

# AIA/CES

The Materials Engineering within the Spectral Art Utilized to Design and  
Manufacture Institutional Casework and Office Furniture

Presented by:

**Rick Clough**

Stevens Industries, Inc.

Course Number: 1004A1

Credit Designation: LU/HSW

Approved: 1/20/2014

# Class Objectives

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- Insights into the wide array of information on the attributes and features of composite cores, surfacing materials and hardware used to manufacture quality casework.
- Know and understand how these materials support marketable designs plus accommodating the environmental requirements for your projects.
- Guidance on how to utilize this information to
  - facilitate your specification drafting skills
  - help you hone your trendsetting designs
  - help your customers understand and appreciate your designs to create their visions.
- Provide information on a comparison basis of the Modular Casework Process to the Architectural Millwork approach.

# Information Credits

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- American Institute of Architect (AIA), Construction Standards Institute (CSI) & Architectural Woodwork Institute (AWI) have been providing guidance in the form of standards to Architect & Consultants, Project Managers, Design Builders, Design Managers, General Contractors, and Subcontractors to help assure that the owners receive what was specified.

# Information Credits

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- CSI offers an extensive outline for building project management.
- AWI's - AWS' documentation covers furnishing & casework specifications.
- AWI's Quality Certification Program QCP will assist you in providing quality products and services to your clients!

# AWI & CSI Mission Objectives:

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- The improvement of industry standards
- Technical help for the design professional & building contractors
- Research of new & improved materials & methods
- Enhancing the quality of services & products
- Seeking continuity in a diverse industry
- Formation and Maintenance of product & service certification programs

# Casework Products References

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- CSI Standard Sections
  - 6055 “Wood & Plastic”
  - 12340 “Laminated Casework”
- AWI / Architectural Woodworking Standards – AWS
  - Edition 1 2009
  - Sections:
    - 1 “Submittal”
    - 2 “Care and Storage”
    - 10 “Casework”
    - 11 “Countertops”
    - Appendix “B” – 12 Installation

Note: To be updated early 2014

# Class Guidelines

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- This class will be (60) minutes in length.
  - due to the short duration there will not be a break.
- You will be provided with an outline of the content of this session at the conclusion.
- The presentation will be a combination of verbal delivery coupled with PowerPoint visual support.
- The course materials & content will be generic & are scripted.
- Discussion will not cover branded products or services from a specific provider until after the conclusion of the credit portion of the class.

# Class Guidelines

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- At the conclusion of the class, a “Program Completion Form” will be circulated for you to verify that your names & membership numbers are correct.
  - this will ensure that you receive the CES points earned
- The AIA/CES Program Completion Form will be given to your training coordinator for verification of your attendance at this training.



# Reporting for Awarding of Points

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- The completed copy of the AIA/CES Program Completion Form B will be sent to:
  - The University of Oklahoma  
AIA/CES Records, Room B-1  
1700 Asp Avenue  
Norman, OK 73072  
T: 800.605.8229  
F: 405.325.6965
- The form must be submitted by the class presenter within two weeks of the completion of the course.

# Introductions

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- Please introduce yourself to the presenter & the other participants!
  - name
  - title
  - company
  - responsibilities

# Sources for the Training Materials

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- AIA - American Institute of Architects
- CSI - Construction Specifications Institute
- AWI - Architectural Woodwork Institute – AWI Quality Certification Program (QCP)
- ASTM - American Society for Testing & Materials
- ANSI - American National Standards Institute
- CPA - Composite Panel Association
- NEMA - National Electrical Manufacturers Association
- BHMA - Builders Hardware Manufacturers Association
- LEED - Leadership in Energy & Environmental Design
- LMA - Laminating Materials Association, Inc.
- SFI - Sustainable Forest Initiative
- FSC – Forest Stewardship Council
- GG-UL – Green Guard – Underwriter Laboratories
- SEFA – Scientific Equipment and Fixture Association

# Core Materials

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Core materials for laminated panels used in casework fabrication...

“It’s what you do NOT see that is very important to the end products service life!”

# Core Materials

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- General Information

- today's particleboard & fiberboard provide industrial users a repeatable, consistent quality range which underpins the "design" flexibility needed for fast, efficient production lines of high impact visually pleasing products that Institutional & commercial customers require.

# Core Materials

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- Particleboard & fiberboard are wood composite panel products used widely in the manufacturing of:
  - casework
  - office furniture
  - many other applications
- Panels are manufactured in a variety of sizes & densities, thus providing great opportunity in design to accommodate your clients' and their custom specifications
- We will focus primarily on particleboard, the work horse of composite panels.

# Core Materials

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- What is particleboard?
  - wood panel product consisting of discrete wood particles of various sizes that are bonded together with a synthetic resin or binder under heat & pressure.

# Properties you need to know!

Grade	Modules of Rupture N/mm2 (psi)	Modules of Elasticity N/mm2 (psi)	Internal Bond N/mm2 (psi)	Hardness N (pounds)	Linear Expansion max. avg. (percent)	Face N (pounds)	Edge N (pounds)	Formaldehyde Max. Emissions (ppm)
H-1	16.5 (2393)	2400 (348100)	0.90 (130)	2225 (500)	NS <sub>s</sub>	1800 (405)	1325 (298)	0.30
H-2	20.5 (2973)	2400 (348100)	.090 (130)	4450 (1000)	NS	1900 (427)	1550 (348)	0.30
H-3	23.5 (3408)	2750 (3989)	1.00 (145)	6675 (1500)	NS	2000 (450)	1550 (348)	0.30
M-1	11.0 (1595)	1725 (250200)	0.40 (58)	2225 (500)	0.35	NS	NS	0.30
M-S <sub>6</sub>	12.5 (1813)	1900 (275600)	0.40 (58)	2225 (500)	0.35	900 (202)	800 (180)	0.30
* M-2	14.5 (2103)	2250 (398900)	0.45 (65)	2225 (500)	0.35	1000 (225)	900 (202)	0.30
** M-3	16.5 (2393)	2750 (398900)	0.55 (80)	2225 (500)	0.35	1100 (247)	1000 (225)	0.30
LD-1	3.0 (435)	550 (79800)	0.10 (15)	NS	0.35	400 (90)	NS	0.30
LD-2	5.0 (725)	1025 (148700)	0.15 (22)	NS	0.35	550 (124)	NS	0.30

