

Architectural
Woodwork Standards

APPENDIX

INTRODUCTION

This **APPENDIX** is provided as additional resources to the manufacturer, design professional, educator, user, or certifying organization and is only part of the standards (compliance requirements) when referenced. For your convenience where referenced it is flagged by the following icon:



TABLE OF CONTENTS

Reference Source Directory	387
Reference Source Listings	388
Preservative & Water Repellent Treatments.....	390
Fire Retardant Coatings	390
Fire Codes	390
ADA Requirements	390
Rated Fire Door Assemblies.....	390
Building Code Requirements.....	390
Seismic Fabrication & Installation Requirements	390
Adhesives Guidelines	391
Specific Gravity & Weight Of Hardwoods	392
Joinery Details	394
Chemical And Stain Resistance (Adapted From SEFA).....	396
Casework Integrity (Adapted From SEFA)	398
Casework Refinishing/Refacing/Refurbishing Guidelines	403
Fraction/Decimal/Millimeter Conversion Table	404
Miscellaneous Conversion Factors.....	405

reference source directory

CONTINUING EDUCATION

AIA - American Institute of Architects
AIBD - American Institute of Building Design
BHMA - Builders Hardware Manufacturers Association
CRA - California Redwood Association
IDC - Interior Design of Canada
IIDA - International Interior Design Association
RAIC - Royal Architectural Institute of Canada

STANDARDS & REGULATION

ANSI - American National Standards Institute
ARE - Association for Retail Environments
ASID - American Society of Interior Designers
AWI - Architectural Woodwork Institute
AWMAC - Architectural Woodwork Manufacturers Association of Canada
BIFMA - Business + Institutional Furniture Manufacturers Association
CPA - Composite Panel Association
CSC - Construction Specifications Canada
CSI - Construction Specifications Institute
DHI - The Door and Hardware Institute
HPVA - Hardwood Plywood & Veneer Association
ICC - International Code Council
IWPA - International Wood Products 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
WI - Woodwork Institute
WWPA - Western Wood Products Association

MANUFACTURING

AF&PA - American Forest & Paper Association
AHFA - American Home Furnishings Alliance
NAM - National Association of Manufacturers
NEMA - National Electrical Manufacturers Association
WDMA - Window & Door Manufacturers 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 - U.S.
Green Globes:
USA - The Green Building Initiative
Canada - ECD Energy and Environment
Rainforest Alliance
SAW - Sustainable Architectural Woodwork
SFI - Sustainable Forestry Initiative Inc.
TFF - Tropical Forest Foundation
USGBC - U.S. Green Building Council

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

AF&PA - American Forest & Paper Association
1111 19th Street NW, Suite 800
Washington, DC 20036
Ph: 800-878-8878 - Fax: 202-463-2700
www.afandpa.org

AHFA - American Home Furnishings Alliance
Box HP-7
High Point, NC 27261
Ph: 336-884-5000 - Fax: 336-884-5303
www.ahfa.us

AIA - American Institute of Architects
1735 New York Avenue NW
Washington, DC 20006
Ph: 800-242-3837 - Fax: 202-626-7547
www.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
www.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
www.ansi.org

APA - The Engineered Wood Association
7011 South 19th Street
Tacoma, WA 98466
Ph: 253-565-6600 - Fax: 253-565-7265
www.apawood.org

ARE - Association for Retail Environments
4651 Sheridan Street, Suite 407
Hollywood, FL 33021-3657
Ph: 954-893-7300 - Fax: 954-893-7500
www.nasfm.org

ASID - American Society of Interior Designers
608 Massachusetts Avenue NE
Washington, DC 20002-6006
Ph: 202-546-3480 - Fax: 202-546-3240
www.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
www.astm.org

AWI - Architectural Woodwork Institute
46179 Westlake Drive, Suite 120
Potomac Falls, VA 20165
Ph: 571-323-3636 - Fax: 571-323-3630
www.awinet.org

AWMAC - Architectural Woodwork Manufacturers Association of Canada
Unit 02A 4803 Centre Street NW
Calgary, AB T2E 2Z6
Ph: 403-652-7685
www.awmac.com

BHMA - Builders Hardware Manufacturers Association
355 Lexington Avenue, 15th Floor
New York, NY 10017
Ph: 212-297-2122 - Fax: 212-370-9047
www.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
www.bifma.org

CPA - Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176
Ph: 703-724-1128 - Fax: 703-724-1588
www.compositepanel.org

CRA - California Redwood Association
818 Grayson Road, Suite 201
Pleasant Hill, CA 94523
Ph: 925-935-1499 - Fax: 925-935-1496
www.calredwood.org

CSC - Construction Specifications Canada
120 Carlton Street, Suite 312
Toronto, ON, M5A 4K2, Canada
Ph: 416-777-2198 - Fax: 416-777-2197
www.csc-dcc.ca

CSI - Construction Specifications Institute
99 Canal Center Plaza, Suite 300
Alexandria, VA 22314
Ph: 800-689-2900 - Fax: 703-684-8436
www.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
www.dhi.org

FSC - Forest Stewardship Council
USA:
212 Third Avenue North, Suite 445
Minneapolis, MN 55401
Ph: 612-353-4511 - Fax: 612-208-1565
www.fscus.org

Canada:
70 The Esplanade, Suite 400
Toronto, ON M5E 1R2
Ph: 514-394-1137
www.fscscanada.org

GREEN GLOBES:
USA:
The Green Building Initiative
2104 SE Morrison,
Portland, Oregon 97214
Ph: 877-424-4241 - Fax: 503-961-8991
www.thegbi.org

Canada:
ECD Energy and Environment
165 Kenilworth Avenue
Toronto, ON M4L 3S7
Ph: 416-699-6671
www.greenglobes.com

HPVA - Hardwood Plywood & Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190
Ph: 703-435-2900 - Fax: 703-435-2537
www.hpva.org

ICC - International Code Council
500 New Jersey Avenue NW, 6th Floor
Washington, DC 20001-2070
Ph: 888-422-7233 - Fax: 202-783-2348
www.iccsafe.org

IDC - Interior Design of Canada
C 536-43 Hanna Avenue
Toronto, Ontario, M6K 1X1, Canada
Ph: 416-649-4425 - Fax: 416-921-3660
www.idcanada.org

reference source listings

IIDA - International Interior Design Association
13-122 Merchandise Mart
Chicago, IL 60654-1104
Ph: 312-467-1950 - Fax: 312-467-0779
www.iida.org

