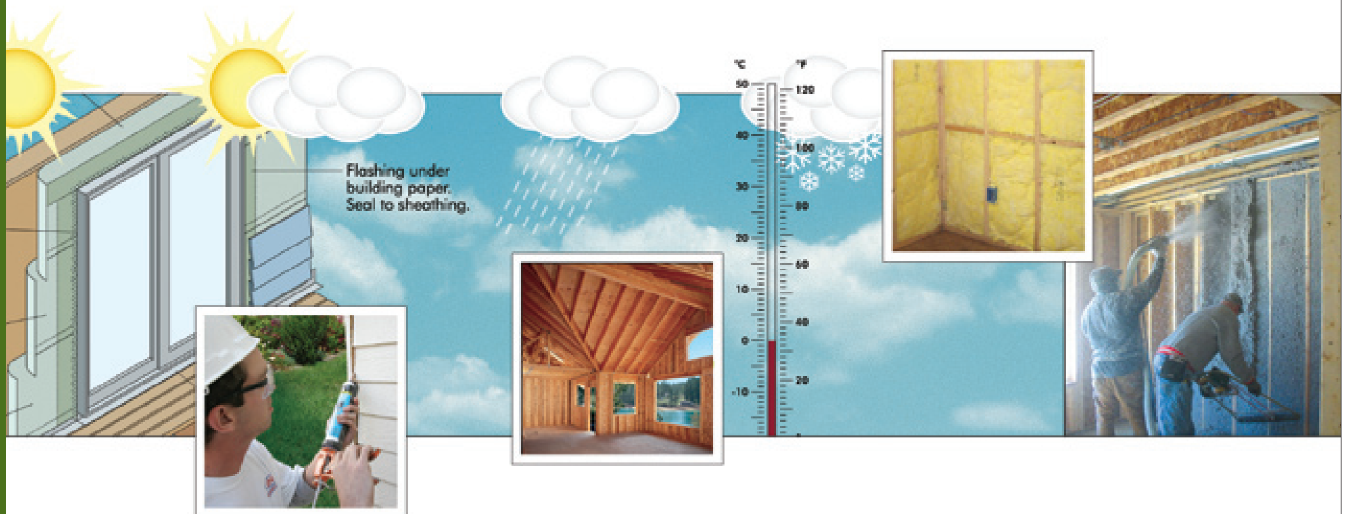
Build Energy Efficient Walls

Builders Meet Code with Durable, Affordable Wood Wall Systems



APA

Five Steps to an Energy Efficient Wall

In today's housing market, energy efficiency is no longer a consideration, it is a requirement. More and more, the burden is falling on the builder to produce homes that are cost effective to build, yet strong, safe and energy efficient to live in. In new home construction, the walls of a house present the greatest opportunity to prevent energy loss. Fortunately, building energy-efficient homes is easier and less expensive than you might expect with wood-framed walls fully sheathed with plywood or oriented strand board (OSB) wood structural panels. This brochure provides five basic steps to constructing energy-saving wood wall systems that meet code, are durable to the forces of nature, and save homeowners money.

1 BUILD WITH WOOD

Wood-framed walls fully sheathed with wood structural panels will meet building codes in every region of the country. Wood wall systems are easy to insulate and provide exceptional shear and racking strength to withstand the forces of high winds and earthquakes. In colder climates, 2x6 wood framing allows for increased insulation. ***See page 5.***

2 SEAL THOROUGHLY

Air sealing and insulation complement each other. Thorough sealing of the building envelope coupled with adequate insulation can cut heating and cooling bills by as much as 30 percent, according to the U.S. Department of Energy. Air sealing is easy and inexpensive, but it must be done at all stages of the construction process. ***See page 8.***

3 INSULATE EFFECTIVELY

Insulation keeps heat where it's wanted. The R-value is a measure of an insulation's resistance to heat flow: the higher the R-value, the more effective the insulation. Installing more insulation increases the R-value. Wall cavity insulation – insulating material that fills the gap between the exterior and interior walls – is a common and cost-effective method for reducing heat flow through the wall system. Proper installation is important – compressed insulation and gaps in a wall can reduce effectiveness by more than 25 percent. ***See page 10.***

4 INVEST IN EFFICIENT WINDOWS

Windows and doors are the least effective insulators in the building envelope, but new high-performance windows and doors reduce energy costs by maintaining uniform interior temperatures and lessening heating and cooling demands. As a result, the house can be outfitted with smaller, less expensive HVAC equipment. The money saved on HVAC equipment can often fund the window upgrades. ***See page 12.***

5 SIZE MECHANICAL SYSTEMS CORRECTLY

Houses built for energy efficiency have reduced peak heating and cooling loads, allowing for smaller, more efficient HVAC systems. The savings realized from purchasing and installing smaller HVAC equipment can be invested in additional energy-saving upgrades. ***See page 13.***

ENERGY EFFICIENCY BENEFITS THE HOMEOWNER AND BUILDER

Increasingly stringent energy-saving measures are being written into building codes and demanded by home buyers. But in the minds of many builders, the term "energy efficiency" translates to increased labor, added time and extra costs. While some additional planning and budgeting is required, the extra effort is rewarded with substantial benefits to the both the homeowner and the home builder alike. Benefits to the builder who uses wood-framed walls sheathed in wood structural panels include:

- Meeting or exceeding building energy and wall bracing codes
- Improved structural performance and building durability
- Cost-saving system trade-offs – such as tighter envelope construction allowing for a smaller heating/cooling system – improving efficiency without inflating construction costs
- Reduced callback and warranty problems
- Recognition for using green, sustainable building materials

The home builder also benefits from increased customer satisfaction due to the advantages of owning an energy-efficient home, including:

- Improved home quality without higher cost of ownership
- Substantial savings on utility and maintenance bills – energy costs cut by as much as 40 percent, according to the U.S. Department of Energy
- Home is more durable to the forces of nature
- Healthier, more comfortable and quieter indoor environment
- Greater financing options – many mortgages reward energy efficiency

WHOLE-HOUSE DESIGN KEY TO SAVING ENERGY AND MONEY

A ***whole-house*** approach views a house as a collection of unique components that interact to produce a combined effect greater than the sum of the individual parts. In other words, every component – the building envelope (walls, windows, doors, roof and floor), the heating, ventilation and air conditioning (HVAC) system, ductwork, appliances and lighting must all be designed to work together in order to cost-effectively maximize energy savings.