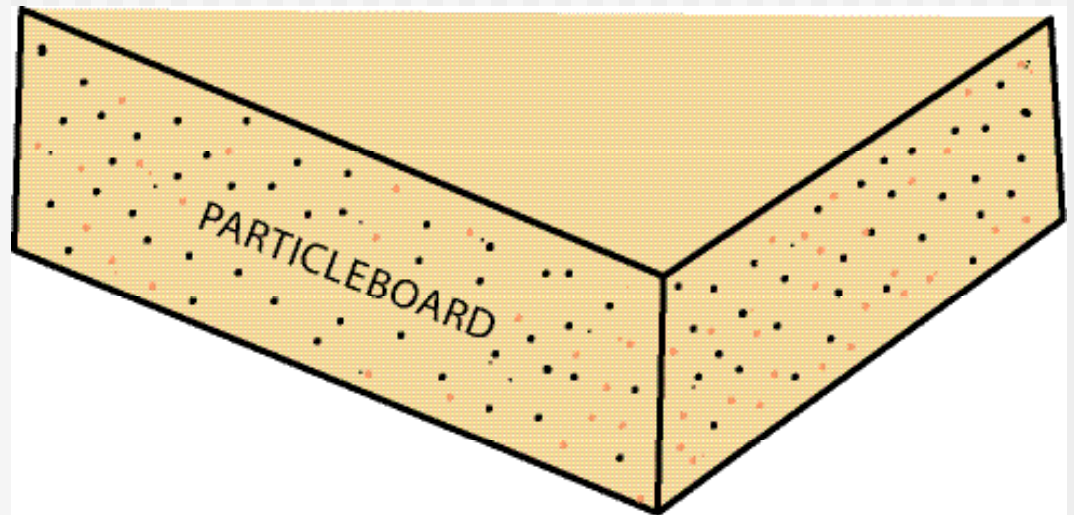
\* M-2 is the performance choice

\*\* M-3 is used when certain wide horizontal spans are required



# Variables Affecting Particleboard Properties

- Special Additives
- MAT Moisture Level
- MAT Moisture Distribution
- Particle Size
- Board Specific Gravity
- Particle Orientation
- Species
- Pressing Variables – cycle time, temperature, & pressure
- Type of Raw Material
- Type of Particle Generated
- Binder Type
- Binder Amount
- Binder Distribution Among Layer



# Definitions of Properties Attributes

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- Density

- an expression of board mass per unit volume in terms of:
  - grams per cubic centimeter
  - pounds per cubic foot
- U.S. industry typically uses “pounds per cubic foot.”

# Definitions of Properties Attributes

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- Moisture Content (M.C.)
  - amount of water in wood, expressed as a percentage of the weight of wood that was fully dried in an oven between 214°F & 221°F. 5% to 7% is ideal.
- Internal Bond Strength (IB)
  - overall measure of the board's integrity that defines how well the core material is bonded together. Values at 65 P.S.I. and above provide a solid structural base.

# Definitions of Properties Attributes

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- Modulus of Rupture (MOR)
  - an index of the ultimate breaking strength of the board when loaded as a simple beam
  - MOR is important in applications such as shelving & desktops
  - particleboard is seldom loaded to the point where actual breakage will occur because objectionable deflection or sagging will occur first

# Definitions of Properties Attributes

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- Modules of Elasticity (MOE)
  - a measure of the board's resistance to deflection or sagging when loaded as a simple beam
  - MOE can be considered a stiffness factor & is critical in applications such as shelving & desktops where only the ends of the board are supported

# Definitions of Properties Attributes

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- Screwholding Power

- a measure of force required to withdraw a number 10 sheet metal screw directly from the face or edge of the board 225 lb and higher provide excellent grounding for face fasteners.
- a pre-drilled pilot hole is required for maximum screw holding

# Definitions of Properties Attributes

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- Formaldehyde/Aldehyde Emissions

- most particleboard adhesive systems emit small quantities of formaldehyde when the panel is new.
  - formaldehyde can be an eye & lung irritant to some individuals at relatively low levels
  - emissions decrease exponentially with age & are reduced even further by surfacing with laminates & coatings

# Definitions of Properties Attributes

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- Flame Spread – Class “III” or “C”
  - particleboard 3/8” & thicker, with urea or phenolic binder, finished or unfinished, is recognized by the U.S. Department of Housing & Urban Development, Underwriters’ Laboratories & model building codes as having a Class III, below 200 flame spread rating.



# Definitions of Properties Attributes

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- Flame spread Class "I" or "A"
- flame spread ratings as low as Class I, below 25, are available from some manufacturers who make fire-retardant particleboard products.
- in certain situations, flame resistant coatings can be used to reduce the flame spread to Class II, below 75.

# Particleboard Standards & Testing

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- Test Methods

- The American National Standards Institute (ANSI) Standard ANSI A208.1- 2009 provides that the physical & mechanical properties of particleboard be tested & inspected in accordance with American Society for Testing & Materials (ASTM) D1037-12: Standard Methods of Evaluating the Properties of Wood-Base Fiber & Particle Panel Materials.

# Typical Particleboard Interior Applications

Shelving	M-1 M-2 M-3	
Counter Tops	M-2 M-3	ANSI A 161.2 1998
Kitchen Cabinets	M-1 M-2	ANSI A 161.1 2000(R2006)
Door Core	LD-1 LD-2	N.W.W.D.A. Industry Standard Series I.S. 1-A & IS 1-87
Stair Treads	M-3	HUD/FHA UM 70a
Mouldings	M-3	W.W.M.M.P.Standard WM 2-73

# Characteristics of Core Material Performance

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- Particleboard & MDF are the recommended substrates for thermo fused decorative laminate, high pressure decorative laminate & wood veneer because of their excellent "flatness" and surface uniformity.

# Characteristics of Core Material Performance

- Fair dimensional stability (expansion/contraction in panel size) is acceptable, unless the product is exposed to wide swings in relative humidity.
  - generally below 20% or above 80% with “rapid” swings of more than 30 points
- AWS section “Care & Maintenance”
  - Wood products interior environment requirements are covered in detail.