ITS - Intertek Testing Services
Ph: 800-967-5352
www.intertek.com

IWPA - International Wood Products Association
4214 King Street West
Alexandria, VA 22302
Ph: 703-820-6696 - Fax: 703-820-8550
www.iwpawood.org

KCMA - Kitchen Cabinet Manufacturers Assoc.
1899 Preston White Drive
Reston VA 20191-5435
Ph: 703-264-1690 - Fax: 703-620-6530
www.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
www.usgbc.org

CaGBC - Canada Green Building Council
47 Clarence Street, Suite 202
Ottawa, ON K1N 9K1
Ph: 866-941-1184 - Fax: 613-241-4782
www.cagbc.org

LMA - Laminating Materials Association
116 Lawrence Street
Lillsdale, NJ 07642-2730
Ph: 201-664-2700 - Fax: 201-666-5665
www.lma.org

MMPA - Moulding and Millwork Producers Association
507 First Street
Woodland, CA 95695
Ph: 530-661-9591 - Fax: 530-661-9586
www.wmmpa.com

NAM - National Association of Manufacturers
733 10th Street, NW, Suite 700
Washington, DC 20001
Ph: 800-814-8468 - Fax: 202-637-3182
www.nam.org

NEMA - National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, Virginia 22209
Ph: 703-841-3200 - Fax: 703-841-5900
www.nema.org

NFPA - National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000 - Fax: 617-770-0700
www.nfpa.org

NHLA - National Hardwood Lumber Association
6830 Raleigh-Lagrange Road
Memphis, TN 38184-0518
Ph: 901-377-1818 - Fax: 901-382-6419
www.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
www.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
www.raic.org

SEFA - Scientific Equipment & Furniture Association
65 Hilton Avenue
Garden City, NJ 11530
Ph: 877-294-5424 - Fax: 516-294-4765
www.sefalabs.com

SFI - Sustainable Forest Initiative, Inc.

USA:
900 17th street, NW, Suite 700
Washington, DC 20006
Ph: 202-596-3450 - Fax: 202-596-3451
www.sfiprogram.org

Canada:
1309 Carling Ave., PO Box 35043
Westgate
Ottawa, ON K1Z 1A2
Ph: 613-722-8734 - Fax: 613-792-1470
www.certificationcanada.org/

RAINFOREST ALLIANCE
233 Broadway, 28th Floor
New York, NY 10279
Ph: 212-677-1900 - Fax: 212-677-2187
www.rainforest-alliance.org

SAW - Sustainable Architectural Woodwork
PO Box 980248
West Sacramento, CA 95798-0248
Ph: 916-372-8242 - Fax: 916-372-9950
www.sawcertified.org

TFF - Tropical Forest Foundation
2121 Eisenhower Avenue, Suite 200
Alexandria, VA 22314
Ph: 703-518-8834 - Fax: 703-518-8974
www.tropicalforestfoundation.org

UL - Underwriters' Laboratories
333 Pfingsten Road
Northbrook, IL 60062-2096
Ph: 847-272-8800 - Fax: 847-272-8129
www.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
www.wdma.com

WI - Woodwork Institute
P.O. Box 980247
West Sacramento, CA 95798
Ph: 916-372-9943 - Fax: 916-372-9950
www.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
www.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
www2.wwpa.org



PRESERVATIVE & WATER REPELLENT TREATMENTS

Within the U.S., preservative and water repellent treatments are governed under I.S. - 4, latest edition, as published by the Window and Door Manufacturers Association (WDMA), www.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, they are governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at www.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., fire codes are primarily governed by the International Code Council, Inc. (ICC), www.iccsafe.org, and the National Fire Protection Association (NFPA), www.nfpa.org. Within Canada, they are governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at www.nrc.ca.

ADA REQUIREMENTS

Within the U.S., ADA requirements are 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. For further information regarding national regulations: a) in the U.S., contact the Access Board at www.access-board.gov, and b) in Canada, see the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at www.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, "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 www.nrc.ca.

BUILDING CODE REQUIREMENTS

Within the U.S., building code requirements are governed by the International Building Code (IBC), subject to any applicable state or local requirements that might be more stringent for the project location. Within Canada, they are governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at www.nrc.ca.

SEISMIC FABRICATION & INSTALLATION REQUIREMENTS

Within the U.S., seismic fabrication and installation requirements are governed by the International Building Code (IBC), subject to any applicable state or local requirements that might be more stringent for the project location. Within Canada, they are governed by the National Building Code of Canada, Section 3.8, Appendix A. Contact the National Research Council Canada at www.nrc.ca.

A

adhesive guidelines

PERFORMANCE RATINGS:

Type I Fully Waterproof (Exterior) Two Cycle Boil/Shear Test

Type II Water Resistant (Interior) Three Cycle Soak Test

GENERAL INFORMATION:

GENERIC NAME	BONDING	RATING	CHARACTERISTICS
ALIPHATIC (Carpenter's Glue)	Wood to wood	Type II	Non toxic; non flammable; non staining; water resistant.
CASEIN	Wood to wood	Type II	Water resistant.
CONTACT ADHESIVE	HPDL and wood veneer to wood	Type II	Water resistant.
EPOXY	Wide range; wood; wood to metals	Type I	Two part system; fully waterproof.
HOT MELT Polyurethane Reactive (PUR)	Wide variety of materials	*	Liquefies when heated; bonds in a liquid state; solidifies as it cools.
PVA (Polyvinyl Acetate)	Wood to wood Wood to HPDL	*	General purpose.
PVA (Polyvinyl Acetate - Catalyzed)	Wood to wood	Type I	Fully waterproof.
PVC (Polyvinyl Chloride)	Wide variety of materials	*	Crystal clear; fast drying.
RESORCINOL RESIN	Wood to wood and laminates	Type I	Fully waterproof; purple glue line; two part system; limited pot life (3 hours).
UREA RESIN	Wood to wood	Type II	Mixes with water; must be clamped; 3 to 7 hours of drying time at 70° F (21.1° C).
PANEL/CONSTRUCTION ADHESIVE	Wide variety of materials	Type II	Plastic epoxy base; liquid state; dries fast; difficult to remove; can be used to set adjustment screws in European type hinges.

