **Coved**

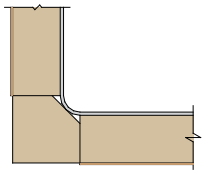

Figure: RG-314

- **FRONT EDGE OPTIONS:**
  - **Matching Edge with Wide Build Up**

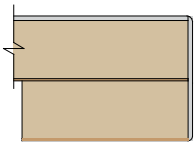

Figure: RG-315

  - **Matching Edge with Narrow Build Up**

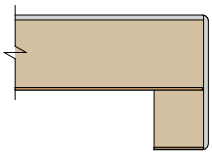

Figure: RG-316

  - **Matching Edge with Drip Groove**

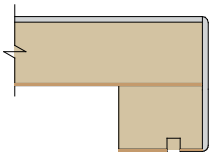

Figure: RG-317

  - **Waterfall**

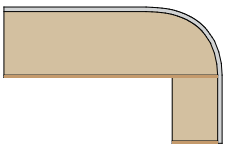

Figure: RG-318

  - **No Drip / Lipped Edge**

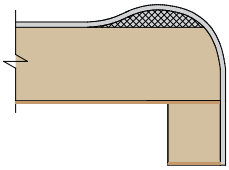

Figure: RG-319

  - **Full Round**

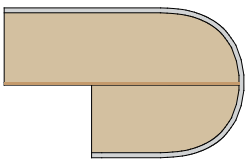

Figure: RG-320

CG TC

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HPL COUNTERTOPS (continued)

- **FRONT EDGE OPTIONS:**
  - **Solid Wood Edgeband w/ V Groove**

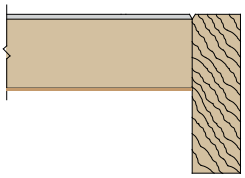

Figure: RG-321

- **Solid Wood Edgeband w/o V Groove**

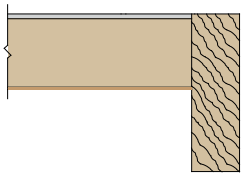

Figure: RG-322

  - **Solid Wood Edgeband with Overlaid Laminate**

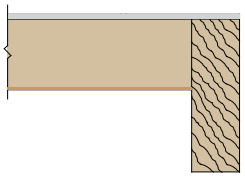

Figure: RG-323

  - **Miter Fold**

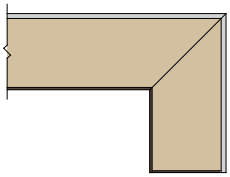

Figure: RG-324

  - **Thick PVC Edgeband**

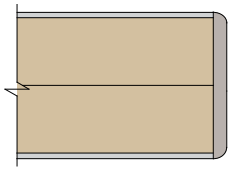

Figure: RG-325

  - **T Mold Edgeband**

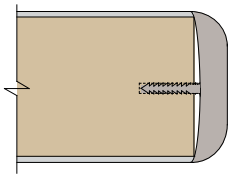

Figure: RG-326

- **TYPICAL MECHANICAL TIGHT JOINT FASTENER:**

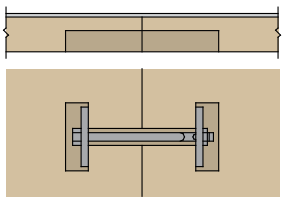

Figure: RG-327

SUGGESTION

RESOURCE GUIDE

CG TC

A B C D E F G H I J K L M N O P Q R S T U V W X, Y, Z

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SOLID SURFACE COUNTERTOPS

- **COLOR** and **PATTERN MATCH -** Some slight color variation may exist from sheet to sheet, sheet to bowl, or sink products. In sheet stock, use of the same batch material will reduce these variations.
- **REPAIRS -** When allowed, repairability varies from material to material and may be visible.
- **PRECAUTIONS -** Product dimensions are nominal. If tolerances are critical, review them with your manufacturer and/or installer.
- **MACHINABILITY**- is an issue with some materials and shall be taken into consideration on selection.
- **CONFIGURATION OPTIONS:**
  - **Built Up Edge**