# Characteristics of Core Material Performance

Panel Core Type	Flatness	Visual Edge Quantity	Surface Uniformity	Dimensional Stability	Screwholding	Bending Strength	Availability
Industrial Particleboard (Medium)	Excellent	Good	Excellent	Fair	Fair	Good	Readily
Medium Density Fiberboard (MDF)	Excellent	Excellent	Excellent	Fair	Good	Good	Readily
Moisture Resistant Particleboard	Excellent	Good	Good	Fair	Fair	Good	Limited
Moisture Resistant MDF	Excellent	Excellent	Excellent	Fair	Good	Good	Limited
Fire Rated Particleboard	Excellent	Fair	Good	Fair	Fair	Good	Limited

## Environmental

“Support your casework supplier should provide”

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The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™, created by the U.S. Green Building Council, is the nationally accepted benchmark for the design, construction and operation of high performance green buildings. The LEED Rating System was created to transform the built environment to sustainability by providing the building industry with consistent, credible standards for what constitutes a green building.

## Environmental

### “Support your casework supplier should provide”

Assembled casework and furniture systems that are GREENGUARD Certified and provide numerous LEED potential contributions for consideration on your current project.

Laminated panels, components and cabinetry/ furnishings that are manufactured with wood composite panel products which contain 100% recycled and/or recovered wood fiber content. Composite Panel Association / Eco-Certified Composite Standard (ECCS) Part B.

Sound and proven forest management practices that are a direct result of companies in the supply chain aggressively participating in the Forest Stewardship Council (FSC®) Certification for Chain of Custody.



# Information on Potential LEED Credits

LEED Category	Intent	Requirements	Stevens Solution
Environmental Quality IEQ 4.1	Improve indoor air quality	Adhesives and sealants	*GREENGUARD™ Certified CI, NC, SCH, HC**
Environmental Quality IEQ 4.2	Improve indoor air quality	Paints and coatings	*GREENGUARD Certified CI, NC, SCH, HC**
Environmental Quality IEQ 4.5	Improve indoor air quality	Use systems furniture and furnishings of low emitting materials	*GREENGUARD Certified CI, NC, SCH, HC**
Environmental Quality IEQ 4.4	Improve indoor air quality	Use composite wood products containing no added formaldehyde resins	*When specified, particleboard core containing no added urea formaldehyde is utilized

# Information on Potential LEED Credits

LEED Category	Intent	Requirements	Stevens Solution
Materials and Resources MR 4.1	Use products that incorporate recycled content material	Sum of recycled content constitutes at least 10% of materials in project	*Particleboard being ECCS Part B certified, containing 100% recycled and recovered wood is utilized; HPL laminates being certified, containing a minimum of 20% recycled content are utilized
Materials and Resources MR 4.2	Use products that incorporate recycled content material	Sum of recycled content constitutes at least 20% of materials in project	*Particleboard being ECCS Part B certified, containing 100% recycled and recovered wood is utilized; HPL laminates being certified, containing a minimum of 20% recycled content are utilized
Materials and Resources MR 5.1	Use regionally manufactured materials	Use 20% of building materials (by cost) that are regionally manufactured	*Manufacturing of ALL products is done in one primary plant location
Materials and Resources MR 7.0	Obtain wood products from FSC Certified Forests	50% of wood based materials must be obtained from forests certified by an FSC accredited certification body	*When specified, particleboard and MDF from FSC Certified suppliers is utilized

# Surfacing Materials

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Surfacing materials for laminated panels used in casework fabrication...

**“The lasting impression you see  
but know little about!”**

# Surfacing Materials

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- Surfacing materials primarily used to laminate a high performance panel for today's designs are:
  - Thermofuse (TFL) Decorative Laminate
  - High Pressure Decorative Laminate (HPL)
  - Veneers

# Surfacing Materials

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- Other decorative surfacing materials categories include:
  - vinyl films
  - low basis weight papers
  - decorative foils
  - heat transfer foils
- These other surfacing do not have the same long service life as TFL, HPL or finish coated veneers.
- Note: Surface abrasion & scratch testing supports these classifications

# Thermofuse Decorative Laminate (TFL)

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- Step 1:
  - Thermofuse laminate is a preprinted or solid color decorative paper that has been 100% saturated with a resin.
- Step 2:
  - Reacted in a press under heat & pressure, these Melamine resin-saturated papers will be thermofused to wood-based materials without need for an adhesive, while simultaneously forming a resin-rich finish on the surface.

# Thermofuse Decorative Laminate (TFL)



Typical  
pressing work  
center

# Thermofuse Decorative Laminate (TFL)

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- These thermofuse products are often referred to as “saturated” overlays & “thermofuse” decorative papers.
- The American Laminators Association has adopted the term “Permalam” to describe these products.



# Thermofused Decorative Laminate (TFL)

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- Thermofused decorative surfaces are easy to clean, & they are heat & stain resistant. Because the laminate becomes an actual part of the panel, it will resist chipping, cracking or peeling.
- Thermofused laminated panels are well suited for many end-use applications such as:
  - casework
  - furniture
  - fixtures

# Thermofuse Decorative Laminate (TFL)

- The properties, appearance & performance of thermofuse panels are dependent upon:
  - Type of resin
    - Melamine
  - Amount of resin saturation
    - 100%
  - Material conditioning procedures
    - Clean room 70° F – 50% R.H.
  - Laminating process utilized
    - Platten or continuous roll press