* Check manufacturer's rating.

HEAT RESISTANCE TEST:

A sample of the laminated plastic approximately 12" x 12" (305 x 305 mm), glued to the substrate for a minimum of 21 days shall be used for this test. A hot air gun rayed at 14 amperes, 120 volts, with a nozzle temperature of 500° F or 274° C shall be directed at the test panel. A thermometer set at the panel surface shall register 356° F or 180° C for an exposure time of 5 minutes. The formation of a blister or void between the overlay and the substrate shall constitute a failure of the adhesive. A metal straightedge shall be used to determine if a blister has occurred. This determination shall be made within 30 seconds of heat removal.



APPENDIX

specific gravity and weight of hardwoods

SPECIES	SPECIFIC GRAVITY ¹	WEIGHT ²
ALDER, RED Alnus rubra	.37	28
ASH, WHITE Average of 4 species	.54	41
ASPEN Populus tremuloides	.35	27
AVODIRE Turraeanthus africanus	n/a	36
BASSWOOD Tilia americana	.32	26
BEECH Fagus grandifolia	.56	45
BIRCH, SWEET Betula lenta	.60	46
BIRCH, YELLOW Betula alleghaniensis	.55	43
BUBINGA Guibourtia demeusil	n/a	55
BUTTERNUT Juglans cinerea	.36	27
CATALPA, NORTHERN Catalpa speciosa	.38	29
CATIVO Prioria copaifera	.40	29
CHERRY, BLACK Prunus serotina	.47	35
CHESTNUT Castanea dentata	.40	30
COTTONWOOD, EASTERN Populus deltoides	.37	28
CUCUMBER TREE, YELLOW Magnolia acuminata	.44	34
CYPRESS (BALD CYPRESS) Taxodium distichum	.42	32

SPECIES	SPECIFIC GRAVITY ¹	WEIGHT ²
DOGWOOD, FLOWERING Cornus florida	.64	51
EBONY (NIGERIAN) Diospyros crassiflora	n/a	63
ELM, AMERICAN Ulmus Americana	.46	36
SWEETGUM (RED AND SAP) Liquidambar styraciflua	.44	34
TUPELO, WATER Nyssa aquatica	.46	35
HACKBERRY Celtis occidentalis	.49	37
HICKORIES, TRUE Average of 4 species	.65	51
HOLLY Ilex opaca	.50	40
LIMBA Terminalia superba	.45	34
LOCUST, BLACK Robinia pseudoacacia	.66	48
MAHOGANY, AFRICAN Khaya ivorensis	.43	31
MAHOGANY, CUBAN Swietenia mahogany	.57	41
MAHOGANY, CENTRAL AMERICAN Swietenia species	.45	32
MAKORE Tieghemella heckelii		40
MAPLE, RED Acer rubrum	.49	38
MAPLE, SILVER Acer saccharinum	.44	33
MAPLE, SUGAR Acer saccharum	.57	44

A

specific gravity and weight of hardwoods

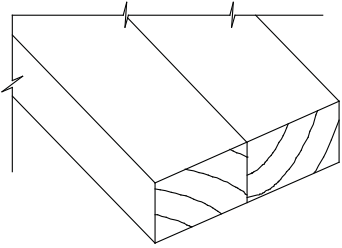
SPECIES	SPECIFIC GRAVITY ¹	WEIGHT ²
MYRTLE Umbellularia Californica	.51	39
NARRA Pterocarpus indicus	.52	42
OAK, COMMERCIAL RED Average of 9 species	.56	44
OAK, COMMERCIAL WHITE Average of 6 species	.59	47
ORIENTAL WOOD Endiandro palmerstoni	n/a	44
OSAGE ORANGE Maclura pomifera	.76	n/a
PADUAK (AFRICAN) Pterocarpus soyauxii	n/a	43
PADUAK (ANDAMAN) Pterocarpus dalbergioides	.62	45
PADUAK (BURMA) Pterocarpus macrocarpus	.75	54
PALDAO Dracontomelum dao	.59	44
PECAN Carya illinoensis	.60	47
PEARWOOD (EUROPEAN) Purus communis	n/a	43
PHILIPPINE HARDWOODS		
RED LAUAN Shorea negrosensis	.40	36
WHITE LAUAN Pentacme contorta	n/a	36
TANGUILE Shorea polysperma	.53	39
POPLAR, YELLOW (TULIPTREE) Liriodendron tulipifera	.38	28
PRIMAVERA Cybistax donnell-smithii	.40	30

SPECIES	SPECIFIC GRAVITY ¹	WEIGHT ²
ROSEWOOD (BRAZIL) Dalbergia nigra	n/a	50
SAPELE Entandrophragma cylindricum	.54	40
SATINWOOD (EAST INDIAN) Chloroxylon swientenio	.83	67
SONORA (MANGGASINORO) Shorea philippinensis	.42	31
SYCAMORE Platanus occidentalis	.46	35
TEAK Tectona grandis	.60	43
TIGERWOOD Lavao klaineana	.45	34
WALNUT, AMERICAN (BLACK) Juglans nigra	.51	39
WILLOW, BLACK Salix nigra	.34	26
ZEBRAWOOD Microberlinia brazzavillensis	.62	48

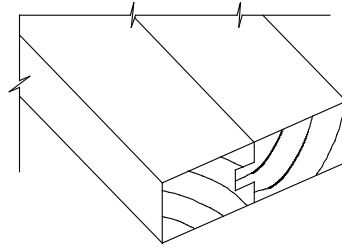
The data for native species as furnished on this chart are from the U.S. Forest Products Laboratory's Technical Bulletin 158.

¹ Based on green volume and oven dry weight.

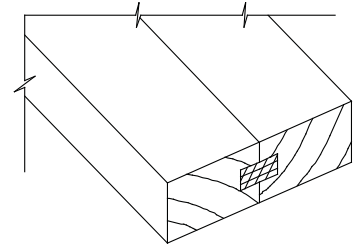
² Based on pounds per cubic foot at 12% moisture content.