Figure: RG-328

  - **Built Up Edge with Butt Splash**

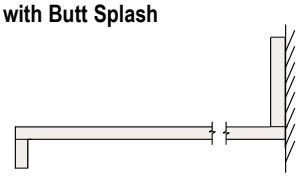

Figure: RG-329

  - **Built Up Edge with Coved Splash**

Figure: RG-330

- **TOP OPTIONS AT SPLASH:**
  - **Waterfall**

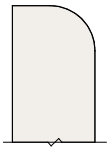

Figure: RG-331

  - **Square**

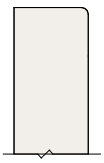

Figure: RG-332

- **DECK OPTIONS AT SPLASH:**
  - **Butt**

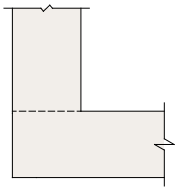

Figure: RG-333

  - **Coved**

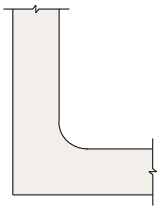

Figure: RG-334

- **EDGE OPTIONS:**
  - **Waterfall**

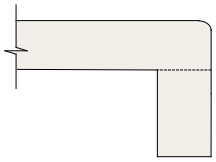

Figure: RG-335

  - **No-drip Lipped**

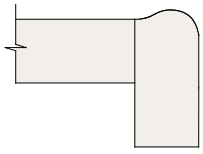

Figure: RG-336

  - **Build Up with Drip Groove**

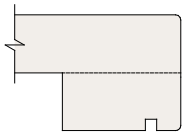

Figure: RG-337

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CGS (Compact Laminate), EPOXY RESIN, AND NATURAL / ENGINEERED STONE COUNTERTOPS