For example, thorough air sealing dramatically reduces energy loss at little added cost to construction. Installing HVAC ducts inside the building envelope prevents conditioned air from leaking into unconditioned spaces and reduces heating and cooling loads at little added cost. High-performance windows add significant cost to construction, but reduce heat loss in the winter and solar heat gains in the summer. If these measures are all effectively implemented, HVAC equipment can often be downsized, saving considerable cost. Often the money saved on HVAC equipment can fund window upgrades. All together it adds up to cost-effective energy savings with minimal extra expense. According to the U.S. Department of Energy, whole-house design can significantly reduce energy consumption with little or no impact on the total cost of construction.

BUILDING AN ENERGY-EFFICIENT WALL

Key to a successful whole-house design is a tightly constructed building envelope that functions as the boundary between the weather outside the house, the *unconditioned space*, and the climate inside the house, the *conditioned space*. A well-designed and constructed wall system represents the greatest opportunity to protect the building envelope against energy loss.

An energy-efficient wall is built to minimize heat transfer. The R-value, a measure of a material's ability to stop the flow of heat, is used to compare the insulating values of building materials. The higher the R-value, the greater the material will protect against energy loss. The total R-value of a wall system takes into account the R-values of all of the individual components of the wall. Builders must factor insulation, framing, sheathing, windows, doors, and all other components when assessing the whole-wall R-value.

The structural performance of the building materials also requires careful consideration. Insulation materials, such as fiberglass, foam and cellulose, have high R-values but add essentially no strength to the house. Wood framing and wood structural panels offer lower R-values but provide required strength and durability. Pair insulation with wood structural panels and studs to construct a wall system that is both energy efficient and structurally sound. Other structural building materials, such as metal framing, provide strength but need the bending and racking resistance under lateral loads that wood structural panels provide. Metal framing and masonry materials also offer less resistance to heat transfer than wood.

While R-values are significant, it is a misconception that insulation is the only energy-saving tool. The greatest energy savings in new home construction are attained by implementing multiple efficiency-improving measures together. Five steps outlining energy efficient wall system construction are highlighted on the following pages. In addition to this brochure, APA offers a comprehensive set of services and tools for builders and design construction professionals. For over 75 years, APA has helped the industry create structural wood products of exceptional strength, versatility and reliability. For additional assistance, contact the APA Product Support Help Desk at (253) 620-7400.

1 BUILD WITH WOOD

2X6 WOOD FRAMING BOOSTS R-VALUES

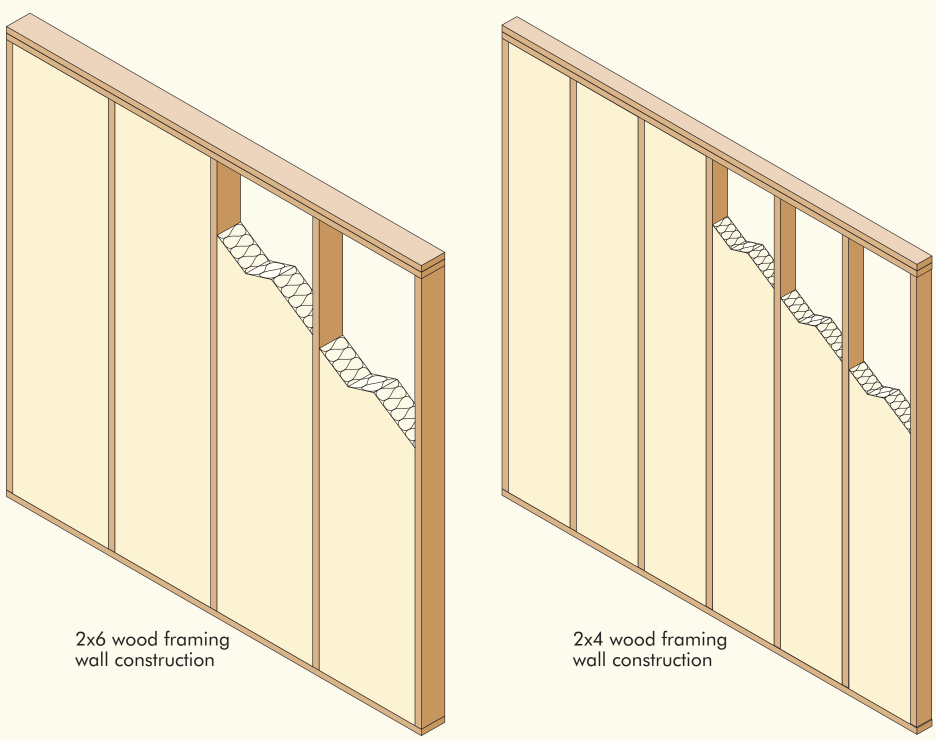
Affordability, durability, strength of structure, and design flexibility are reasons why wood has traditionally been the predominant choice for house framing in the United States, but more recently, wood framing – in particular 2x6 framing in colder climates – is earning recognition for its energy saving advantages. Although 2x4 wood framing spaced 16 inches on center is the industry standard, 2x6 wood framing spaced 24 inches on center can boost the insulating value of a wall more cost effectively than adding rigid foam sheathing to the exterior of the wall. While 2x4 wood framing supports R-13 cavity insulation, the additional 2 inches of wall depth of 2x6 wood framing allows for upgrading to R-19, R-20 or R-21 cavity insulation.