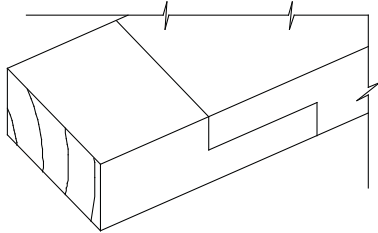
Butt



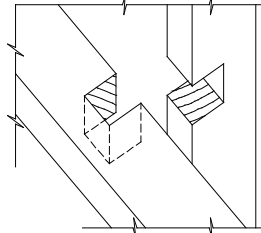
Tongue & Groove



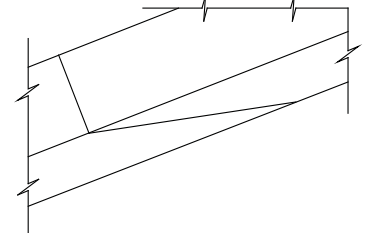
Spline



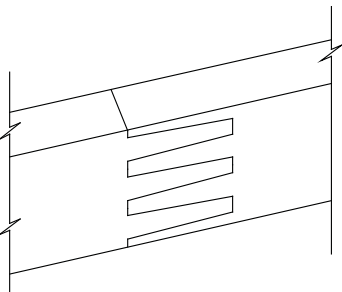
Half Lap



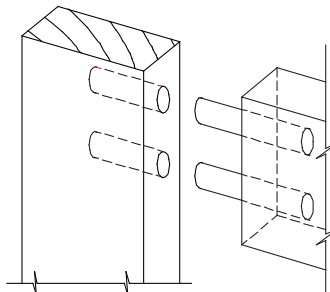
Half Lap



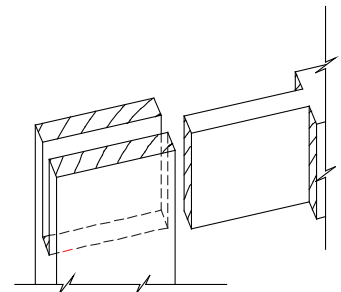
Scarf



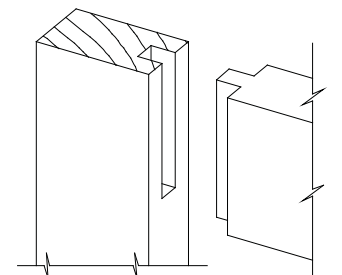
Finger



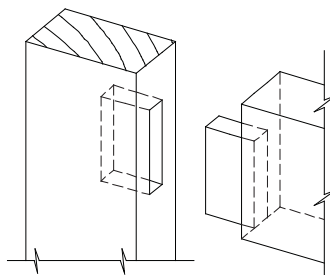
Doweled



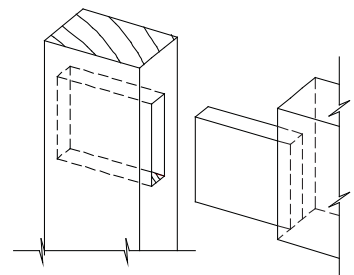
Slotted Mortise & Tenon



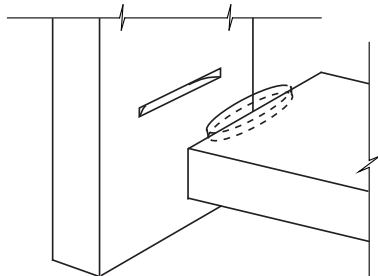
Stub Mortise & Tenon



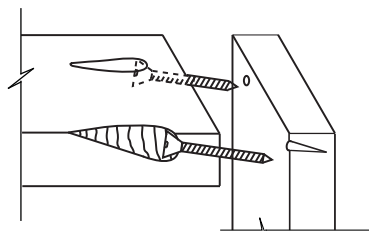
Blind Mortise & Tenon



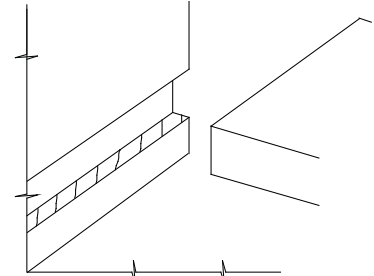
Through Mortise & Tenon



Biscuit Spline



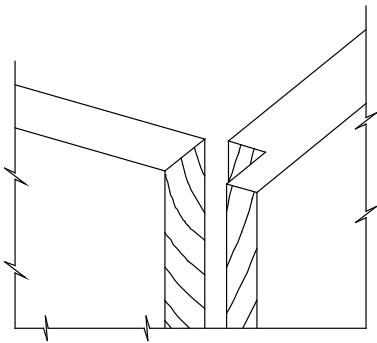
Pocket Screw



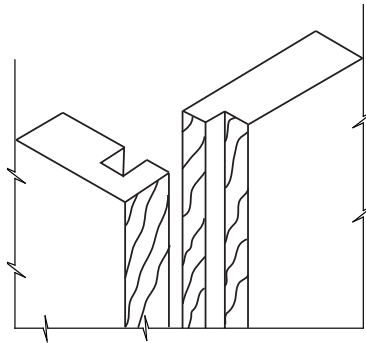
Plowed In

A

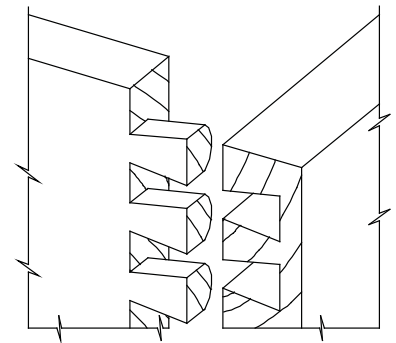
joinery details



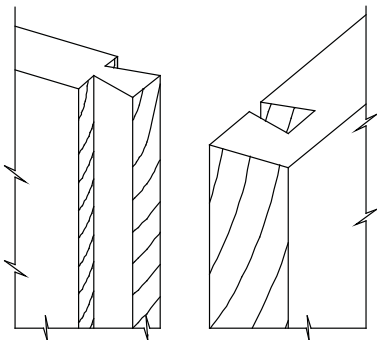
Rabbet



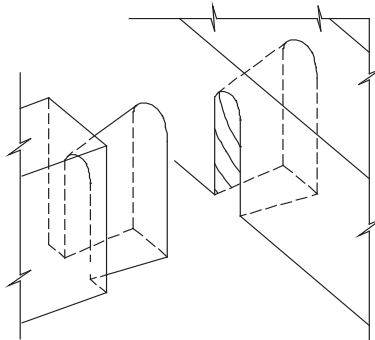
Lock Shoulder



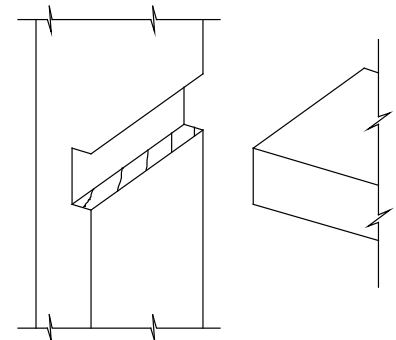
Dovetail



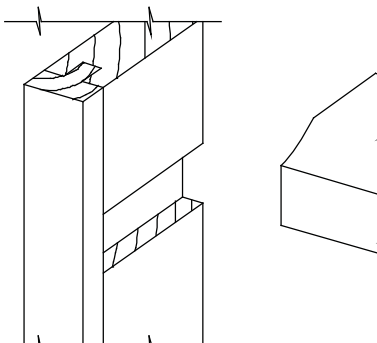
Dovetail (French) Dado



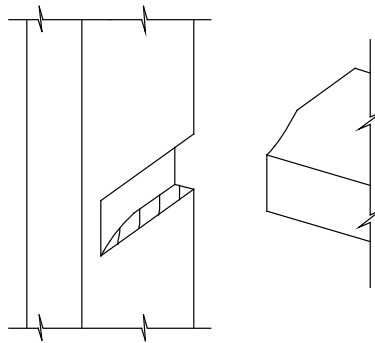
Blind Dovetail



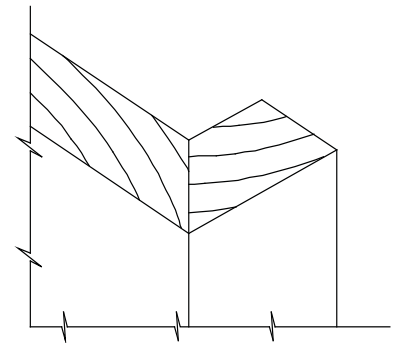
Dado



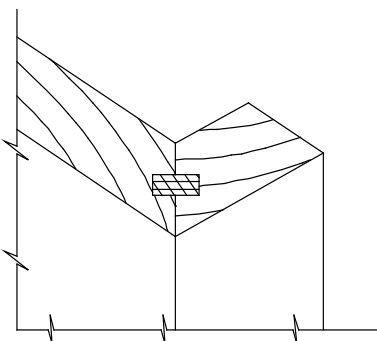
Dado, Blind Or Stopped



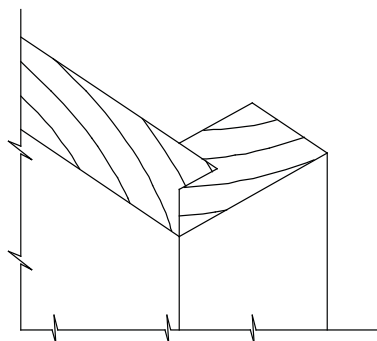
Dado, Blind Or Stopped



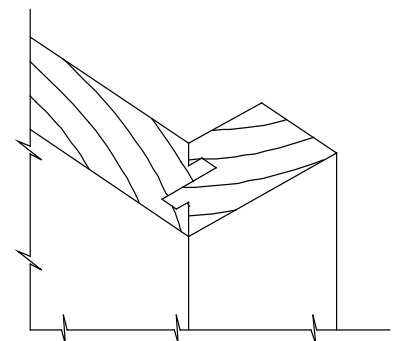
Miter



Splined Miter



Shoulder Miter



Lock Miter

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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 NEMA LD3 (latest edition) for chemical resistance and ASTM D3023 and C1378 (latest editions) for stain resistance. 