# Performance Standards For Thermofused Decorative Laminates (TFL)

Note:  
TFL as  
compared to  
HPL per NEMA  
LD-3

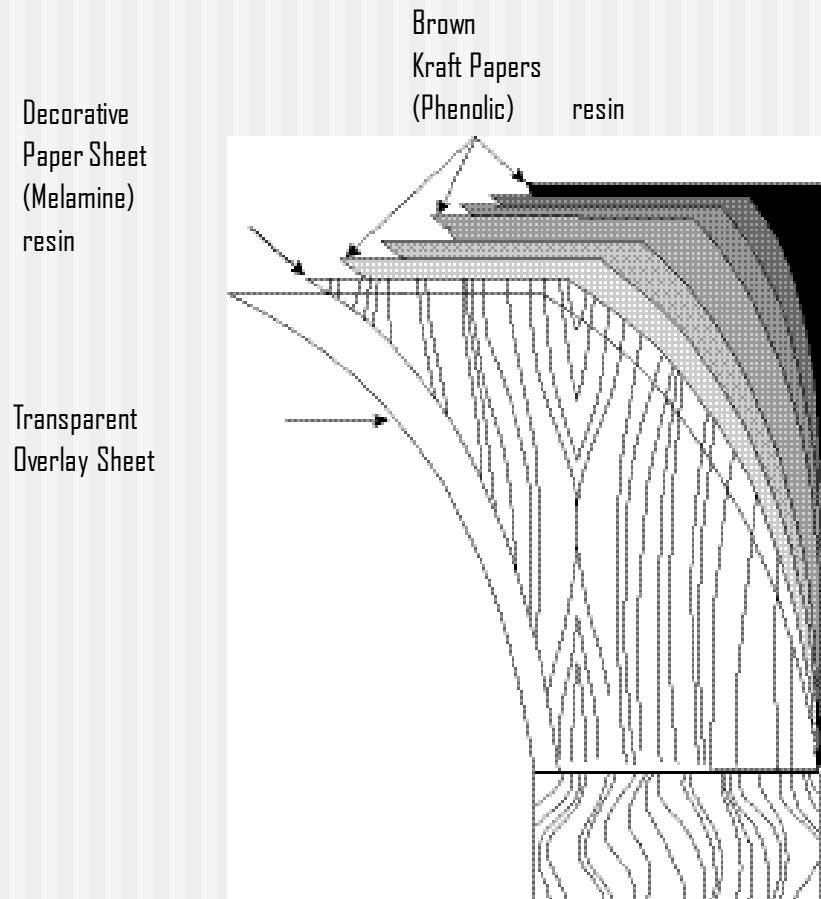
Tests for Resistance to:	Test Description <sup>(1)</sup>	Thermofused Melamine		High Pressure
		Minimum Requirements		NEMA LD3-2000 GP-20 Minimum Performance Standard
		Solid Colors	Wood Grains	
Wear	A measure of the ability of a decorative overlaid surface to maintain its design or color when subjected to abrasive water.	400 cycles	125 cycles	400 cycles
Scuff	A measure of the ability of a decorative overlaid surface to maintain its original appearance when exposed to scuffing.	No effect	No effect	No effect
Stain	A measure of the ability of a decorative overlaid surface to resist staining or discoloration by contact from 29 common house-hold substances.	No effect 1-23. Moderate 24-29.	No effect 1-23. Moderate 24-29.	No effect 1-23. Moderate 24-29.
Cleanability	A measure of the ability of a decorative overlaid surface to be cleaned, using a sponge.	No effect. Surface cleaned in 10 or fewer strokes.	No effect. Surface cleaned in 10 or fewer strokes.	Slight
Light	A measure of the ability of a decorative overlaid surface to retain its color after exposure to a light source having a frequency range approximating sunlight.	Slight	Slight	Slight
High Temperature	A measure of the ability of a decorative overlaid surface to maintain its color and surface texture when subjected to a high temperature (356 F.).	Slight	Slight	Slight
Radiant Heat	A measure of the ability of a decorative overlaid surface to resist spot damage when subjected to a radiant heat source.	No effect up to 60 seconds	No effect up to 60 seconds	No effect up to 60 seconds
Boiling Water	A measure of the ability of a decorative overlaid surface to maintain its color and surface texture when subjected to boiling water.	No effect	No effect	No effect
Impact	A measure of the ability of a decorative overlaid surface to resist fracture due to spot impact by a steel ball dropped from a measured height.	15" without fracture	15" without fracture	15" without fracture

(1) Test procedures are identical to those used by the National Electrical Manufacturers Association (NEMA) for testing high-pressure decorative laminates. Minimum requirements to comply for SOLID COLORS meet or exceed NEMA Standard LD3-2000 for high-pre

# HPL Elements

## High Pressure Decorative Laminates

- Resin-impregnated kraft papers decorative backing face material & a clear protective overlay sheet, are formed and enhanced under heat & pressure. The monolithic assembly offers resistance to wear, many common stains & chemicals. Common uses include casework exteriors, countertops, & wall paneling.



# Types of HPL

- There are different types of high pressure laminate materials designed to meet specific requirements that are available from suppliers in standard sheet sizes. They include:
  - general purpose
  - postforming
  - backer

# Types of HPL

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- General Purpose

- most widely used because it is suitable for almost all horizontal & vertical surface applications
- typical thicknesses are from 0.020" to 0.050"
- Resin is thermo set

# Types of HPL

- Postforming

- Reactivates by using heat to soften the resin system & then subsequent restraint & cooling, these nominal 0.040" thick laminates can be bent or soft-roll formed to radii as small as 1/2" or less
- Resin is thermo plastic

# Types of HPL

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- Backer

- this laminate without a decorative face is used on the back of panel assemblies to:
  - protect the substrate from changes in humidity
  - balance the panel construction



# Types of HPL

- Other types used by fabricators when needed to meet specific product requirements:
  - cabinet liners
  - high-wear
  - fire rated
  - "antistatic"
    - designed for:
      - computer floor panel
      - work surfaces

# Performance Properties & Values of HPL

Values  
from  
NEMA  
L.D. -3

	Property	Grade** Units	General Purpose				Post Forming		Flame Retardant		
			HGS	HGL	VGS	VGL	HGP	VGP	SGF	HGF	VGF
	Nominal Thickness	mm (in.)	1.2 (0.048)	1.0 (0.039)	.7 (0.028)	0.5 (0.20)	1.0 (0.039)	0.7 (0.028)	1.5 (0.059)	1.2 (0.048)	0.8 (0.032)
LD3 Test Method	Thickness Tolerance	mm (in.)	±0.12 (±0.005)	±0.12 (±0.005)	±0.10 (±0.004)	±0.10 (±0.0045)	±0.12 (±0.005)	±0.10 (±0.004)	±0.12 (±0.005)	±0.12 (±0.005)	±0.12 (±0.005)
3.1	Appearance	See Section 3.1 and Table 2-4 for Requirements									
3.2	Surface Finish	See Table 1-1									
3.3	Light Resistance	Rating, * Min.	SL	SL	SL	SL	SL	SL	SL	SL	SL
3.4	Cleanability	Rating, * Min.	20	20	20	20	20	20	20	20	20
	Stain 1 - 10	Rating, * Min.	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Stain 11 - 15	Rating, * Min.	M	M	M	M	M	M	M	M	M
3.5	Boiling Water Resistance	Rating, * Min.	NE	NE	NE	NE	NE	NE	NE	NE	NE
3.6	High Temperature Resistance	Rating, * Min.	SL	SL	SL	SL	SL	SL	SL	SL	SL
3.7	Linear Glass Scratch Resistance	See Chart 3-1 of Section 3.7.7									
3.8	Ball Impact Resistance	mm (in.) Min.	1250 (50)	900 (35)	500 (20)	400 (15)	750 (30)	500 (20)	1400 (55)	1150 (45)	500 (20)
3.9	Dart Impact Resistance	mm	500	300	200	---	300	200	550	450	200
3.10	Radiant Heat Resistance	Sec., Min.	125	100	80	60	100	80	125	75	50
3.11	Dimensional Change	% MD, Max.	0.5	0.6	0.7	0.8	1.1	1.1	0.5	0.5	0.7
		% CD, Max.	0.9	1.0	1.2	1.3	1.4	1.4	0.9	0.9	1.2
3.12	Room Temperature Dimensional Stability	% MD, Max.	0.5	0.6	0.6	0.8	1	1	0.5	0.5	0.7
		% CD, Max.	0.8	1.0	1.1	1.3	1.3	1.3	0.9	0.9	1.2
3.13	Wear Resistance	400	400	400	400	400	400	400	400	400	400
3.14	Formability	mm(in.) Radius, Min.	---	---	---	---	---	---	---	---	---
3.15	Blister Resistance	Sec., Min.	---	---	---	---	---	---	---	---	---