An added benefit of 2x6 wood framing is reduced thermal bridging. A thermal bridge occurs when heat is transferred through a building component at a higher rate than the transfer through the surrounding envelope. Some degree of energy loss through a wall as a result of thermal bridging is unavoidable because framing materials are less resistant to heat than insulation. However, a 2x6 wood-framed wall spaced 24 inches on center employs fewer total studs than a 2x4 framed wall spaced 16 inches on center, equating to fewer thermal bridges. The added depth of a 2x6 wall also provides greater resistance to heat flow. In addition, wood's natural insulative qualities make it more resistant to thermal bridging than some other framing materials, such as steel. Steel framing is seldom used for exterior house walls because it conducts heat more than 300 times faster than wood framing. As a result, the amount of insulation in a steel wall must be increased to compensate for energy loss from thermal bridging.

Although the perceived added cost of upgrading from 2x4 to 2x6 framing deters some builders, the actual cost may be offset by reductions in the total amount of framing lumber required. Therefore, 2x6 wood framing is an excellent value in colder climates with more stringent energy code requirements. In warmer climates, 2x4 wood framing is adequate to meet or exceed code requirements. Both framing methods provide exceptional wind and seismic resistance when fully sheathed with wood structural panels.

WOOD FRAMING SYSTEMS

Walls constructed with 2x6 wood framing spaced 24 inches o.c. are 2 inches deeper than walls constructed with 2x4 wood framing spaced 16 inches o.c. The added depth allows for additional insulation; for example, R-13 cavity insulation can be upgraded to R-19, R-20 or R-21 cavity insulation. This method also provides a greater insulation-to-framing member ratio.

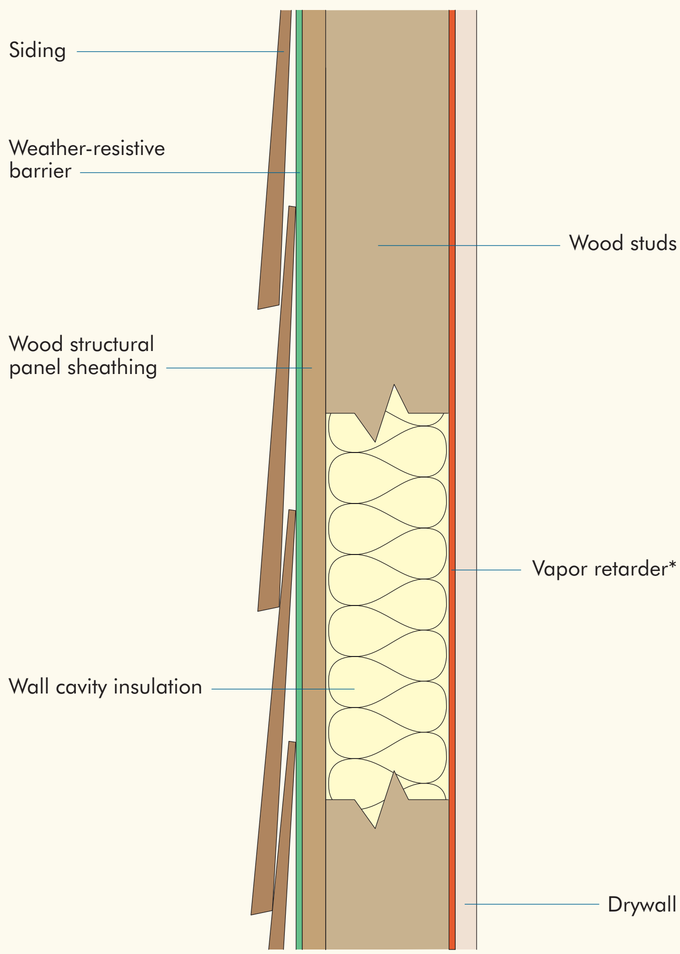


DURABLE WOOD SHEATHING ADDS STRENGTH TO THE SYSTEM

Of the many sheathing materials on the market, plywood and OSB wood structural panels offer the best balance of energy efficiency, structural performance and affordability. Wood sheathed walls are easy to insulate for high R-values while providing shear and racking strength to the structure to resist high wind and earthquake forces.

Structural performance must not be overlooked when evaluating sheathing options. Code wall bracing requirements are increasingly stringent, and walls must resist imposed uplift loads, lateral loads and wind pressures. Wood structural panels feature unmatched strength and stiffness properties, and are the easiest and most economical way to meet the prescriptive bracing requirements of building codes. In fact, no other sheathing solution provides greater design and structural latitude for all code bracing methods. Additionally, wood structural panels are highly impact resistant and deliver added protection to the home and its occupants against airborne debris in high winds. For more information, refer to *Brace Walls with Wood*, Form G440, from APA or visit www.wallbracing.org.

WOOD WALL ASSEMBLY



*If appropriate. See building code for type and placement of vapor retarder.

Most flexible siding materials (such as vinyl) require solid structural sheathing in order to resist wind pressure loads. Wood structural panels are recognized by building codes for this purpose, providing the suction and debris penetration resistance for cladding through continuous structural coverage between framing elements. (Refer to APA Technical Note, *Understanding the Importance of Structural Wall Sheathing as a Wall Covering,* Form J430, for more about this code requirement.) Wood sheathed walls also simplify siding installation because structural panels provide a solid nail base for most siding products. In addition, the smooth panel surface results in more even siding and fewer costly callbacks. Wood-sheathed walls also experience less wall flexing that can cause drywall problems and cracks in stucco walls.

Structural insulated panels (SIPs) are high-performance building panels made by sandwiching a core of rigid foam insulation between two skins of wood structural panels. SIPs save time because they are fabricated off site and install quickly. Panels range in thickness from 4-1/2 to 12-1/4 inches and provide R-4 to R-6 insulation per inch depending on the type of foam core used. For more information, refer to *Structural Insulated Panels,* Form H650, from APA.

