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Wood Structural Panels as an Air Barrier



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

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Webinar Attendee Survey




[Wood Structural Panels as Air Barrier Survey - APA – The Engineered Wood Association \(apawood.org\)](https://www.apawood.org/wood-structural-panels-as-air-barrier-survey)

Stephanie Thomas-Rees

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Learning Objectives

- Understand the importance of an air barrier system
- Recognize different types of air barrier systems and the challenges associated with each
- Understand code and testing requirements of air barrier systems
- Recognize the difference between properly and improperly installed air barrier systems



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Learning Objectives

- Understand the importance of an air barrier system
- Recognize different types of air barrier systems and the challenges associated with each
- Understand code and testing requirements of air barrier systems
- Recognize the difference between properly and improperly installed air barrier systems
- **This webinar references IECC...**



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Agenda

- Define air barrier
- Control layers
- Testing and certification
- Air Barrier Assemblies
- Air Sealing Checklist
- Wood Structural Panel Advantages



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Agenda

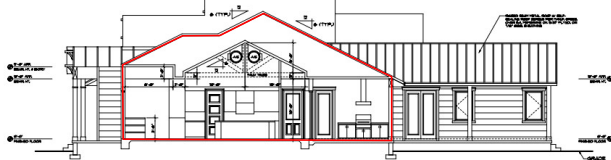
- Define air barrier
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What is an Air Barrier?

Air Barrier System – An assembly of material(s) assembled and joined together to provide a barrier to air leakage/convective heat flow through the building envelope.



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What is an Air Barrier?

- Solid components
 - Plywood, OSB, R-board
 - ≤ 0.004 cfm/sf @ 1.57 psf pressure differential or $0.02L/s \cdot m^2$ @75Pa
 - Meet ASTM E 2178



Technical Topics: Air Permeability of Wood Structural Panels as Air Barriers – APA Form TT-107

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Qualified Components of an Air Barrier

Recognized as air barrier materials by:

- ASHRAE
- International Residential Code
- International Energy Conservation Code
- National Building Code of Canada

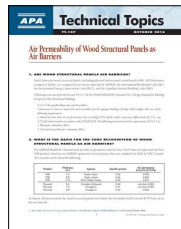


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Qualified Components of an Air Barrier

APA Technical Topic

- Form TT-107
 - Answers questions regarding the performance of wood structural panels in air barrier systems
 - Free download at www.apawood.org



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What is an Air Barrier?

- Flexible Component
 - Weather Resistant Barrier
 - barrier wraps, asphalt paper, applied membranes
 - Install per manufacturer specifications
 - ASTM E2357, ASTM E1677 or ASTM E283



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What is an Air Barrier?

- **Sealants**
 - Foam, caulk, silicone, mastic
 - Caulk and backer rod application
 - Approved construction adhesive/sealant

SEALANT MATERIALS



FOAM CAULK MASTIC

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Simple Air Sealing – APA Form T210

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Agenda

- **Define air barrier**
- **Control layers**
- Testing and certification
- Air Barrier Assemblies
- Air Sealing Checklist
- Wood Structural Panel Advantages

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Control Layer - Air



Older buildings:
one layer does everything



Newer buildings:
control functions are
separated in different layers

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Control Layers

- Air
- Vapor
- Water
- Thermal

Flashing under building paper. Seal to sheathing.

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Control Layer - Air

- Reduce heating and cooling costs
- Improve indoor air quality
- Separate indoor/outdoor
- Reduce moisture problems

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Control Layer – Vapor

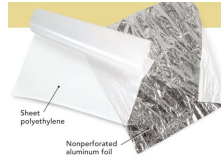
- Vapor Control Layer – retarders, barriers
- Slows the movement of water vapor through an assembly
- Right side!!!
- Does not control air flow

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Permeability

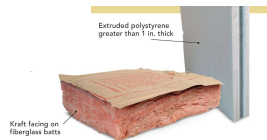
- **Class I (impermeable)**
 - ≤ 0.1 perm rating
 - Sheet polyethylene, non-perforated aluminum foil



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Permeability

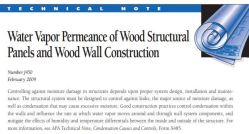
- **Class II (semi-impermeable)**
 - >0.1 to ≤ 1.0 perm rating
 - Kraft faced batts, polystyrene



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Permeability

- **Class III (semi-permeable)**
 - >1.0 to ≤ 10 perm rating
 - Latex paint
 - WSP



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Control Layer – Vapor Retarder