\* Rating System : NE - No Effect, SL- Slight Effect, M - Moderate effect, S - Severe effect

\*\* Grade designations are not acronyms

# Laminating Adhesives

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- “Works internally to hold selected design components together.”
- A variety of adhesives have been found satisfactory for bonding HPL, vinyl films, low basis weight papers, foils & veneers to particleboard substrates.

# Laminating Adhesives

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- The type of adhesive selected will depend upon the product being produced & the fabricator's capabilities.
- The most commonly used adhesive types are:
  - thermosetting
  - thermoplastic
  - contact

# Thermosetting

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- Thermosetting adhesives cure at room temperature or in the hot press by chemical reaction to form rigid bonds that are "not" resoftened by subsequent exposure to heat.

# Thermosetting

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- Urea Formaldehyde
  - good for most applications
  - good moisture resistance
- Resorcinol & Phenol Resorcinol
  - used where waterproof bonds, good heat, & higher fire ratings resistance are required

# Thermosetting

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- Casein

- good for applications where moisture exposure resistance is not critical

- Epoxy

- good for bonding to impervious substrates such as metal
- performs well on almost all substrates.
- good gap-filling properties

# Thermoplastic

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- Thermoplastic adhesives harden at room temperature through loss of water or solvent & "re-softens" upon subsequent exposures to heat



# Thermoplastic

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- Polyvinyl Acetate (White Glue)
  - good for bonding HPL to wood substrates
  - low moisture & heat resistance
  - not recommended for sink tops
- Catalyzed Polyvinyl Acetate
  - good for most applications
  - gives moisture resistant or waterproof bonds depending upon formulation

# Contact

- Can be water- or solvent- based
- Suitable for bonding HPL to most substrates
- Must be applied to both mating surfaces & dried to the touch before bonding
- Laminating can be accomplished at room temperature

- High-strength, water resistant bonds are developed almost immediately upon contact of coated surfaces
- Glue line remains flexible
  - allows HPL to expand & contract independently of the substrate
    - minimizes the tendency to warp (particularly for one-sided constructions)

# Cabinet Hardware

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- “Hardware components are the enabler within the design.”
- Hardware categories for Institutional & Medical Market:
  - hinges
  - pulls
  - knobs
  - catches & latches
  - shelf brackets & standards
  - drawer slides
  - tracks & guides

# Hinges

- Hinges for the institutional & medical markets are dominated by three types for the standard frameless construction type:
  - Five-knuckle Institutional
  - Institutional Barrel
  - Fully Concealed

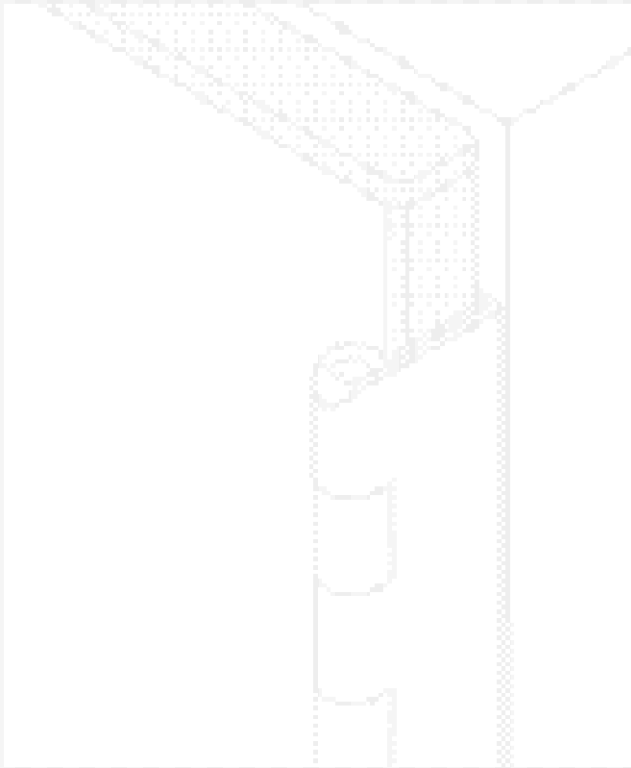


# Five-knuckle Institutional

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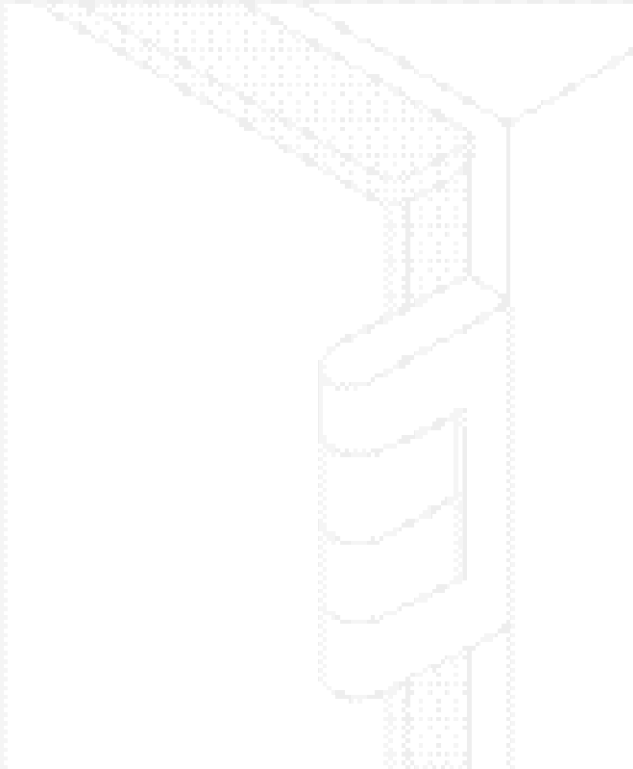
- Pleasing bold appearance
- Includes safety-tip with non-removable pins
- Proven institutional quality & strength that stands up to the rigors of everyday use