WITHSTANDING THE FORCES OF NATURE

Weather varies by climate region, but every part of North America is vulnerable to occasional high winds, heavy rains or earthquakes. From the driving storms of the Gulf Coast to the relentless rains of the Pacific Northwest, tightly constructed wood wall systems will stand strong against the forces of nature.

Tornadoes, hurricanes, strong winds, and earthquakes damage thousands of homes across North America each year. These natural events produce three forces that threaten buildings:

- Lateral forces push against the building, causing walls to rack out of square and weaken the structure.
- Uplift forces work against gravity to separate the roof from the walls, the walls from the floor, and the floor from the foundation.
- Inward and outward wind pressures pull on the cladding and sheathing, separating sections of the roof and walls from the building and exposing the interior to moisture and air infiltration.

Plywood and OSB wood structural panels help homes to simultaneously resist all three of these forces, reducing the need for additional force resisting systems, like metal connectors and proprietary bracing systems. History has shown that properly applied wood sheathing protects homes against high winds and seismic events. That is an important reason why wood structural panel wall sheathing accounts for more than 75 percent of all residential wall sheathing products used today, according to APA. Rigid foam and other nonstructural sheathing products lack shear/racking strength and require additional wall bracing to meet code. To learn more about code-required wall bracing, visit www.wallbracing.org.

WOOD STRUCTURAL PANELS ARE SMART VAPOR RETARDERS

Moisture vapor moving through walls is unavoidable, so it is important to design wall systems that can manage moisture vapor. The ideal wall will restrict moisture gain when the wall is dry but allow for drying to both sides of the wall when moisture vapor is elevated. A material's ability to allow the diffusion of water vapor is referred to as permeance and is measured in perms. Materials with a perm rating of less than 1.0 are considered vapor retarders. The perm rating of plywood and OSB exterior wall sheathing is low when the relative humidity is low and increases as the relative humidity increases. As a result, plywood and OSB not only minimize moisture intrusion into a dry wall, but they also have increased permeance when the wall humidity is elevated, thereby aiding the drying of the wall. Products that do this are called "smart vapor retarders."

For example, at 50 percent humidity, the water vapor permeance of plywood is approximately 1.0 perm, which helps keep moisture out of a wall cavity. But the permeance increases by a factor of 10 when the humidity increases to 90 percent. This increased permeability aids water vapor diffusion through the exterior wall, facilitating the drying of the wall cavity when the wall humidity is high. (For more information, refer to the APA Technical Note, *Water Vapor Permeance,* Form J450.) Some foam sheathing products are vapor impermeable at high relative humidities, and may trap moisture in the wall cavity, especially when used in conjunction with interior wall vapor retarders.

If too much water gets into the wall, it's possible that the wetting rate will exceed the ability of the wall assembly to dry. Therefore, it is vital to minimize leaks that allow bulk water into the wall. Preventing moisture intrusion is achieved through proper design, construction and maintenance.

Wood building materials have a proven history of durability and will last the lifetime of the structure when properly protected from prolonged moisture. The Build a Better Home program from APA provides builders with the construction guidelines they need to protect homes against damaging moisture infiltration. For more information, refer to the APA publication *Build a Better Home: Walls*, Form A530, or visit www.buildabetterhome.org.

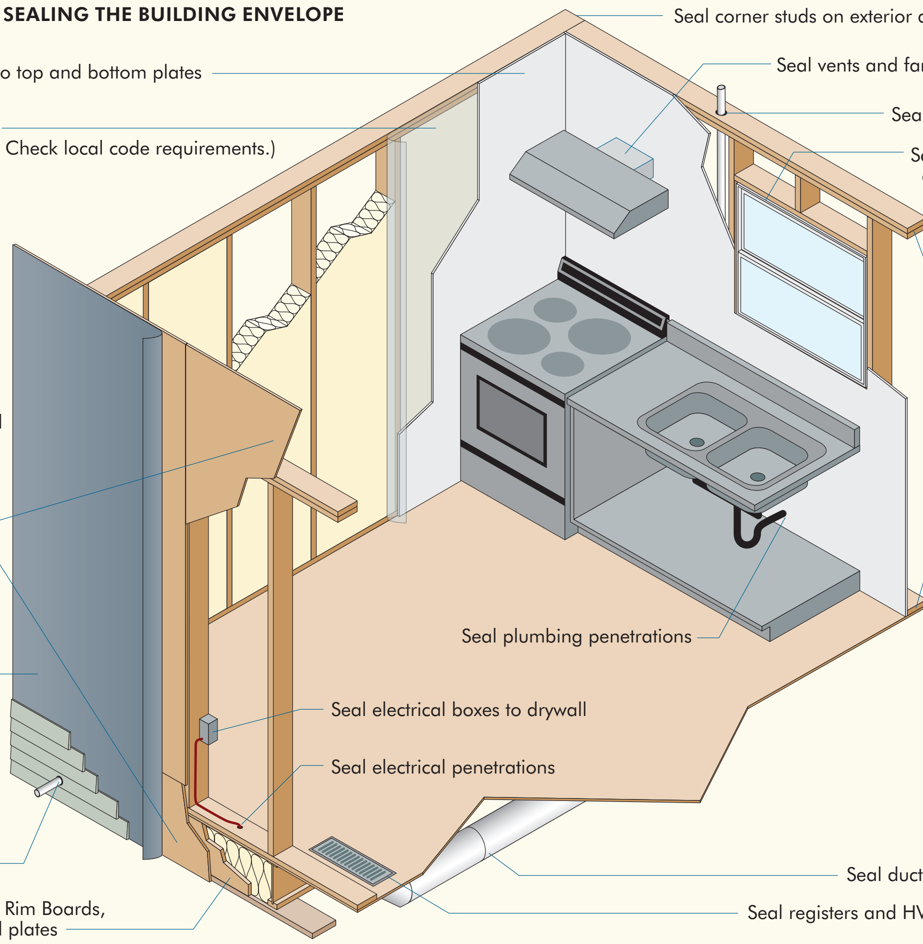
2 SEAL THOROUGHLY

Insulation may be regarded as the most important energy-saving tool, but its effectiveness is minimized without the protection of a continuous air barrier. Air sealing is the process of sealing holes in the building envelope to create a tight air barrier. According to the U.S. Department of Energy, air tightness coupled with proper insulation can cut heating and cooling bills by as much as 30 percent.