- **CONFIGURATION OPTIONS:**
  - **Butt Splash**

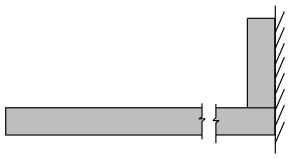

Figura: RG-338

  - **Build Up**

Figure: RG-339

  - **Build Up with Butt Splash**

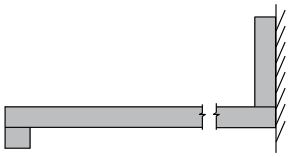

Figure: RG-340

- **TOP AND DECK OPTIONS AT SPLASH:**
  - **Waterfall**

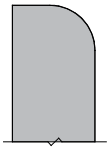

Figure: RG-341

  - **Square**

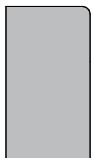

Figure: RG-342

  - **Butt**

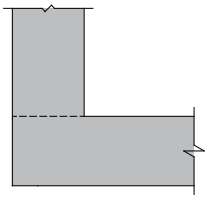

Figure: RG-343

  - **Removable Ledge**

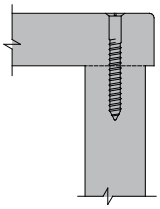

Figure: RG-344

- **EDGE OPTIONS:**
  - **Drip Groove**

Figure: RG-345

  - **Marine Edge**

Figure: RG-346

  - **Waterfall**

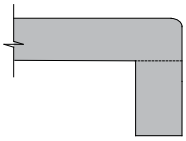

Figure: RG-346

  - **Champher Edge**

Figure: RG-348

  - **Bull Nose Edge**

Figure: RG-349

  - **Build Up with Drip Groove**

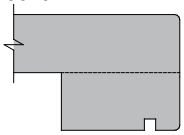

Figure: RG-350

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WOOD COUNTERTOPS

- **CONFIGURATION OPTIONS:**
  - **Solid Butcher Block**

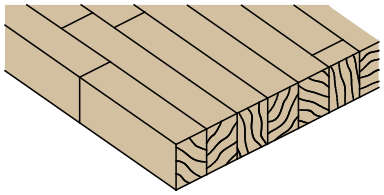

Figure: RG-351

  - **Solid Wide Width**

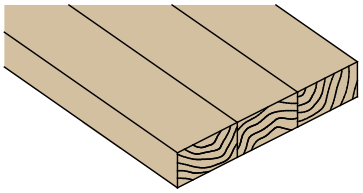

Figure: RG-352

  - **Solid, Splined Wide Width**

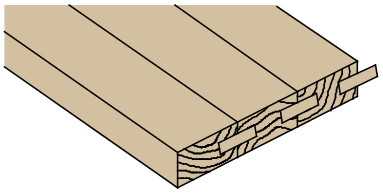

Figure: RG-353

  - **Veneer Edgebanded**

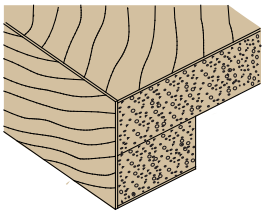

Figure: RG-354

  - **Solid Edgebanded**

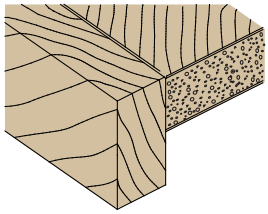

Figure: RG-355

  - **Solid Edgebanded with Overlaid Veneer**

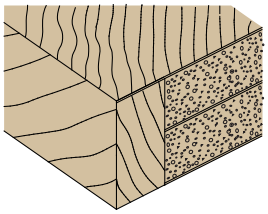

Figure: RG-356

TO PREVENT TELEGRAPHING, inset solid wood edging when used must have similar moisture content as panel core, be glued securely and calibrated with panel core thickness prior to being laminated with a wood veneer on both faces.

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HISTORIC RESTORATION

INTRODUCTION

The United States Department of the Interior (doi.gov/), the National Park Service (nps.gov/), and the Historic Sites and Monuments Board of Canada (parkscanada.gc.ca/) publish documents related to work under their jurisdiction. The most recent publications from these entities will provide valuable information for the design professional and the woodwork fabrication, finishing, and installation.

The rationale and intent of this section is to assist in compliance with the U.S. Secretary of the Interior's "*STANDARDS FOR THE TREATMENT OF HISTORIC PROPERTIES* (The Standards) with Guidelines for Preserving, Rehabilitation, Restoring, and Reconstructing Historic Buildings (The Guidelines)" or the *STANDARDS AND GUIDELINES FOR THE CONSERVATION OF HISTORIC PLACES IN CANADA* which spell out requirements such as:

- The historic character of a property will be retained and preserved. The removal of distinctive materials or alterations of features, spaces, and spatial relationships that characterize a property will be avoided.
- Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
- Changes to property that have acquired historic significance in their own right will be retained and preserved. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property will be preserved.
- Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
- Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible Treatments that cause damage to historic properties will not be used.
- New additions, exterior alterations, or related new construction will not destroy historic materials and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale, proportion, and massing to protect the historic integrity of the property and its environment.
- New additions and adjacent or related new construction will be undertaken in such a manner that if they are removed in the future, the essential form and integrity of the historic property and its environment will be unimpaired.
- Acceptable requirements of lumber and/or sheet products used within this woodwork product section are established by Sections 3 and 4, unless otherwise modified herein.
- Contract documents, furnished by the design professional, shall clearly indicate or delineate all material, fabrication, installation, and applicable building code / regulation requirements.

Quality assurance can be achieved by adherence to these standards and will provide the owner a quality product at competitive pricing. Working with a Woodwork Institute Certified Millwork Professional (CMP) and the Woodwork Institute Accredited Millwork Company (AMC) they represent to provide your woodwork will help ensure the understanding and performance of the quality level required. Illustrations in this Section are not intended to be all inclusive, other engineered solutions may be acceptable. In the absence of specifications; methods of fabrication are the manufacturer's choice. The design professional, by specifying compliance to these standards increases the probability of receiving the product quality expected.

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RESOURCES AND REFERENCES

Museums with period rooms - There are many historic houses around the country which are open to the public. Eighteenth Century homes such as Gunston Hall in VA, and Drayton Hall, near Charleston, SC, along the Eastern Seaboard and Neoclassical houses as one moves West. There are museums with period rooms as well. The Metropolitan Museum in New York, the Philadelphia Museum of Art, and Colonial Williamsburg are only a few.

Publications - Dover Publications, Inc., 31 East Second Street, Mineola, NY 11501.

Dover Publications has an incomparable listing of books which, for the most part, are reprintings of older publications; from Andrea Palladio's Four Books of Architecture to Augustus Charles Pugin's Gothic Ornament as well as handbooks and specialized subjects.