# Five-knuckle Institutional



- Black epoxy
- Pearl epoxy
- Grey epoxy
- US26D Satin
- US26D Brushed

# Institutional Barrel



- Nickel
- Black

Mid-sized  
External hinge design

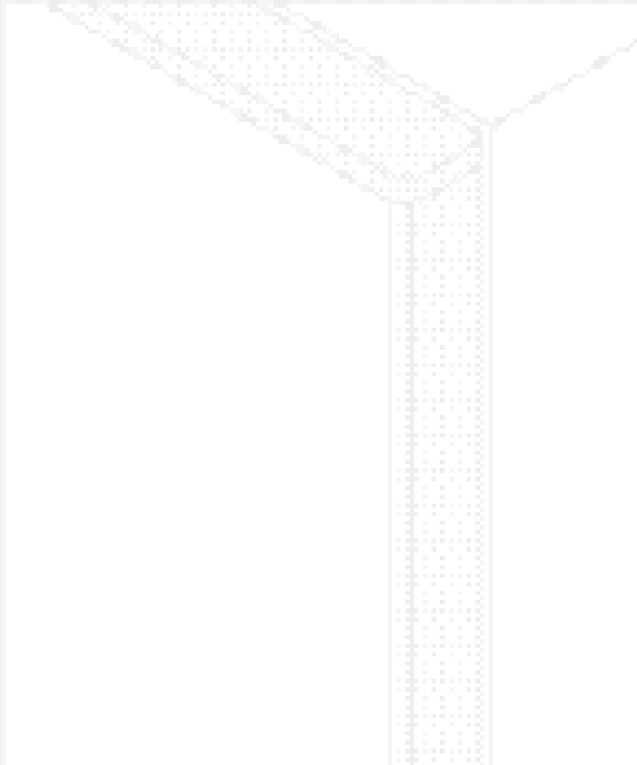


# Fully Concealed

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- Clean uninterrupted exterior appearance with use of concealed hinges.
- Full opening 165-degree or space saving 110-degree designs available.

# Fully Concealed



- Surfacing choices flow uninterrupted in a visual panoramic display.

# Pulls

- Pull design standards include:
  - contour
  - bent wire
  - bar



# Catches

- Typical selections include:
  - roller
  - magnetic
  - friction



# Adjustable Shelf Clips

- Usually made of plastic or metal.
- Various designs of shelf supports offer design functional value & visual appeal.



# Drawer Slides

- A slide assortment with internal workings that supports whatever the customer wants to store in the drawer
  - Bottom-mounted, side-adjustable drawers & slide-out shelves ride on nylon roller.
  - 100#-rated epoxy-coated steel slides to ensure quiet, smooth operation.
  - Slides have built-in drawer stop & self-close feature.

# Drawer Slides



# Cabinet Hardware Summary

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- Cabinet Hardware is usually a buy out item for most OEM cabinet manufacturers. Hardware suppliers are a valued member of the manufacturers' supply chain. Manufacturers work closely with the cabinet hardware supplier to ensure that specified quality levels are met.



# Cabinet Hardware Summary

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- Where it has been necessary, material requirements have been established to insure safety & stability to which the public is entitled. However, since cabinet hardware styling & functional application are ever changing, new items are constantly being introduced. Each manufacturer of this type of hardware shall determine which of its products will meet these requirements. On all items, styling is optional.

# Cabinet Hardware Summary

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- Cabinet hardware products generally have been described in three levels of performance. Choice of product is made on the basis of utility, aesthetics, security objectives & end use task.

# Cabinet Hardware Summary

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- As a general guide: B.H.M.A.
  - Grade 1
    - highest and is suitable for most institutional applications.
  - Grade 2
    - often used in all applications.
  - Grade 3
    - suitable for most residential uses.

# Architectural Woodwork Institute AWS

## Construction Types

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- Modular Caseworks
- Architectural Millwork Cabinets

# Modular & Architectural Millwork Cabinets

## Sections 10 & 11

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- These sections cover casework, cabinets, countertops, & fixtures custom manufactured in units or modules to design for a particular function or project. The terms "cabinet", "casegoods" & "casework" are often used interchangeably. Typical projects are for schools, medical facilities, nursing homes, children daycare & store fixtures.

# Specification Requirements

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- AWS Grade must be specified.
  - these standards provide for three Grades:
    - Premium Grade.
    - Custom Grade.
    - Economy Grade.

# Premium Grade

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- AWS Premium Grade:
  - specified when the highest degree of control over the quality of workmanship, material, installation & execution of the design intent is required. Usually reserved for special projects or feature areas within a project.
  - Supplier often has to remove proprietary design features to meet premium grade of the standard

# Custom Grade

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- AWS Custom Grade:
  - specified for most conventional architectural casework. This Grade provides a well defined degree of control over the quality of workmanship, materials & installation of a project. The vast majority of all work produced is Custom Grade.
  - Compromise between a general performance level and supplier innovations



# Economy Grade

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- AWS Economy Grade:
  - defines the minimum expectation of quality, workmanship, materials & installation within the scope of these Standards.
  - Supplier working with design team has the highest level of propriety design feature implementation in final products

# Modular Caseworks

## AWS Section 10

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- Whether cabinets are specified in Section 06000 or in Section 12000 of your office master, they are often built in “modules”.
- Modular caseworks are often specified from a catalog rather than the more traditional dialog associated with individual custom millwork cabinetry.

# Modular Caseworks

## AWS Section 10

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- AWI/AWMAC member firms can & do make modular caseworks. Some have the capability to make both a line of standard modular caseworks as well as the custom work often associated with schools, libraries, health care facilities, etc.
- In many cases the performance of these cabinets exceeds that of traditional kitchen & bath cabinets sold in the retail & residential contract markets.