Air leaks are gaps in the air barrier through which air enters and escapes. Air leaks translate to wasted energy, but eliminating them with air sealing is inexpensive and does not require specialized labor. The key is an attention to detail: seams, cracks, and joints must be identified and comprehensively sealed throughout the construction process: during framing, before insulation, and after drywall. Be mindful of potential leaks that could be hidden from view, such as those often found at the intersections of top or bottom wall plates with Rim Boards®, band joists and floor sheathing.

Common air sealing materials – such as caulks, foams, gaskets, house wraps and weatherstripping – can be used in conjunction with wood structural panel sheathing to form a tight, continuous air barrier. The rigidity of the wood panels also provides strength and durability that help the air barrier resist air pressures as well as airflow.

TIPS FOR AIR SEALING THE BUILDING ENVELOPE



Where's the Leak?

Every house has its share of air leaks. Here are 20 common sources of air infiltration that should be checked and sealed thoroughly during construction while all parts of the building envelope are still accessible. Be sure to look for other cracks, gaps or openings.

- ☐ Top and bottom plates
- ☐ Sill plates, Rim Boards, and band joists
- ☐ Partition intersections
- ☐ Subfloor and wallboard joints
- ☐ Exterior wall corner assemblies
- ☐ Seams and tears in house wrap or building paper
- ☐ Window frames
- ☐ Door frames and thresholds
- ☐ Dropped ceilings and soffits
- ☐ Attic hatches and kneewall access doors
- ☐ Vents, registers and HVAC penetrations
- ☐ Ductwork
- ☐ Plumbing penetrations
- ☐ Bathtubs and showers on outside walls
- ☐ Utility chases
- ☐ Chimney and flue penetrations
- ☐ Fireplace dampers
- ☐ Electrical outlets and wiring penetrations
- ☐ Recessed light and fan fixtures
- ☐ Exterior penetrations (utility service holes, etc.)

TOOLS OF THE TRADE

Creating an effective air barrier requires a combination of materials and techniques. Common air sealing tools include:

Caulk: A sealing compound used to fill seams and cracks of less than 1/2 inch. Select grade (interior, exterior, high-temperature) based on application. Easy to install with an inexpensive caulk gun. Check product expiration date before use.

Spray foam: Fills larger gaps and small holes up to 3-inches wide. Available in high-expansion and low-expansion varieties that are easily dispensed from canisters. Avoid using high-expansion foams around windows and doors where foam expansion could warp frames.

Backer rod: A round, flexible length of extruded foam that fills gaps from 1/4-inch to 2-inches wide. Often used as a surface backing for caulk in larger seams, such as the rough openings around windows and doors. Available in a variety of diameters.

Gaskets: Rubber or foam gaskets are used to seal joints between major framing members and drywall to framing. Specialty foam gaskets are made to fit around electrical boxes.

Weatherstripping: A strip of rubber, nylon or similar material used to seal gaps around windows and exterior doors. The weatherstripping should seal well when the door or window is closed but still allow it to open freely.

Wood panels: Wood structural panels lay flat and nail tight to framing members. Lap exterior sheathing panels over wall and floor intersections and/or seal at panel joints and around edges.

Sheet metal: Seal sheet metal or other noncombustible sheet goods between framing and chimneys or flues with fire-rated caulk.

House wrap: Weather-resistive barriers are required by code for all exterior sheathing types (see IRC R703.2). House wraps are synthetic, weather-resistive barriers installed over exterior sheathing to seal outside walls and prevent moisture intrusion. Seal seams and tears with tape recommended by the house wrap manufacturer.

Mastic: A sticky, asphalt-like material used to seal duct connections and joints. Available in both water-based and solvent-based varieties. In most cases, select UL 181-rated mastic that is more flexible, adheres better to ducts and lasts longer than other mastics.

Energy Audit: Air tightness can be verified by a professional energy auditing service. Auditors use blower door tests and thermographic scans to identify sources of air infiltration. Energy audits are often required to qualify for energy efficiency incentive programs, such as ENERGY STAR®.

3 INSULATE EFFECTIVELY

In the winter, heat flows out of the house, and in the summer, heat flows in. Heating and cooling costs add up to more than half of the energy used in a typical American home. In a properly air-sealed house, insulation reduces heat flow through the building envelope, keeping heat where it's wanted. There are several types of insulations to choose from and all are rated by R-value. The R-value is determined by the type of material, its thickness and its density. Installing more insulation increases the R-value and the resistance to heat flow. The total R-value of a wall system takes into account the R-value of the insulation plus all other components of the wall (e.g., framing, sheathing, windows and doors).

The type and amount of insulation needed depends on the house design, the efficiency of the other building components, the air tightness of the building envelope and the climate. Minimum insulation R-values are code required by climate zone or local regulations. Because cavity insulation and air sealing are relatively inexpensive methods of conserving energy, exceeding code requirements is a cost-effective way to improve efficiency. The U.S. Department of

Choosing Insulation

Builders can choose from a variety of insulations that vary in cost, performance and ease of installation. Important considerations include the house design, the efficiency of the other components of the wall system, and R-value code requirements. Here are the most common insulations to consider when constructing energy-efficient wall systems. Be sure to follow the manufacturer's instructions for safe, correct product installation.