One invaluable Dover handbook is Illustrated Dictionary of Historic Architecture by Cyril M. Harris. It is from Harris that the definitions and many of the illustrations in the Glossary have been used with permission.

Three others which offer good illustrations are:

- Colling, James K. *Medieval Decorative Ornament*, New York, (Reprint of 1874 edition); Dover Publications, Inc. 1995
- Griesbach, C.B. *Historic Ornament: A Pictorial Archive*, New York, Dover Publications, Inc., 1975.
- Speltz, Alesander. *The Styles of Ornament*, (Reprint of German Edition of 1906), New York, Dover Publications, Inc., 1959.

Several books explaining in detail the orders of architecture are:

- Adam, Robert. *Classical Architecture: A Comprehensive Handbook to the Tradition of Classical Style*, New York: Harry N. Abrams, Inc., Publishers, 1990.
- Chitham, Robert. *The Classical Orders of Architecture,* New York: Rizzoli International Publications, Inc., 1985 (may be out of print).
- Ware, William R. *The American Vignola: A Guide to the Making of Classical Architecture*, New York: Dover Publications, Inc., 1994.

A definitive history of architecture is:

- Fletcher, Sir Banister. *A History of Architecture on the Comparative Method*, 20th edition ed., Dan Cruickshank and Andrew Saint, Oxford: Architectural Press, 1996.

For carving classical architectural elements:
Wilbur, Frederick. *Carving Architectural Detail in Wood: the Classical Tradition*, Lewes, UK: Guild of Master Craftsmen Publications, Ltd. 2000.

CARE & STORAGE

INTRODUCTION

Herein we address the most important aspects of preserving a good woodwork installation. Storage, jobsite conditions and relative humidity requirements before, during and after installation.

CARE

All construction related products, regardless of material, have particular care and storage requirements. Woodwork is not unique in this respect.

Architectural woodwork should be treated like fine furniture, particularly that which is constructed of wood finished with a transparent finish system. Modern commercial finishes are durable and resistant to moisture.

FINISH MAINTENANCE - With the exception of true oil-rubbed surfaces, modern finishes do not need to be polished, oiled, or waxed. In fact, applying some polishing oils, cleaning waxes, or products containing silicone may impede the effectiveness of touch-up or refinishing procedures in the future.
Remove oil or grease deposits with a mild flax soap, following the directions for dilution on the container.
No abrasives, chemical or ammonia cleaners should be used to clean woodwork surfaces.

Routine cleaning is best accomplished with a soft, lint-free cloth lightly dampened with water or an inert household dust attractant. Allowing airborne dust, which is somewhat abrasive, to build up will tend to dull a finish over time.

IMPACT - Avoid excessive or repetitive impact, however lightly applied. The cellular structure of the wood will compact under pressure. Many modern finishes are flexible and will show evidence of impact and pressure applied to them.

HEAT - Avoid localized high heat, such as a hot pan or plate, or a hot light source, close to or in contact with the finished surface.

PHOTODEGRADATION – Avoid exposure to direct sunlight as this may alter the appearance of woodwork over time.

HUMIDITY - Maintain the relative humidity around the woodwork in accordance with the guidelines published in these standards, every hour of every day, to minimize wood movement.

MOISTURE - Architectural woodwork, when properly finished, is relatively durable and resistant to moisture. Prevent direct contact with moisture, and wipe it dry immediately should any occur. Allowing moisture to accumulate on, or stay in contact with, any wood surface, no matter how well finished, will cause damage.

OXIDATION - Is a reaction of acids in wood (e.g., tannic acid), with iron, oxygen, and moisture, whether this be relative humidity or direct moisture. Control of moisture is a simple way to protect wood products from stains as a result of oxidation.

ABUSE - Use the trims, cabinets and fixtures, paneling, shelving, ornamental work, stairs, frames, windows, and doors as they were intended. Abuse of cabinet doors and drawers, for example, may result in damage to them as well as to the cabinet parts to which they are joined.

CLEANING - should be routine and accomplished with a soft, lint-free cloth lightly dampened with water or an inert household dust attractant. Allowing airborne dust, which is somewhat abrasive, to build up will tend to dull a finish over time:

- Remove oil or grease deposits with a mild flax soap, following its directions for dilution.
- Do not use abrasives, chemical or ammonia cleaners on fine architectural woodwork surfaces.