# Modular Caseworks

## AWS Section 10

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- A non proprietary specification & quality standard for mass-produced modular caseworks acceptable primarily for institutional or commercial use can be derived.

# Modular Caseworks

## AWS Section 10

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- Includes:
  - this section will discuss cabinets, cases & fixtures, produced from a manufacturer's standard details adapted to use for a particular project.
- Excludes :
  - counter tops (see Section 11).

# Modular Caseworks Advantages

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- Modular caseworks allow the design professional to use manufacturer-designed & engineered quality when the economics of mass production outweigh the needs for design flexibility.

# Modular Caseworks Advantages

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- Certain casework applications may require alternate construction techniques for high abuse laboratory environments. It is suggested the design professional consult the AWI/AWS Appendix "A" 14 & 16 for the performance criteria of laboratory furniture, casework, shelving & tables & specify accordingly.

# Modular Casework Advantages

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- **Consistent Appearance**
  - The use of modular caseworks on a project will give a consistency in appearance due to the standardization of materials & construction methods.
- **Functional Flexibility**
  - The use of modular components facilitates changes in function within a building area



# Modular Casework Advantages

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- Designs for Institutional Needs
  - Modular casework manufacturers incorporate designs that address specific cabinet functions & specific internal dimensions to meet identified institutional customer needs for the ever changing environment in which they operate.
- Economies of Mass Production
  - High quality & increased productivity are achieved through standardization of materials & machine controlled CNC dimensions using modern production techniques.
  - Innovative lines accommodate units quantities of one to as many as you need.

# Modular Casework Advantages

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- Pre-Engineered Hardware
  - By using specially researched & tested heavy-duty hardware, modular caseworks meet the high-use needs of institutional & commercial projects envisioned by the owner.
- Serviceability
  - Use of high-quality, factory-finished materials reduces maintenance during the service life of the installation. Matching of replacement parts or complete cabinets is possible should the need arise due to damage or additions.

# Modular Casework Advantages

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- Ease of Installation
  - The modular casework concept lends itself to standardized & economical installation techniques
- Most importantly, AWI/AWMAAC casework manufacturers are eager to work with the design team during the developmental phase of the project to review form, function & features. The design professional often has a greater variety of choices than is customary with retail or contract cabinets.

# Edgings

- Continuity or contrast from face to edge
- For years, edgeband & T-molding were viewed as a simple way to cover raw board edges. Today's designers appreciate them for their real potential - as an integral part of furniture design, adding art & functionality to any piece.



# Edgings

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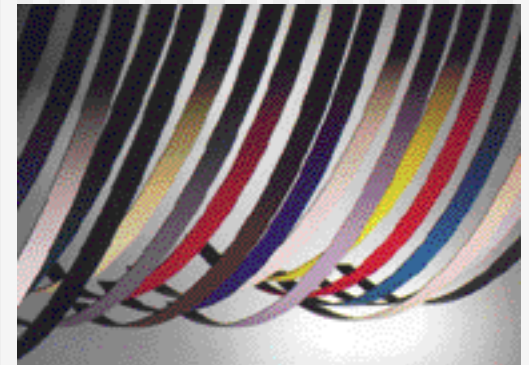
- Vinyl T-Molding dominated the edging preference until 1963 when PVC was introduced to North America.

# Edgings

- ABS has had a secondary role in the furniture industry to date. However, with the increased interest in environmental concerns, ABS is taking on a new demand.

# Edgings

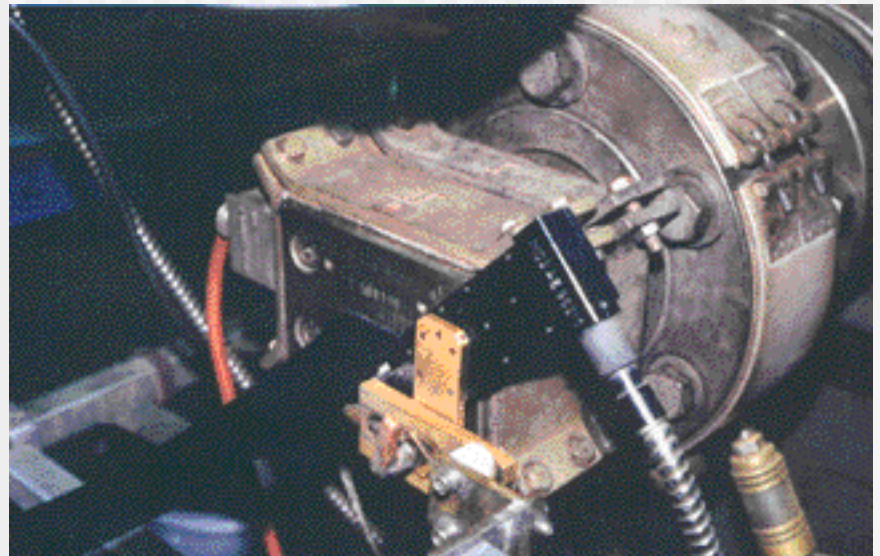
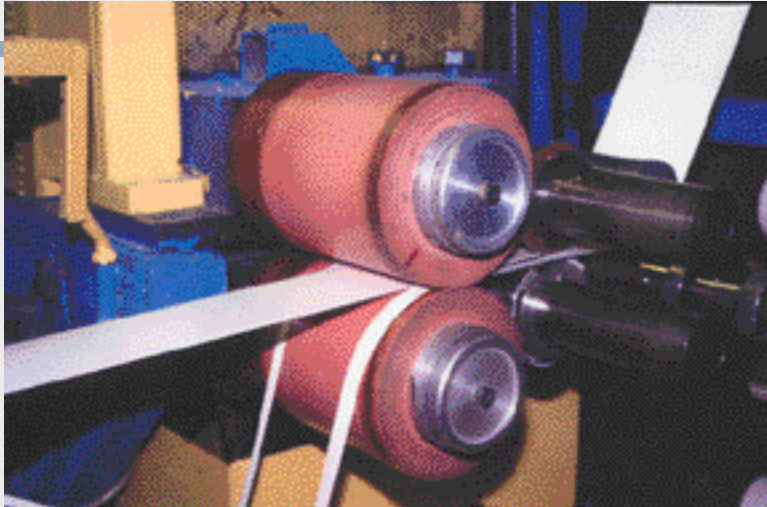
- Edging suppliers work with many industries & through this diverse exposure find opportunities for new edging materials development.
- Environmental concerns now play a major part of new material edge types development



- What is PVC?
  - Poly Vinyl Chloride is the most commonly known & widely used polymer for edgebanding worldwide.
  - PVC edgebanding is respected in the North American woodworking industry for its easy & forgiving processing characteristics.
  - Contains very small amounts of encapsulated chloride



# Edgings



- What is ABS?
  - Acrylonitrile Butadiene Styrene is a shockproof mechanically & thermally durable, high-quality thermoplastic. This chlorine-free plastic has been used for applications in the furniture industry for more than 15 years now.