Spray-in-Place Insulation

Spray-in-place cellulose, fiberglass and mineral wool are cavity insulations that are mechanically blown into the wall. R-values vary depending on installation but generally range from R-3 to R-4 per inch of thickness. Spray-in-place insulation costs more than blanket insulation but is well suited for insulating around obstructions and irregularly shaped areas. Be sure to allow wet-blown insulation to dry completely before installing drywall. One potential drawback to loose-fill spray-in-place insulations is that over time, the R-value can decrease because of settling; however, this effect can be minimized if the wall cavity is initially filled completely with insulation at the proper density. Refer to the product manufacturer's instructions for details.

Spray foam – or liquid foam – insulation is usually made of polyurethane or other polymers. Special equipment is required to meter, mix, and spray the foam into place. After application, spray foam expands and conforms to the shape of the wall cavities, helping to minimize air infiltration. The ability to conform to space makes spray foam ideal for insulating around obstructions and other hard-to-reach areas. Spray foam materials and installation cost more than blanket insulation, but its effectiveness at minimizing air infiltration can reduce the amount of air sealing needed, making spray foam a cost-competitive option.

Energy's Building Energy Codes Program, an informational resource on national model energy codes, offers a free code compliance program called RES*check*™ that helps builders meet code requirements. Visit www.energycodes.gov to access RES*check* and other code compliance tools. For additional building code information, see Meeting Energy Codes on page 14.

Cavity insulation – insulating material that fills the gap between the exterior and interior walls – is the most popular and cost-effective method for reducing heat flow through the wall system. Common types of wall cavity insulation include blanket batts and rolls and spray-in-place insulation. Different insulations can be used together to yield higher R-values. For example, blanket batts can be added over spray-in-place insulation. Avoid compressing lower-density insulation under the weight of higher density insulation: compressed insulation and gaps in wall insulation can reduce effectiveness by more than 25 percent, according to the U.S. Department of Energy. Proper installation is important to achieving maximum R-value, so carefully follow the manufacturer's installation instructions. Most cavity insulations do not stop air leaks on their own, so extra attention must be paid to air sealing when these types of products are used.

Visit the U.S. Department of Energy's website, www.energy.gov/insulationairsealing.htm, to learn more about choosing and installing insulation.

Blanket Batts and Rolls

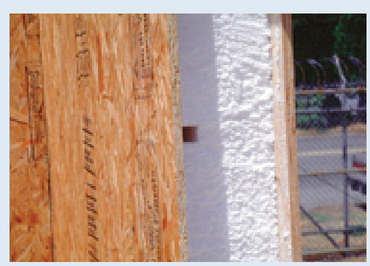
Blanket batts and rolls are the most cost-effective and widely available types of insulation. They are made from fiberglass, mineral wool, and plastic or natural fibers, and generally have R-values between R-3 and R-4 per inch of thickness. Blanket batts and rolls are cavity insulations, available in widths that fit securely between standard wall stud spacings of 16 or 24 inches. Rolls come in long rolls that can be cut to required lengths and batts come in pre-cut lengths, typically 4 or 8 feet. Blanket insulation is inexpensive, but the pieces must be hand-cut to fit snugly around obstructions, such as window frames, wires and pipes. Gaps between batts or small uninsulated areas of the wall will lower the whole-wall R-value.

Rigid Foam Insulation

Rigid foam insulation is made from fibrous materials and plastic foams – such as polystyrene, polyurethane or polyisocyanurate – that are molded into rigid boards in a variety of sizes. Lightweight and easy to install, rigid foam provides higher insulating value but offers little resistance to racking or impact forces on the structure. Typical R-values range from R-4 to R-6 per inch of thickness. Interior applications must be used with a building-code-recognized thermal barrier. Exterior applications should be used with a weather-resistive barrier to prevent moisture infiltration and wood structural panels to adequately brace the structure.

Other Options

Structural Insulated Panels (SIPs) combine rigid foam insulation and wood structural panels to create high-performance building panels that provide increased R-values and strength of structure. For more information, refer to *Structural Insulated Panels,* Form H650, from APA.



4 INVEST IN EFFICIENT WINDOWS

Windows and doors are thermal weak spots in the building envelope that can account for approximately one-third of the total heat loss in an average home. In addition to heat loss in the winter and heat gain in the summer, condensation at windows can lead to window damage as well as decay in the structural framework of the wall and interior trim. But technological advances in recent years have resulted in improved high-performance windows and doors that eliminate condensation and reduce energy costs, making homes healthier and more comfortable.

High-performance windows and doors help maintain uniform interior temperatures year round. In the warmer months, windows with spectrally selective coatings on the glass reduce solar heat gains, keeping rooms cooler while still providing sufficient light. In the colder months, double- or triple-pane windows with low emissivity (low-e) coating on the glass minimize heat loss and prevent cold air infiltration. A common measurement for window efficiency is the U-factor, the rate of heat loss or gain due to differences between indoor and outdoor air temperatures – the lower the U-factor, the better the insulating performance. A U-factor of 0.35 or below is recommended in colder climates. In moderate climates, where houses require both heating and cooling, install windows with a low U-factor and solar heat gain coefficiency (SHGC).

High-performance windows and doors are more expensive, but reduce the maximum power requirement of heating/cooling systems, otherwise known as the peak loads. The peak loads determine the size of the HVAC equipment required for a building. Reducing peak loads allows for smaller heating/cooling systems that cost less to purchase and operate. The money saved on HVAC equipment can fund window upgrades.

Look for the ENERGY STAR® label when sourcing windows and doors. ENERGY STAR qualified products meet efficiency requirements set by the U.S. Department of Energy. Installing ENERGY STAR windows instead of single-pane windows can lower energy bills by up to $465 a year in some climates, according to a 2007 U.S. Department of Energy study. The performance of ENERGY STAR qualified windows is independently tested and certified in accordance with National Fenestration Rating Council (NFRC) energy efficiency regulations. NFRC product ratings are displayed on an energy performance label that appears on qualified windows and doors. Visit www.nfrc.org for more information.