REFINISHING - Contact a local Sponsor Association member / affiliate, to explore the options for repair or refinishing. It is often cost effective to replace damaged woodwork elements rather than attempting large scale, on site refinishing.

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RELATIVE HUMIDITY AND MOISTURE CONTENT

The space in which architectural woodwork is to be installed should be engineered with appropriate humidity controls to maintain its optimum relative humidity. Wood for architectural woodwork manufacturing use needs a moisture content within an optimum range.

A major cause for failure in architectural woodwork is the lack of controls for maintaining a consistent, year-round, appropriate relative humidity in a building or building space. Wood is susceptible to movement, shrinkage, expansion and warpage when exposed to air that has not been humidified. Without considerations made to properly regulate the relative humidity in any space containing architectural woodwork, some degree of failure of the woodwork can be expected.

Relative humidity outside the range shown on Table RG-011 for the respective region is particularly harmful to wood and wood products.

This table is intended to establish a range in which architectural woodwork can be properly stored, acclimatized, installed and maintained.

The most important effect of temperature is the effect it has on altering relative humidity levels See Table RG-012. Once a controlled humidity and temperature environment has been established the humidity shall be maintained without sudden changes, especially repetitive changes. It is suggested that daily / monthly range vary no more than 10° F (5.6° C) degrees and 15% relative humidity.

The table and map that follow (adapted from USDA's *The Wood Handbook* (latest edition), published by their Forest Products Laboratory, fpl.fs.fed.us/index.php) shows the Optimum Moisture Content and the Indoor Relative Humidity required to hold such moisture content within the general areas of the United States and Canada.

SOME OF THESE AREAS HAVE ADDITIONAL MICRO-CLIMATES NOT SHOWN OR REFERENCED.

CARE & STORAGE (continued)

Table: RG-011 - **RELATIVE HUMIDITY** and **OPTIMUM MOISTURE CONTENT**

CLIMATE CONTROLLED areas will be maintained with an operational HVAC system, and relative humidity meeting the range appropriate for the region as follows:

Geographical Location	Optimum Moisture Content	Optimum Relative Humidity
Most of U.S. and Canada	5-10%	25-55%
Damp Southern Coastal areas of the U.S. and Canadian Eastern Coastal Provinces	8-13%	43-70%
Dry Southwestern U.S.	4-9%	20-50%
Alberta, Saskatchewan, and Manitoba in Canada	4-9%	20-50%

and maintained Optimum Moisture Content between 5 - 10% inclusive, except in:

The damp Southern Coastal areas of the U.S. and in Eastern Coastal Provinces will be between 8 - 13% inclusive.

and

The dry Southwestern U.S., and Alberta, Saskatchewan, and Manitoba in Canada will be between 4 - 9% inclusive.