TABLE R702.7(2)
VAPOR RETARDER OPTIONS

CLIMATE ZONE	VAPOR RETARDER CLASS		
	CLASS I ^a	CLASS II ^b	CLASS III
1, 2	Not Permitted	Not Permitted	Permitted
3, 4 (except Marine 4)	Not Permitted	Permitted ^c	Permitted
Marine 4, 5, 6, 7, 8	Permitted ^d	Permitted ^d	See Table R702.7(3)

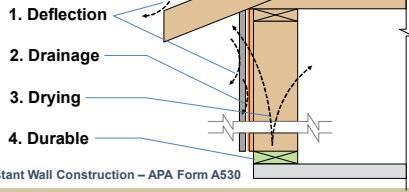
a. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.
 b. Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an approved design.
 c. Where a Class II vapor retarder is used in combination with foam plastic insulating sheathing installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table R702.7(4) and the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B).



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Control Layer - Water

- Water control layer - drainage plane with gap
- Ensures drying
- Optimizes durability



Build A Better Home: Moisture-Resistant Wall Construction – APA Form A530

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Control Layer – Thermal

- Insulation
- Radiant barrier
- Low heat conductivity
- Manages the loss or gain of heat



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Control Layers

- Air
- Vapor
- Water
- Thermal

The diagram shows a vertical cross-section of a wall assembly. From left to right, the layers are: Siding, Water barrier, Air barrier, Thermal barrier, Vapor barrier, Wood studs, and Drywall. The APA logo is in the bottom right corner.

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Agenda

- Define air barrier
- Control layers
- Requirements and Testing
- Air Barrier Assemblies
- Air Sealing Checklist
- Wood Structural Panel Advantages

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IECC Compliance - Four Options

```

graph TD
    Root[Both are Prescriptive paths] --> P[Prescriptive]
    Root --> UA[U-Factor and "UA" Alternatives]
    Root --> SP[Simulated Performance (software)]
    Root --> ERI[ERI (software)]
    
    P --> P1[R-values (no tradeoffs) Table 402.1.1]
    UA --> UA1[U-factor (Tradeoffs) Ind. Comp. Table 402.1.2]
    UA --> UA2[Total Building UA Table 402.1.3]
    SP --> SP1[Simulated Performance Alternative Section R405]
    ERI --> ERI1[ERI Section R406]
  
```

Air sealing and testing is required in all compliance pathways

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Air Leakage Limits

- Performance
- All climate zones
- ≤ 5 ACH50

- Prescriptive
- Climate zones 0-2
- ≤ 5 ACH50

- Climate zones 3-8
- ≤ 3 ACH50

Climate Zones for 2021 IECC

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Air Leakage Test

Blower Door

DG-700
Pressure Gauge

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Air Sealing and Insulation

- 2021 IECC R402.4.1.1 Installation:

The components of the building thermal envelope listed in table R402.4.1.1 shall be installed per mfg. requirements and field inspected by the code official or an *approved* third party independent from the installer.

FOAM

CAULK

MASTIC

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Agenda

- Define air barrier
- Control layers
- Testing and certification
- Air barrier assemblies
- Air Sealing Checklist
- Wood Structural Panel Advantages



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Air Barrier Assemblies

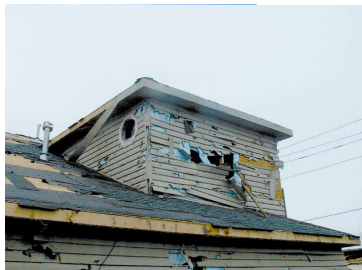
- Continuous



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Air Barrier Assemblies

- Continuous
- Strong and stiff





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MU 2/64

Air Barrier Assemblies



- Continuous
- Strong and stiff
- Durable



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Air Barrier Assemblies

- Continuous
- Strong
- Stiff
- Durable
- Air impermeable



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Air Barrier Assemblies

- Flexible and Rigid



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Slide 34

MU [2]64 I am sure you are looking, but a picture here would be great

Mary Uher, 9/28/2021

Air Barrier Assemblies

- Flexible and Rigid



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Air Barrier Assemblies

- Flexible and Rigid
- Mechanically Attached

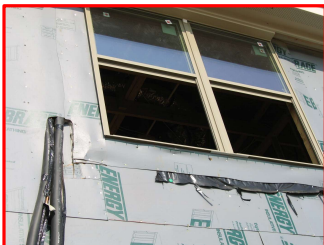


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SR 216

Air Barrier Assemblies

- Flexible and Rigid
- Mechanically Attached



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Slide 38

SR [2]6 may wish to blurr out Beazer, BFS

Stephanie Rees, 9/9/2022

Air Barrier Assemblies

- Flexible and Rigid
- Mechanically Attached
- Self Adhered Membrane



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Air Barrier Assemblies

- Flexible and Rigid
- Mechanically Attached
- Self Adhered Membrane
- Liquid



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Air Barrier Assemblies

- Flexible and Rigid
- Mechanically Attached
- Self Adhered Membrane
- Liquid
- Integrated barrier



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Agenda

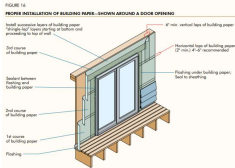
- Define air barrier
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Ensuring Effective Use of Air Barriers

- Start with the biggest penetrations & gaps
- Where air moves, so does heat & moisture
- According to the US DOE as much as 30 percent of a home's energy usage can be from air leakage.