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 actual sample testing to evaluate the resistance a finish has to chemical spills, the SEFA 8-1999 (Scientific Equipment and Fixture Association) 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 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.

A 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:

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 a given 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.

	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	Dichlor Acetic 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
26	Iodine, Tincture of	B
27	Methyl Ethyl Ketone	A
28	Methylene Chloride	A
29	Mono Chlorobenzene	A
30	Naphthalene	A

chemical and stain resistance

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

To evaluate the overall integrity of casework, portions of SEFA 8-1999 (Scientific Equipment and Fixture Association) methods of testing and acceptable results have been adapted for use in these standards as the minimum acceptable level of integrity for casework conforming to all grades.

TEST LISTING

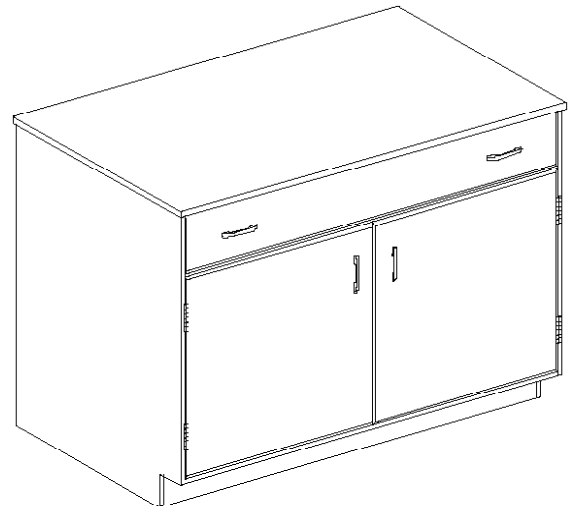
- Structural Integrity - Base Cabinet
- Concentrated Load - Base Cabinet
- Torsion - Base Cabinet
- Base Submersion
- Structural Integrity - Wall Cabinet
- Door and Door Hinge Durability
- Door Impact
- Drawer Bottom Impact
- Drawer Support
- Drawer and Door Pull
- Drawer Rolling Load
- Shelf Load
- Structural Integrity - Table

SHELF TEST UNIT - Shelves, both fixed and/or adjustable, regardless of material or application, shall be tested using the following procedure. This is inclusive of shelves in wall cabinets, base cabinets, full height cabinets, wall mounted shelves, and free standing shelves.