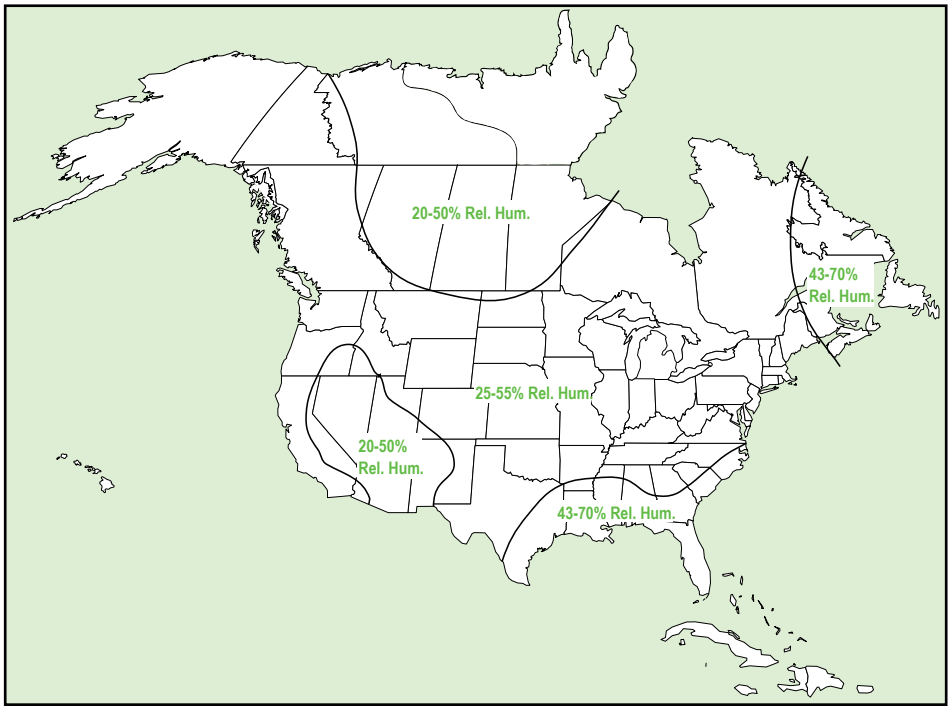

Figure: RG -357

RECLAIMED or RECYCLED WOOD

Ambient humidity and initial moisture content of reclaimed wood can be very important factors in insuring dimensional stability of the end product, and:

- With reclaimed wood moisture content may need to be addressed on a case by case basis. Typically. “barn wood” is supplied “dry” and is of little concern in this regard. On the other hand-timbers encrusted in earth or reclaimed from moist environments exposed to rain and water may require further drying to ensure stability.
- Additional drying may be particularly important when secondary milling is required to create the final form. Wood that may appear to be dry may contain a reservoir of moisture at its core which could be activated by further milling. This could result in a product which checks, cracks and distorts in unacceptable ways.
- For some design purposes instability may be a desired result. In other words, initial high moisture content may cause lumber to twist and crack after installation over time in ways that achieve a particular aesthetic result. Achieving these effects is the responsibility of the design professional working in close collaboration with the architectural woodwork manufacturer.

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Table: RG-012 - **EQUILIBRIUM MOISTURE CONTENT VALUES AT VARIOUS TEMPERATURES AND HUMIDITY**

The following table indicates relative humidity must average between 25% and 55% to maintain wood moisture content between 5-10%. This range is best suited for most of the U.S. and Canada. While temperature has an impact on relative humidity, temperature alone has little effect on wood products if the relative humidity is maintained within recommended ranges.