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TABLE RM02.A.1.1
AIR BARRIER and INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. Exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop-down stair or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim joints	Rim joints shall include the air barrier.	Rim joints shall be insulated.
Floors (including above-garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the foundation to the corner of all exterior frame elements.

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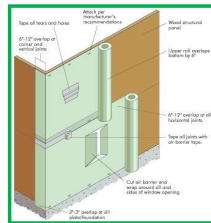
Air Sealing & Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
General Requirements	<p>A continuous air barrier shall be installed in the building envelope.</p> <p>The exterior thermal envelope contains a continuous air barrier. Breaks or Joints in the air barrier shall be sealed.</p>	<p>Air-permeable insulation shall not be used as a sealing material</p>



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Properly Installed Exterior Air Barriers



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Poorly Installed Exterior Air Barriers



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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Ceiling/Attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.



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Properly installed Soffit Air Barrier



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Poorly Installed Soffit Air Barrier



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Knee wall Air Barriers



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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Walls	<p>The junction of the foundation and sill plate shall be sealed.</p> <p>The junction of the top plate and the top of the exterior walls shall be sealed.</p> <p>Knee walls shall be sealed.</p>	<p>Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum.</p> <p>Exterior thermal envelope insulation shall be installed in contact and alignment with the air barrier.</p>

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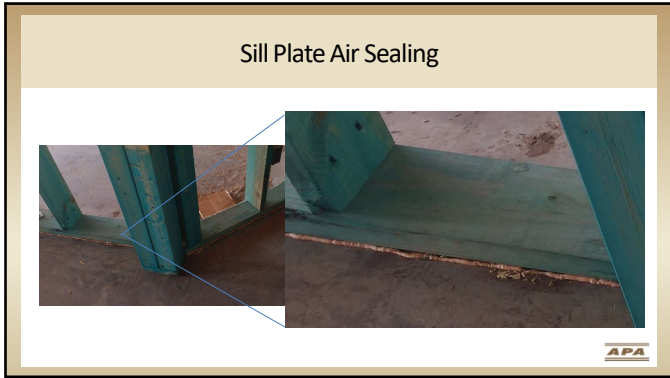
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Sill Plate Air Sealing



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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Windows, Skylights and Doors	The space between Window/Door jambs and framing and skylights and framing shall be sealed.	

Note: When using foam be sure it is low expansion.

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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Rim Joist	Rim Joist shall include an air barrier	Rim Joist shall be insulated

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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Floors (including above garages and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of the sub floor decking, or floor framing cavity insulation shall be to be in contact with the top side of sheathing or continuous insulation installed on the underside of the floor framing.

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Air Sealing and Air Barrier Checklist


Component	Air Barrier Criteria	Insulation Criteria
Crawl space walls	Exposed earth in unvented crawlspaces shall be covered with a Class 1 Vapor retarder/air barrier in accordance with R402.2.10.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls in accordance with R402.2.10.




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Crawlspaces

Vented Crawl Space



Enclosed Conditioned Crawlspace







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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Garage Separation	Air sealing shall be provided between the garage and conditioned space.	





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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Shower/Tub on exterior wall	The air barrier at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.


*This air barrier often should be installed by the framer before the tub/shower is roughed in.



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Air Barrier Behind Showers and Tubs




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Air Sealing and Air Barrier Checklist

Component	Air Barrier Criteria	Insulation Criteria
Shafts, Penetrations	Duct Shafts, utility penetrations and flue shaft openings to exterior or unconditioned space shall be sealed.	



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Air Sealing around Ducts



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Air Sealing Around Plumbing and Wiring



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Air Sealing and Air Barrier Checklist


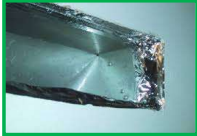
Component	Air Barrier Criteria	Insulation Criteria
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	




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Air Sealing and Air Barrier Checklist

Component	Air Barrier Checklist	Insulation Checklist
HVAC register boots	HVAC register boots that penetrate the building thermal envelope shall be sealed to the subfloor or drywall.	