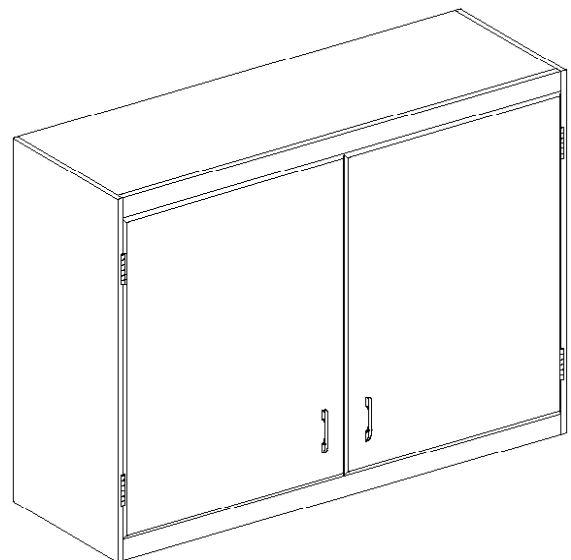
TABLE TEST UNIT - Shall be 48" (1219 mm) long, 24" (610 mm) deep, and 36" (914 mm) high. A top of 1" (25.4 mm) thick medium density fiberboard shall be positioned on the table so that it will overhang the frame perimeter by 1" (25.4 mm), and its weight shall be included in the test as live load. Tables are represented by a large range of styles and designs, including free standing tables, desks, aprons mounted between two fixed areas (such as a wall or casework), mobile tables (free standing tables on wheels or casters), and mobile under counter units.

BASE CABINET TEST UNIT - Shall be 48" (1219 mm) wide, 36" (914 mm) high, and 22" (559 mm) deep with one full width drawer (approximately one fourth the height of the cabinet's face opening) and two doors. Cabinet shall be designed to provide unobstructed entry into the cabinet interior with the doors open and shall contain one adjustable shelf. For LABORATORY USE, the cabinet back shall be removable and tested with the cabinet back removed.

The cabinet shall be free standing, squared, and set level. A piece of 1" (25.4 mm) thick medium density fiberboard shall be positioned on the cabinet without glue or fasteners of any kind, of such dimensions that it will overhang the cabinet perimeter by 1" (25.4 mm), and its weight shall be included in the test as live load. Doors and the drawer should be free moving, and the door shall latch properly.



WALL CABINET TEST UNIT - Shall be 48" (1219 mm) wide, 36" (914 mm) high, and 12" (305 mm) deep with two swinging doors and one shelf, and shall be designed in such a way that when the doors are open, access to the cabinet is unobstructed.

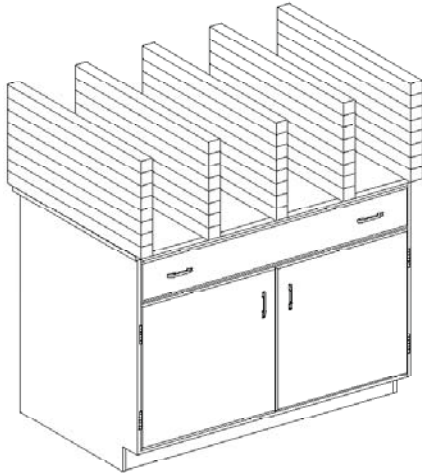


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casework integrity

STRUCTURAL INTEGRITY TEST - BASE CABINET

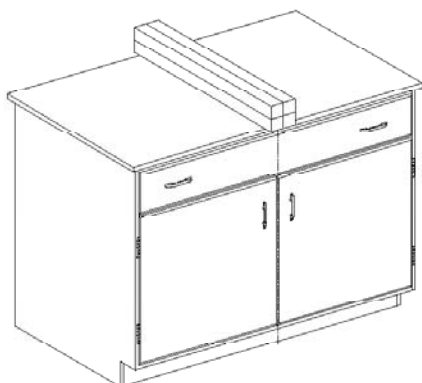
- **CHALLENGES** the load bearing capability of a cabinet's construction.
- **PROCEDURE** - Load the cabinet top by using 2000 lbs (907 kg) of solid steel bars stacked eight high and evenly spaced for a time period of 10 minutes, then unload the cabinet.



- **ACCEPTANCE LEVEL** - Cabinet shall have no signs of permanent failure. If used, inspect the levelers; any deformation shall not interfere with the function of the leveling system.

CONCENTRATED LOAD TEST - BASE CABINET

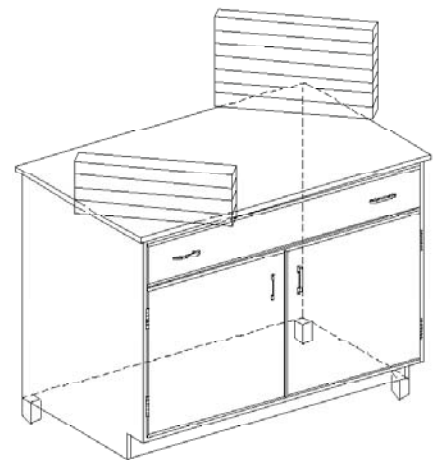
- **CHALLENGES** the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.
- **PROCEDURE** - Using solid weights or 10 lb (4.53kg) sand bags, apply a total of 200 lbs (90.7 kg) to the top of the cabinet along the cabinet centerline. Operate the doors and the drawer.



- **ACCEPTANCE LEVEL** - Door and drawer operation shall be normal under condition of test load and there shall be no signs of permanent distortion to the front rail, cabinet joinery, doors, or the drawer after load is removed.

TORSION TEST - BASE CABINET

- **CHALLENGES** the structural integrity of the cabinet construction when subjected to a torsional load.
- **PROCEDURE** - The cabinet shall be tested in its normal upright position, raised not less than 4" (101.6 mm) off the floor, and supported on both rear corners and one front corner. The area of support under the cabinet shall be located not more than 6" (152.4 mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars (350 lbs [159 kg]) on the top of the cabinet to prevent overturning. Apply four solid steel bars (200 lbs [90.7 kg]) to the unsupported corner for a period of 15 minutes. Remove the weight, and place the cabinet on the floor in its normal upright position. Observe the cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.