Wet bulb lowering in degrees Fahrenheit

Dry bulb temperature in degrees Fahrenheit	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
40	83 17.6	75 14.8	68 12.9	60 11.2	52 9.9	45 8.6	37 7.4	29 6.2	22 5.0	15 3.5	8 1.9																	
45	85 18.3	78 15.6	72 13.7	64 12.0	58 10.7	51 9.5	44 8.5	37 7.5	31 6.5	25 5.3	19 4.2	12 2.9	6 1.5															
50	86 19.0	80 16.3	74 14.4	68 12.7	62 11.5	56 10.3	50 9.4	44 8.5	38 7.6	32 6.7	27 5.7	21 4.8	16 3.9	10 2.8	5 1.5													
55	88 19.5	82 16.9	76 15.1	70 13.4	65 12.2	60 11.0	54 10.1	49 9.3	44 8.4	39 7.6	34 6.8	28 6.0	24 5.3	19 4.5	14 3.6	9 2.5	5 1.3											
60	89 19.9	83 17.4	78 15.6	73 13.9	68 12.7	63 11.6	58 10.7	53 9.9	48 9.1	43 8.3	39 7.6	34 6.9	30 6.3	26 5.6	21 4.9	17 4.1	13 3.2	9 2.3	5 1.3	1 0.2								
65	90 20.3	84 17.8	80 16.1	75 14.4	70 13.3	66 12.1	61 11.2	56 10.4	52 9.7	48 8.9	44 8.3	39 7.7	36 7.1	32 6.5	27 5.8	24 5.2	20 4.5	16 3.8	13 3.0	8 2.3	6 1.4	2 0.4						
70	91 20.9	86 18.2	81 16.5	77 14.9	72 13.7	68 12.5	64 11.6	59 10.9	55 10.1	51 9.4	48 8.8	44 8.3	40 7.7	36 7.2	33 6.6	29 6.0	25 5.5	22 5.6	19 4.3	15 3.7	12 2.9	9 2.3	6 1.5	3 0.7				
75	91 21.0	86 18.5	82 16.8	78 15.2	74 14.0	70 12.9	66 12.0	62 11.2	58 10.5	54 9.8	51 9.3	47 8.7	44 8.2	41 7.7	37 7.2	34 6.7	31 6.2	28 5.6	24 5.1	21 4.7	18 4.1	15 3.5	12 2.9	10 2.3	7 1.7	4 0.9	1 0.2	
80	92 21.2	87 18.7	83 17.0	79 15.5	75 14.3	72 13.2	68 12.3	64 11.5	61 10.9	57 10.1	54 9.7	50 9.1	47 8.6	44 8.1	41 7.7	38 7.2	35 6.8	32 6.3	29 5.8	26 5.4	23 5.0	20 4.5	18 4.0	15 3.5	12 3.0	10 2.4	7 1.8	5 1.1
85	92 21.3	88 18.8	84 17.2	80 15.7	76 14.5	73 13.5	70 12.5	66 11.8	63 11.2	59 10.5	56 10.0	53 9.5	50 9.0	47 8.5	44 8.1	41 7.6	38 7.2	36 6.7	33 6.3	30 6.0	28 5.6	25 5.2	23 4.8	20 4.3	18 3.9	15 3.4	13 3.0	11 2.4
90	92 21.3	89 18.9	85 17.3	81 15.9	78 14.7	74 13.7	71 12.8	68 12.0	65 11.4	61 10.7	58 10.2	55 9.7	52 9.3	49 8.8	47 8.4	44 8.0	41 7.6	39 7.2	36 6.8	34 6.5	31 6.1	29 5.7	26 5.3	24 4.9	22 4.6	19 4.2	17 3.8	15 3.3
95	92 21.3	89 19.0	85 17.4	82 16.1	79 14.9	75 13.9	72 12.9	69 12.2	66 11.6	63 11.0	60 10.5	57 10.0	55 9.5	52 9.1	49 8.7	46 8.2	44 7.9	42 7.5	39 7.1	37 6.8	34 6.4	32 6.1	30 5.7	28 5.3	26 5.1	23 4.8	22 4.4	20 4.0
100	93 21.3	89 19.0	86 17.5	83 16.1	80 15.0	77 13.9	73 13.1	70 12.4	68 11.8	65 11.2	62 10.6	59 10.1	56 9.6	54 9.2	51 8.9	49 8.5	46 8.1	44 7.8	41 7.4	39 7.0	37 6.7	35 6.4	33 6.1	30 5.7	28 5.4	26 5.2	24 4.9	22 4.6
110	93 21.4	90 19.0	87 17.5	84 16.2	81 15.1	78 14.1	75 13.3	73 12.6	70 12.0	67 11.4	65 10.8	62 10.4	60 9.9	57 9.5	55 9.2	52 8.8	50 8.4	48 8.1	46 7.7	44 7.5	42 7.2	40 6.8	38 6.6	36 6.3	34 6.0	32 5.7	30 5.4	28 5.2
120	94 21.3	91 19.0	88 17.4	85 16.2	82 15.1	80 14.1	77 13.4	74 12.7	72 12.1	69 11.5	67 11.0	65 10.5	62 10.0	60 9.7	58 9.4	55 9.0	53 8.7	51 8.3	49 7.9	47 7.7	45 7.4	43 7.2	41 6.8	40 6.6	38 6.3	36 6.1	34 5.8	33 5.6

13% moisture — 10% moisture — 5% moisture

TO USE TABLE

Obtain wet and dry bulb readings. Subtract wet bulb reading from dry bulb reading. Find dry bulb on left margin of table and follow across to the column where the value at the top corresponds with the difference between wet and dry readings. At point of intersection, the upper figure in the square gives relative humidity in percent and the lower figure gives equilibrium moisture content of the woodwork.

EXAMPLES OF MOISTURE EQUILIBRIUM TABLE USE

The above may be used as a guide in determining whether or not the conditions in a construction area are suitable for receiving woodwork. For example: if woodwork with an 8% average moisture content is to be installed and the average temperature in the building will be maintained at 70° F, it can be determined by following the 70° F column horizontally to the right until the lower moisture content figures of 8.3% and 7.7% are reached.