Measures can be taken during the design and construction process to further improve window and door efficiency. To increase solar heating in the winter, face major glass areas to the south. To reduce solar heating in the summer, minimize east- and west-facing glass areas. Install flashing and seal every window and door properly to avoid air infiltration and bulk water intrusion around the frame.

When considering windows and doors in building design, keep in mind that the more openings there are in a wall, the greater the wind loads on the areas without openings, or the opaque areas. Wood-framed walls fully sheathed with wood structural panels meet code wall-bracing requirements and offer the widest possible latitude to change window and door configurations, size and placement, including field modifications without extensive redesign or engineering.

The National Symbol of Energy Efficiency

ENERGY STAR®, the most recognized symbol for energy efficiency in the United States, was developed by the U.S. Environmental Protection Agency and the U.S. Department of Energy to help consumers identify products that are more efficient than comparable products. The ENERGY STAR label can be found on qualifying windows, doors, appliances and other products.

ENERGY STAR certification is also available to new houses that meet specific efficiency requirements that are more stringent than International Residential Code® requirements, including upgraded insulation, better air sealing and high-performance windows. ENERGY STAR certified homes are 20 to 30 percent more efficient than standard homes, and consumers recognize that the ENERGY STAR label equates to lower utility bills and overall improved product performance.

ENERGY STAR Builder Option Packages (BOPs) are pre-approved efficiency checklists that builders can follow to qualify for certification. Inspection and testing by an ENERGY STAR home performance specialist is required. Visit www.energystar.gov for more information.

LEARN MORE AT energystar.gov

5 SIZE MECHANICAL SYSTEMS CORRECTLY

Heating and cooling is the largest energy expense for most U.S. homes. However, with proper planning, these costs can be minimized and energy saved. Oversizing HVAC equipment is a common and expensive mistake. Bigger HVAC systems with excess capacity waste energy and cost more to purchase, install and operate. They produce extra noise, uncomfortable temperature swings inside the home and are less-effective dehumidifiers. Houses built for energy efficiency realize reduced peak loads, allowing for smaller, more efficient HVAC equipment. Builders who size HVAC systems correctly will save on equipment and installation costs.

Do not size HVAC equipment by simply estimating a predetermined amount of heating or cooling per square foot of living area. Equipment should be correctly sized using *Manual J Residential Load Calculation*, the industry standard for calculating heating and air conditioning loads, published by the Air Conditioning Contractors of America (ACCA). *Manual J* evaluates multiple factors in determining correct equipment size. HVAC equipment manufacturers, HVAC contractors, and gas and electric utilities are familiar with *Manual J* procedures. To learn more, visit the ACCA website at www.acca.org.

In the past, air leaks in the building envelope provided homes with natural ventilation that reduced indoor pollutants, moisture, dust, and bacteria. Because today's more energy-efficient homes minimize the exchange between indoor and outdoor air, some additional controlled ventilation is often required to maintain good air quality and control moisture. Ventilation solutions include whole-house ventilation systems and spot ventilation, such as localized exhaust fans found in kitchens and bathrooms. Air-to-air heat exchangers conserve heating and cooling energy while ventilating homes by transferring heat from the air being exhausted to the fresh, outside air entering the house. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends that homes receive 0.35 air changes per hour or 15 cubic feet per minute (cfm) per person, whichever is greater. For more information, visit www.ashrae.org.

More Energy Saving Options

Many energy saving opportunities exist beyond the walls of the house. Consider these cost-saving trade-offs to improve building efficiency and meet performance codes:

Efficient HVAC Equipment

High-efficiency equipment is just as important as correctly sized equipment. Efficient heating/cooling systems can yield significant operating cost reductions – as much as 20 percent, according to the U.S. Environmental Protection Agency. Look for ENERGY STAR® qualified equipment.

Ductwork

Heating/cooling systems work harder to condition air that travels through ducts in unconditioned attics or basements, so locate ductwork inside the home's conditioned space, or in the conditioned, closed crawl space of a raised wood floor. Ducts located in unconditioned spaces should be insulated to minimize heat loss. Recommended duct insulation R-values vary by climate zone.

Reflective Roof Sheathing Panels

These structural wood panels with a radiant barrier foil surface minimize the effects of the sun's radiant heat, helping to lower attic temperatures and improve energy efficiency in warmer climates. More information is available at www.apawood.org/specialty.

Shade the Windows

Roof overhangs, awnings and landscaping can be used to shade sun-facing windows during warm weather, reducing solar heating and HVAC cooling demands.

Meeting Energy Codes

Building codes are local, regional or national regulations that specify standards for design, construction, materials and other related aspects of building. These ordinances are enforced to ensure human safety and welfare. Depending on the location of the building, you may need to comply with the International Residential Code® (IRC®), International Energy Conservation Code® (IECC®), state-developed amendments to these codes and/or other local laws or ordinances. The IRC/IECC codes include energy efficiency criteria for new residential buildings.

The U.S. Department of Energy's Building Energy Codes Program, an informational resource on national model energy codes, offers a free compliance program called RES*check*™. RES*check* print and software tools simplify and expedite the IRC/IECC code-compliance process for builders, designers, plan-check personnel and field inspectors.