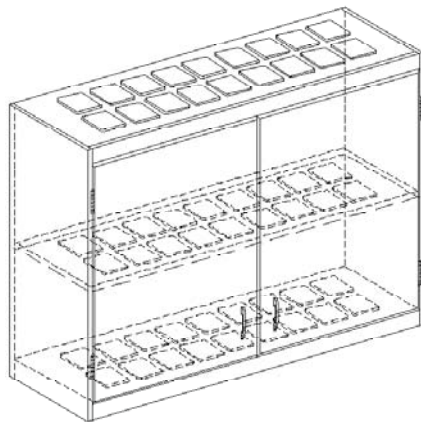
- **ACCEPTANCE LEVEL** - When returned to the normal position, the operation of the cabinet shall be normal without any signs of permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8" (3.2mm).

SUBMERSION TEST - BASE CABINET (Only applicable to casework specified for moisture resistant or laboratory use)

- **CHALLENGES** the cabinet's resistance to standing water and is only applicable to cabinets whose bases are within 2" (50.8 mm) of the finished floor.
- **PROCEDURE** - The material thickness along the perimeter of the cabinet shall be measured on 6" (152.4 mm) increments. Record the thickness of the material to be submerged in water. Calculate the arithmetic mean of the data taken. Place the entire test cabinet in its upright position so that the cabinet is submerged in a pan filled with 2" (50.8 mm) of water. After 4 hours, remove the unit from the water and immediately measure the thickness of the material at the same points measured initially. Calculate the new arithmetic mean. After the unit has been allowed to dry, inspect for other damage.
- **ACCEPTANCE LEVEL** - The cabinet will show no signs of permanent deformation or deterioration. Any increase in thickness of the base material shall not exceed 4% of the initial mean measurements.

STRUCTURAL INTEGRITY TEST - WALL CABINET

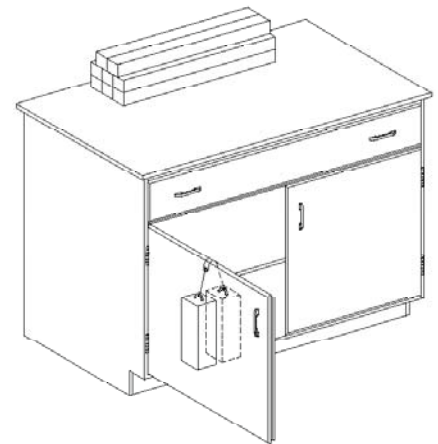
- **CHALLENGES** the strength of the back of the wall cabinet as well as the joinery of the cabinet and the function of the doors when the wall mounted unit is subjected to load.
- **PROCEDURE** - Using sand or shot bags weighing 10 lbs (4.5 kg) each, load the cabinet bottom, shelf, and top uniformly to a maximum of 200 lbs (90.7 kg) each, with the maximum load not exceeding 600 lbs (272 kg).



- **ACCEPTANCE LEVEL** - With weights in place, operate the doors through full travel to verify the normal operation of the doors. Remove the weights and operate the doors to verify normal operation. Verify that there is no significant permanent deflection of the cabinet top, cabinet back, cabinet bottom, or shelf. After the weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelf.

DOOR and DOOR HINGE DURABILITY TEST

- **CHALLENGES** the durability of the door and its hardware (hinge leaf, screws, etc.) to an applied load of 200 lbs (90.7 kg).
- **PROCEDURE** - Remove the shelf for this test. With the unit and top set, add sufficient weight to the top in order to prevent overturning. With the cabinet door open 90 degrees, hang a sling made up of two 100 lb (45.4 kg) weights (shot bags or solid weights) over the top of the door at a point 12" (305 mm) out from the hinge center line. Slowly move the door through the full cycle of the hinge, up to a 160 degree arc. Remove the weight, swing the door through its full intended range of motion, and close the door.



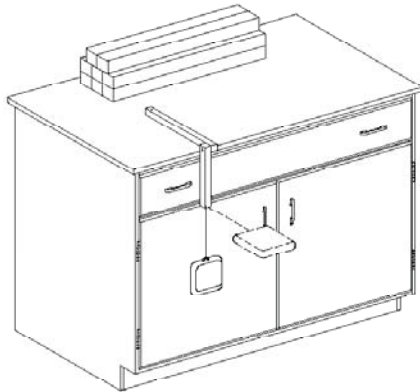
- **ACCEPTANCE LEVEL** - The open door shall withstand a load of 200 lbs (90.7 kg) when applied at a point 12" (305 mm) from the hinge centerline without significant permanent distortion that will cause binding of the door or hinges or that will adversely affect the operation of the catch.

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casework integrity

DOOR IMPACT TEST

- **CHALLENGES** the resistance of a 240 inch pound impact to the door face and is applicable only to cabinet doors that extend below the work surface, excluding glass doors.
- **PROCEDURE** - With the unit and top set, add sufficient weight to the top in order to prevent overturning. A 20 lb (9 kg) sand bag shall be suspended and dropped to provide an impact of 240 inch pounds at the center of the closed door.



- **ACCEPTANCE LEVEL** - After the test, the door and catch shall operate normally and show no signs of permanent damage.

DRAWER BOTTOM IMPACT TEST

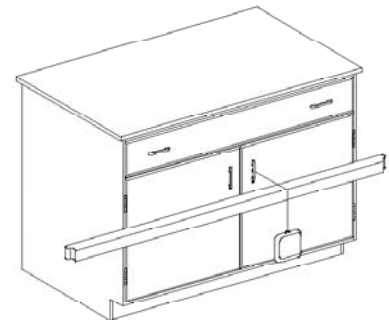
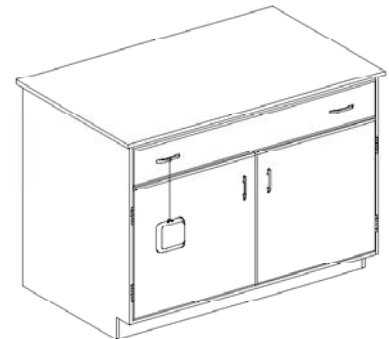
- **CHALLENGES** the resistance to impact of the drawer bottom and slide mechanism.
- **PROCEDURE** - Open the drawer to 13" (330 mm) of travel. Drop a 10 lb (4.5 kg) sand or shot bag from a height of 24" (610 mm) into the bottom of the drawer at the center of the width of the drawer and 6" (152 mm) back from the inside face of the drawer. Remove the sand or shot bag.
- **ACCEPTANCE LEVEL** - Operate the drawer through the full cycle. The drawer shall operate normally. Any deformation will not cause binding or interfere with the operation of the drawer.