# Edgings

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- Product applications for edgebands are practically unlimited: from offices to bathrooms, kitchen, exhibitions, shop-fitting, home furnishing & interior decorating.

- ABS edgebands are manufactured in an extrusion process & are colored throughout.
  - manufactured in an extrusion process & are colored throughout. The even through-color of the material enables clean & problem-free edgeband rounding.

- What is Vinyl?
  - Vinyl a plastic polymer developed in 1920's which offers a clean, durable & economical base material. This vinyl resin is the feed stock utilized in the extruding of T-molds.

# Edging

- T-mold, as the name implies, utilizes a friction “T” barb in a pre-machined slot to hold to the panel edge.
- Vinyl T-molds are not widely used in today's institutional & medical market furniture.

# Adhesives

## General Characteristics

ADHESIVE:			
PERFORMANCE TEST:			
		Type I-Fully Waterproof (Exterior)	2 Cycle Boil/Shear Test
		Type II-Water Resistant (Interior)	3 Cycle Soak Test
		Type III-Water Resistant (Interior)	2 Cycle Soak Test
GENERIC NAME	USED FOR BONDING	ANSI/HPVA NWWDA -I.S.	CHARACTERISTICS
1. Aliphatic (Carpenter's Glue)	Wood and wood products	Type II	Non-toxic; non-flammable; non-staining; water resistant; <b>NOT</b> waterproof
2. Casein	Wood and wood products	Type II	Highly water resistant; <b>NOT</b> waterproof
3. Contact Cement	Plastic laminates and veneers to wood	Type II	Highly water resistant; <b>NOT</b> waterproof
4. Epoxy	Wide range; wood; wood to metals	Type I	Two-part glue-formulas vary; completely waterproof
5. Hot-melt Glue*	Wide range; bonds wood to vinyl, metal and wood	Not tested for moisture resistance	Liquefies when heated; bonds in a liquid state; solidifies as it cools; Used extensively for edge banders and other automatic equipment
6. Polyvinyl Acetate PVA	Wood and wood products	Slight moisture resistance	Good for cabinet work and interior woodwork; <b>NOT</b> recommended for joints with sustained loads
7. Polyvinyl Acetate PVA Catalyzed	Wood and wood products	Slight moisture resistance	Used for assembly gluing where exterior
8. Polyvinyl Chloride PVC	Wide variety of materials	Not tested for moisture resistance	Crystal clear; fast drying
9. Resorcinol Resin	Wood, wood products and laminates	Type I	Fully waterproof; purple glue line; two parts--liquid resin and powdered catalyst; Pot life-3hours
10. Urea Resin	Wood and wood products	Type II	Plastic resin glue; mixed with water; excellent for cabinet work; must be clamped; Drying time 3 - 7 hours at 70 degrees F
11. Panel / Construction Adhesive	Metal to wood particleboard, or plywood; also plastic surfaces	Type II	Plastic epoxy base; liquid state; dries fast; very difficult to remove; can be used to permanently set adjustment screws in European type hinges

\*Commonly available HOT MELT ADHESIVES are ethelene vinyl Acetate, Ponyohelin (PO) and Polyurethane (PUR).

# Manufacturing of Casework

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- Panels

- Casework parts are sawn or CNC routed to shape from a variety of panel material & colors to custom fit your needs. Laminated panels are available in both thermofused decorative laminates & high pressure laminates. To best economize your material costs, panels are produced in a full range of solid colors, woodgrains & patterns in 4' x 6' through 5' x 10' sizes & 1/4" through 1 1/8" thicknesses.



# Manufacturing of Casework

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- Both Thermofused laminate & HPL surfaced panels are pressed internally or purchased externally by OEMs.

# Manufacturing of Casework

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- Machine types for a modern high quality operation in today's market consist of:
  - sawing.
  - shaping.
  - drilling.
  - edgebanding.
  - milling.
  - clamping.

# Manufacturing of Casework

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- The goal of the casework OEM is to provide a complete package of products & services to achieve the winning value in the competitive bidding process.
- Functional integration, supported by state of the art software such as Enterprise Management & Supply Chain Management, leads to a high throughput of casework meeting customer requirements of cost and on time delivery.

# Manufacturing of Casework

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- Control of the transportation service for the casework delivery provides an extra assurance of on-time delivery to the site.

# Quality

- Technically astute laminators in the market today start with complete testing of particleboard or fiberboard core materials to exacting internal & external third party standards.



- The “B” – staged decorative laminates are carefully thermofused under heat & pressure directly to the surface of the panel. The process eliminates glue lines & allows the laminate to become an integral part of the core. Thermofused finished laminate surfaces are easy to clean and are heat, stain and water resistant. Because the laminate becomes an actual part of the panel, it will greatly resist chipping, cracking or peeling.

# Quality

- Total customer satisfaction is what is strived for as part of this goal. The OEM will manufacture intricate shaped component parts to exact specifications with total accuracy time & time again. Custom shapes, cutouts, grooves, holes & finished edges are all cost-effective operations performed on the latest CNC-controlled equipment.
- Quality control data is charted & utilized to daily improve the process.

# Quality

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- Final project/product reviews include but are not limited to tip-over concerns, pinch points, adequate fasteners to ensure structural integrity, edging attachment, hardware functionality & many others for safety and structural integrity.



# Summary

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- Today's class has exposed you to the principles of casework manufacturing.
- We have briefly touched on:
  - materials.
  - process capabilities.
  - varying design styles.

# Summary

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- Full line manufacturers provide a wide selection of products from laminated panels to furniture to casework. OEMs provide added value to the customer base through innovative engineering, design & workmanship, along with expertise that leads to cost-effective trendsetting solutions. Backed by an extensive Quality Assurance program, the industry's commitment to their customers allows you "not only to think outside the box but inside and beyond".

THANK YOU!

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- Question & Answer session