Here the upper figures in the same squares show that ideally a relative humidity of between 44% and 40% should be maintained in order to achieve dimensional equilibrium. After the woodwork is painted or finished, moisture changes in the wood are retarded so that maintenance of relative humidity between the practical limits shown on the curve (between 5%-10% moisture content) of the humidity table, i.e., 25%-55% relative humidity, is usually satisfactory.

FRACTION, DECIMAL, & MILLIMETER CONVERSIONS

FRACTION	DECIMAL	MILLIMETER
1/64	0.01563	0.3969
1/32	0.03125	0.7938
3/64	0.04688	1.1906
1/16	0.06250	1.5875
5/64	0.07813	1.9844
3/32	0.09375	2.3813
7/64	0.10937	2.7781
1/8	0.12500	3.1750
9/64	0.14063	3.5719
5/32	0.15625	3.9688
11/64	0.17188	4.3656
3/16	0.18750	4.7625
13/64	0.20312	5.1594
7/32	0.21875	5.5563
15/64	0.23438	5.9531
1/4	0.25000	6.3500
17/64	0.26563	6.7469
9/32	0.28125	7.1438
19/64	0.29688	7.5406
5/16	0.31250	7.9375
21/64	0.32813	8.3344
11/32	0.34375	8.7313
23/64	0.35938	9.1281
3/8	0.37500	9.5250
25/64	0.39063	9.9219
13/32	0.40625	10.3188
27/64	0.42188	10.7156
7/16	0.43750	11.1125
29/64	0.45313	11.5094
15/32	0.46875	11.9063
31/64	0.48438	12.3031
1/2	0.50000	12.7000

FRACTION	DECIMAL	MILLIMETER
33/64	0.51563	13.0969
17/32	0.53125	13.4938
35/64	0.54688	13.8906
9/16	0.56250	14.2875
37/64	0.57813	14.6844
19/32	0.59375	15.0813
39/64	0.60938	15.4781
5/8	0.62500	15.8750
41/64	0.64063	16.2719
21/32	0.65625	16.6688
43/64	0.67188	17.0656
11/16	0.68750	17.4625
45/64	0.70313	17.8594
23/32	0.71875	18.2563
47/64	0.73438	18.6531
3/4	0.75000	19.0500
49/64	0.76563	19.4469
25/32	0.78125	19.8438
51/64	0.79688	20.2406
13/16	0.81250	20.6375
53/64	0.82813	21.0344
27/32	0.84375	21.4313
55/64	0.85938	21.8281
7/8	0.87500	22.2250
57/64	0.89063	22.6219
29/32	0.90625	23.0188
59/64	0.92188	23.4156
15/16	0.93750	23.8125
61/64	0.95313	24.2094
31/32	0.96875	24.6063
63/64	0.98438	25.0031
1	1.00000	25.4000

CG TC

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MISCELLANEOUS CONVERSIONS

WHEN KNOWN	MULTIPLY BY	TO FIND
Inches	2.54	Centimeters
Inches	25.4	Millimeters
Square Inches	6.452	Square Centimeters
Feet	30.48	Centimeters
Square Feet	.0929	Square Meters
Yards	.9144	Meters
Square Yards	.8361	Square Meters
Miles	1.6	Kilometers
Square Miles	2.59	Square Kilometers
Acres	.4047	Hectares
Ounces	28.349527	Grams
Pounds	.4536	Kilograms
Pressure	.0703	Bar
Radius	2	Diameter
Diameter	.5	Radius
Diameter	3.1416	Circumference
Diameter	.8862	Side of an Equal Square
Circumference	.31831	Diameter
Circumference	.15915	Radius
Circumference	.2821	Side of an Equal Square
Square of Diameter	.7854	Area of Circle
Square of Diameter	3.1416	Square of Sphere of Globe
Square of Circumference	.07958	Area of Circle
Square of Radius	3.1416	Area of Circle
TO FIND	DIVIDE BY	WHEN KNOWN

WHEN KNOWN	MULTIPLY BY	TO FIND
Fahrenheit	0.556 after subtracting 32	Celsius
Celsius	1.8 and add 32	Fahrenheit

END OF RESOURCE GUIDE

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