DRAWER SUPPORT TEST

- **CHALLENGES** the ability to support a point load given to the front of the drawer and will challenge the attachment of the drawer head to the drawer.
- **PROCEDURE** - With the unit and top set, add sufficient weight to the top in order to prevent overturning. Open the drawer to 13" (330 mm) of travel and hang 150 lbs (68 kg) from the drawer head at the centerline of the drawer for 5 minutes. Remove the weight and operate the drawer through the full cycle.
- **ACCEPTANCE LEVEL** - There shall be no interference with the normal operation of the drawer.

DRAWER AND DOOR PULL TEST

- **CHALLENGES** the strength of the pull hardware.
- **PROCEDURE** - Pulls are to be installed in accordance with the manufacturer's practice, using the specified attaching hardware and method. Block the door and the drawer closed. Using a cable pulley and weight assembly, apply a force of 50 lbs (22.7 kg) perpendicular to each pull. Revise the setup to hang weight from each pull.



- **ACCEPTANCE LEVEL** - The pulls shall resist force and support weight without breakage. After completion of the test and removal of the weight, there shall be no significant permanent distortion. Some pull designs will require variations to set up apparatus. These pulls shall be tested in conformance to the applied pull forces.

DRAWER ROLLING LOAD TEST

- **CHALLENGES** the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.
- **PROCEDURE** - Position the drawer on a table at a 45 degree angle. Place a 2" (50.8 mm) diameter by 12" (305 mm) long steel rod (approximately 10 lbs [4.5 kg]) 13" (330 mm) from the target impact area (so that the rod will roll freely to impact the back) of the drawer. Subject the back to three impacts, and reverse the drawer to subject the front to three additional impacts.



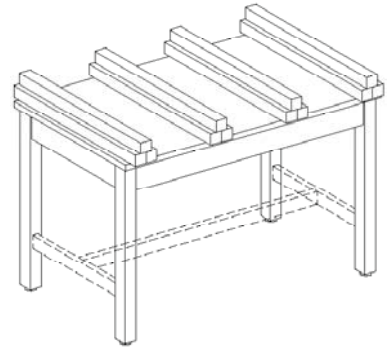
- **ACCEPTANCE LEVEL** - The drawer shall show no signs (other than minor scratches and dents) of permanent damage. All joinery shall be intact, and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

SHELF LOAD TEST

- **CHALLENGES** the ability of a shelf and its mounting hardware to support normal loads.
- **PROCEDURE** - The shelf shall be mounted as designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Using shot or sand bags weighing 10 lbs (4.5 kg) each, uniformly load the shelf to a maximum of 200 lbs (90.7 kg). Measure the deflection on the shelf by measuring the distance to the reference point and calculating the difference between the two measurements.
- **ACCEPTANCE LEVEL** - The maximum deflection shall be 1/180 of the span, not to exceed 1/4" (6.4 mm).

TABLE STRUCTURAL INTEGRITY TEST

- **CHALLENGES** the table components to a normal load.
- **PROCEDURE** - Load the table top with an evenly distributed load of no less than 300 lbs (136 kg) for mobile, 600 lbs (272 kg) for free standing, and 2000 lbs (907 kg) for fixed. Include the weight of the working surface as a live load by using solid steel bars, each weighing 50 lbs (22.7 kg).



- **ACCEPTANCE LEVEL** - No structural breakage shall occur, and the apron rails shall not deflect more than 1/8" (3.2 mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer.

casework refinishing/refacing/refurbishing - guidelines

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 shall 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 UBC 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, and existing surfaces, including doors, drawer fronts, cabinet face, and finished ends:

- If HPDL, shall be removed with any damaged core areas repaired and core surface suitably prepared for proper adhesion of the new surface material.
- If paint, shall be stripped to the original surface with any damaged areas repaired and resurfaced with the specified material.

Does not include the 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.

All work shall meet the requirements of first class workmanship.

APPENDIX

fraction/decimal/millimeter conversions

FRACTION	DECIMAL	MILLIMETER	FRACTION	DECIMAL	MILLIMETER
1/64	0.01563	0.3969	33/64	0.51563	13.0969
1/32	0.03125	0.7938	17/32	0.53125	13.4938
3/64	0.04688	1.1906	35/64	0.54688	13.8906
1/16	0.06250	1.5875	9/16	0.56250	14.2875
5/64	0.07813	1.9844	37/64	0.57813	14.6844
3/32	0.09375	2.3813	19/32	0.59375	15.0813
7/64	0.10937	2.7781	39/64	0.60938	15.4781
1/8	0.12500	3.1750	5/8	0.62500	15.8750
9/64	0.14063	3.5719	41/64	0.64063	16.2719
5/32	0.15625	3.9688	21/32	0.65625	16.6688
11/64	0.17188	4.3656	43/64	0.67188	17.0656
3/16	0.18750	4.7625	11/16	0.68750	17.4625
13/64	0.20312	5.1594	45/64	0.70313	17.8594
7/32	0.21875	5.5563	23/32	0.71875	18.2563
15/64	0.23438	5.9531	47/64	0.73438	18.6531
1/4	0.25000	6.3500	3/4	0.75000	19.0500
17/64	0.26563	6.7469	49/64	0.76563	19.4469
9/32	0.28125	7.1438	25/32	0.78125	19.8438
19/64	0.29688	7.5406	51/64	0.79688	20.2406
5/16	0.31250	7.9375	13/16	0.81250	20.6375
21/64	0.32813	8.3344	53/64	0.82813	21.0344
11/32	0.34375	8.7313	27/32	0.84375	21.4313
23/64	0.35938	9.1281	55/64	0.85938	21.8281
3/8	0.37500	9.5250	7/8	0.87500	22.2250
25/64	0.39063	9.9219	57/64	0.89063	22.6219
13/32	0.40625	10.3188	29/32	0.90625	23.0188
27/64	0.42188	10.7156	59/64	0.92188	23.4156
7/16	0.43750	11.1125	15/16	0.93750	23.8125
29/64	0.45313	11.5094	61/64	0.95313	24.2094
15/32	0.46875	11.9063	31/32	0.96875	24.6063
31/64	0.48438	12.3031	63/64	0.98438	25.0031
1/2	0.50000	12.7000	1	1.00000	25.4000

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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

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