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The Impact of Air Infiltration Rates

ACH	Energy Cost	Difference
2.5 ACH @ 50	\$1492.00	\$-14.00
3.0 ACH @ 50	\$1506.00	\$0.00 – Baseline
3.5 ACH @ 50	\$1520.00	\$14.00
4.0 ACH @ 50	\$1534.00	\$28.00
4.5 ACH @ 50	\$1549.00	\$43.00
5.0 ACH @ 50	\$1564.00	\$58.00



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Above Code





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Wood Structural Panels

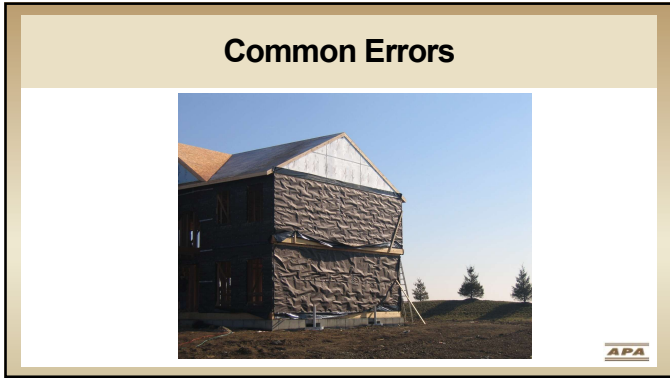


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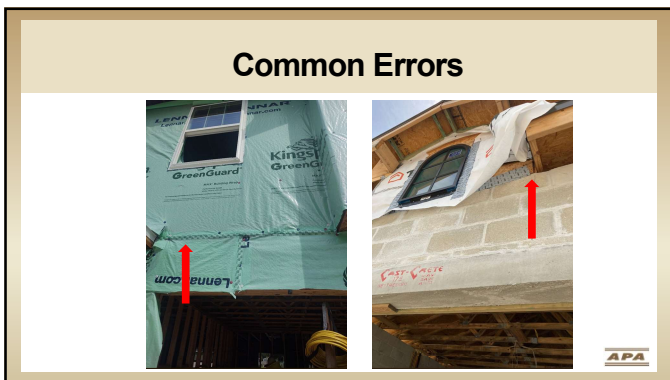
Wood Structural Panels



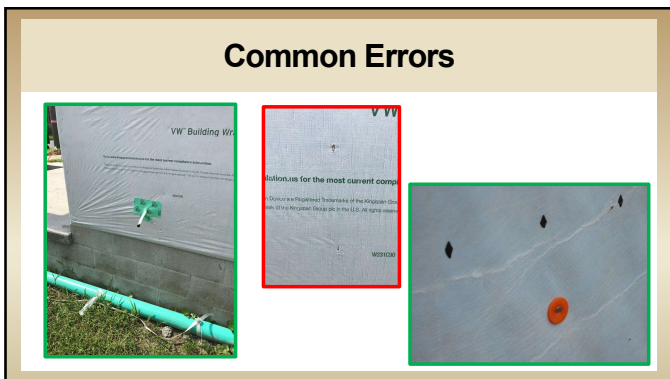
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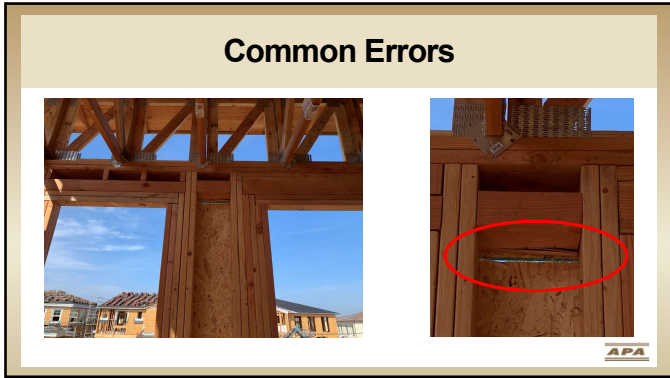
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DID YOU KNOW?

10 Benefits of Wood Structural Panel Wall Sheathing

Fully Sheathed Wood Walls

- AIR BARRIER
- DURABILITY
- STRENGTH & SUPPORT
- ENERGY CODE
- WALL BRACING
- INSULATION OPTIONS
- SIMPLE SIZING & TRIM
- SLICK TOP
- ADVANCED FRAMING
- SCHEDULES

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APA Publications

Formaldehyde and Engineered Wood Products

APA Technical Topics: Air Permeability of Wood Structural Panels as Air Barriers

Moisture-Resistant Wall Construction

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Questions/Comments/Survey

Questions?

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