To use RES*check*, builders must incorporate basic efficiency measures (such as air sealing and duct insulation) into the building design as detailed in the RES*check* Basic Requirements Guide. Next, builders choose one of three compliance approaches to determine insulation and window requirements:

- **The prescriptive package approach** allows the builder to select from a group of packages of insulation and window requirements based on climate zone. The builder meets or exceeds the package requirements to achieve code compliance. This approach is simple but restrictive. The limited choices available to the builder do not afford flexibility in product selection.
- **The trade-off approach** allows the builder to trade off insulation and window efficiency levels in different parts of the building, as long as the building as a whole meets the overall code insulation and window requirements. This approach offers the builder increased flexibility in product selection and the opportunity to build a stronger, more energy efficient house for less cost.
- **The software approach** offers the greatest flexibility, allowing for trade-offs between all building envelope components and HVAC equipment. Trade-off calculations are automated by RES*check*, enabling the builder to quickly compare different components and systems. When all components are decided on, RES*check* automatically generates a report that can be submitted to the local building code enforcement authority for plan review and document compliance.

Free RES*check* tools are available from the Building Energy Codes Program website at www.energycodes.gov. Check with your local building code enforcement authority to verify that RES*check* documentation is accepted in your jurisdiction. Local authorities can also recommend additional code-compliance resources, such as home energy professionals who assess building efficiency.

About APA

APA is a nonprofit trade association of and for wood structural panel, glulam timber, wood I-joist, laminated veneer lumber, and other engineered wood product manufacturers. Based in Tacoma, Washington, APA represents approximately 150 mills throughout North America, ranging from small, independently owned and operated companies to large integrated corporations.

APA is a leader in wood-design testing and research. APA's 42,000-square-foot Research Center is staffed with an experienced corps of engineers, wood scientists, and wood-product technicians. Their expertise plays important roles in producing panel and engineered wood systems that meet the industry's highest performance standards and braced-wall designs that reduce the risk of catastrophic home failure. For our latest research in building strong, safe and durable structures, visit www.apawood.org.

MORE INFORMATION ON WOOD CONSTRUCTION SYSTEMS

APA offers a comprehensive set of services and tools for design construction professionals. If you're looking for detailed product information, training materials or technical assistance, APA can help.

www.apawood.org **–** APA's website, is your link to in-depth design and building support, including a library of more than 400 publications available for instant PDF download or hard-copy purchase.

APA Product Support Help Desk **–** Staffed by specialists who have the knowledge to address a diverse range of inquiries, the Help Desk can answer your questions about specification and application of APA products, or put you in touch with your nearest market development specialist. Call (253) 620-7400 or send an e-mail to help@apawood.org.

Wall Bracing **–** Understanding the code requirements for wall bracing can be a challenge, but following them is of critical importance to the structural integrity of a home. APA helps you easily understand, design and build wall bracing systems. The following publications and more information are available at www.wallbracing.org.

- *Introduction to Wall Bracing*, Form F430
- *Brace Walls with Wood*, Form G440

For additional wall bracing information, refer to *A Guide to the 2006 IRC® Wood Wall Bracing Provisions,* authored by APA and the International Code Council® (ICC®). The guide and wall bracing seminars and resources are available at www.iccsafe.org.

Build a Better Home **–** APA's Build a Better Home program is designed to provide builders and homeowners with the construction guidelines they need to protect their homes against damaging moisture infiltration. Key elements in the building envelope are the roof, walls and foundation. The following publications and more information are available at www.buildabetterhome.org.

- *Build A Better Home: Foundations,* Form A520
- *Build A Better Home: Mold and Mildew,* Form A525
- *Build A Better Home: Roofs,* Form A535
- *Build A Better Home: Walls,* Form A530

REFERENCES

- U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy: ***www.eere.energy.gov***
- U.S. Department of Energy, Building Energy Codes Program: ***www.energycodes.gov***
- U.S. Department of Energy, Building Technologies Program: ***www.buildingamerica.gov***
- U.S. Department of Energy, Consumer's Guide to Energy Efficiency and Renewable Energy: ***www.eere.energy.gov/consumer/your_home/***
- ENERGY STAR®: ***www.energystar.gov***
- National Institute of Building Sciences: ***www.nibs.org***
- Oak Ridge National Laboratory: ***www.ornl.gov***

WOOD
The Natural Choice

Engineered wood products are a good choice for the environment. They are manufactured for years of trouble-free, dependable use. They help reduce waste by decreasing disposal costs and product damage. Wood is a renewable, recyclable, biodegradable resource that is easily manufactured into a variety of viable products.

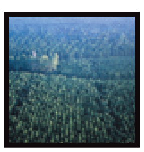
A few facts about wood.

- ***We're growing more wood every day.*** Forests fully cover one-third of the United States' and one-half of Canada's land mass. American landowners plant more than two billion trees every year. In addition, millions of trees seed naturally. The forest products industry, which comprises about 15 percent of forestland ownership, is responsible for 41 percent of replanted forest acreage. That works out to more than one billion trees a year, or about three million trees planted every day. This high rate of replanting accounts for the fact that each year, 27 percent more timber is grown than is harvested. Canada's replanting record shows a fourfold increase in the number of trees planted between 1975 and 1990.

- ***Life Cycle Assessment shows wood is the greenest building product.*** A 2004 Consortium for Research on Renewable Industrial Materials (CORRIM) study gave scientific validation to the strength of wood as a green building product. In examining building products' life cycles – from extraction of the raw material to demolition of the building at the end of its long lifespan – CORRIM found that wood was better for the environment than steel or concrete in terms of embodied energy, global warming potential, air emissions, water emissions and solid waste production. For the complete details of the report, visit www.CORRIM.org.

- ***Manufacturing wood is energy efficient.*** Wood products made up 47 percent of all industrial raw materials manufactured in the United States, yet consumed only four percent of the energy needed to manufacture all industrial raw materials, according to a 1987 study.

Material	Percent of Production	Percent of Energy Use
Wood	47	4
Steel	23	48
Aluminum	2	8



- ***Good news for a healthy planet.*** For every ton of wood grown, a young forest produces 1.07 tons of oxygen and absorbs 1.47 tons of carbon dioxide.

Wood: It's the natural choice for the environment, for design and for strong, lasting construction.

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying engineered wood products, contact us:

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Form No. J440 • Issued December 2008/0200

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