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Maximizing the Design Potential of Patio Doors

Patio Door Material Use, Function and Features

Aluminum

Light yet strong, aluminum patio doors can be configured into a wide variety of combinations. The narrowness of the frame places the focus on the glass and subsequently, the view it offers. Because aluminum is a very dimensionally stable product, many manufacturers can build in very large sizes. Multi-panel door systems are often made with aluminum frames to facilitate indoor-outdoor living. The sleek design of aluminum windows allows for natural daylight and is often used in contemporary or mid-century style homes.



Aluminum is not recommended in beach homes for while the material is water resistant, it can suffer corrosion from salt water and salt air. The corrosion affects hardware operation and frame performance.



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Vinyl

Vinyl patio doors were originally designed in Western Europe. In recent years, vinyl has grown in popularity in the United States, changing the fenestration industry with high performance frames and the flexibility to create a profile to mimic the contemporary design of aluminum. Hollows are designed into vinyl profiles to improve thermal conductivity of the frame. When sealed with welded corners the air-convection inside the frame circulates to prevent temperature changes from hot to cold. Some manufacturers have the ability to inject the frame with foam that can further enhance this affect. Most vinyl patio doors can meet ENERGY STAR® requirements in all zones.



Ultra-violet light, expansion-contraction that is inherent in PVC can contribute to a shorter life span. Ingredients such as titanium dioxide that resists ultra-violet damage can increase the frames performance over time. While most vinyl recipes include pigments and other additives for a smooth finish, many manufacturers today offer painted exteriors in a multitude of colors.

Fiberglass

Fiberglass frames are essentially composed of glass fibers and resin, materials that expand and contract very little with temperature changes in the weather. Until recently, the complex profiles required for window designs have been impossible to attain with fiberglass. Innovation has made it possible to design a fiberglass frame and fiberglass windows and patio doors are becoming more popular among homeowners for its beauty and long-lasting durability.

The energy performance rating of a fiberglass frame is similar to that of vinyl patio doors; especially when adding Low-E glass and argon or krypton gas between the panes. The global green building movement is spurring demand for sustainable products with low life cycle costs.



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Fiberglass substrates take the lowest embodied use of energy to create. More mainstream window and door manufacturers are introducing fiberglass profiles to meet these demands. Because fiberglass frames are dimensionally stable and energy efficient, many doors have side light and transom options that can be built into very large sizes. This gives the homeowner increased daylight that will enhance a room's overall comfort.

Wood

Compared to vinyl and fiberglass, wood frames require more maintenance. Regular sealing, staining or painting is needed to prolong the beauty and performance of the window or door. Frequent touchups and the occasional refurbishing, sanding and applying new coats is almost always required. Wood patio doors used in today's homes and buildings are most commonly clad with low maintenance exteriors such as vinyl, aluminum or fiberglass composites. Many manufacturers use non-conductive cladding such as vinyl or fiberglass to help reduce moisture and damage to the wood interior. Clad wood doors are commonly accepted for offering comfort, elegance and dependability to design that can last for generations. Oftentimes architects and designers will select clad wood windows for historic projects or in custom homes where energy efficiency meets elegant design.

Clad wood windows are popular due to a wide range of low maintenance exterior color choices and when matched with wood species such as pine, fir or mahogany the design capabilities are suitable not only for custom homes but many urban living spaces.

Patio Door Configurations

Sliding Doors

Sliding patio doors are an affordable, space-saving way to open up a room. While hinged doors require objects to be well away from the door, a sliding door needs no swing room at all. The doors open by sliding along horizontal tracks at the head and sill. A sliding door will have either a right-hand or left-hand operation.



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French-style sliding patio doors have wider stiles and rails, which makes them an appropriate choice for traditional architectural styles. French-style patio doors operate on a track and require virtually no interior or exterior space for opening. They are available with either a right-hand or left-hand operation.

Swing Doors



In-swing operation opens into the room like in the image shown here whereas out-swing opens to the outside. Typically in-swing operation is used. However, when specifying an in-swing French patio door, it is important to ensure there is enough room for the doors to swing in without hitting walls or furniture.

Glass Walls

Architects and designers trying to make the most out of limited spaces are opening up rooms to patios and backyards with large glass wall style doors. These are especially popular for markets like Southern California where the weather is conducive for opening windows and doors all year.

What is interesting is that these doors are also becoming a popular option in the Pacific Northwest where homeowners are willing to pay the premium to have a glass wall overlooking a beautiful view.





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Stacking Glass Wall Systems open up by sliding large glass panels on top of each other, flooding the room with natural light and fresh air. Typically these doors are specified as 3 to 4 panel units, but are able to get much larger. As the number of panels increase so does the width required for the track. This is an important consideration in the design phase.

Pocket style Glass Wall Systems provide an un-obstructed clear space. When fully open, the panels slide into the wall pocket and completely disappear from view. Like the stacking doors these doors are specified as 3 to 4 panel units, but are able to get much larger. Another consideration is the space needed to accommodate the pocket, because this wider space is needed pocket style doors are typically used in remodel and new construction applications.

Adding transoms and side lights to door configuration opens up the day-lighting area. Side lights allow for more airflow and daylight than a two-panel door, but do not require the extra space for an additional panel. The handle on the sidelight is smaller than the door handle as to not overwhelm the design aesthetics.

This indoor/outdoor living trend is translating into homeowners choosing other popular options like the covered backyards with fireplaces, TVs, and open kitchens etc. The interesting aspect with these glass walls is that these have to be chosen upfront as part of the home construction whereas open kitchens can be added at a later point.

Testing Requirements

Patio doors that meet ENERGY STAR® standards for thermal performance are certified and include an National Fenestration Rating Council (NFRC) label stating individual product performance. This is required by most states and provinces in both the U.S. and Canada. The NFRC label includes important performance ratings such as u-factor, solar heat gain coefficient, and visible transmittance air leakage and condensation resistance.

The patio door's performance grade communicates the design pressure, product type, water and air infiltration and forced entry. Design pressure is the amount of wind pressure a window in the building is required to withstand. Factors that determine design pressure include wind speed, exposure category and building height. The highest pressure areas in the building are at the corners and on the back side of the building.



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We observed the four major performance criteria for NAFS testing:

- Air infiltration is tested to ASTM standard E283, this test measures leakage in cubic feet per minute
- Water penetration is tested to ASTM standard 547. For this test, the chamber is calibrated to 5 US gallons per hour the test is equal to 8 inches of water per hour for four 5-minute cycles
- The structural Performance is test to 150% of rated design pressure; this provides a 50% safety margin
- Forced Entry tested to ASTM F588 for Windows and ASTM F842 for Sliding Doors and AAMA 1304 for Hinged Doors; it includes a lock strength and security test.

When doors carry the gold label, it's a sign all of the requirements of the American Architectural Manufacturer's Association (AAMA) National Certification Program are met. The AAMA Certification Program is the only program in the window and door industry that requires components used in the finished door assembly pass their own set of performance tests. These performance ratings are certified by a third party entity and approved by AAMA. AAMA tests are reported either as a pass/fail or the pounds per square foot that was used to test the window. The air infiltration test is determined by cubic feet per minute, the test must be under 0.30 cubic feet per minute.

The water penetration is rated in pounds per square foot. The water penetration test is conducted with four 5-minute cycles. During the test, the patio door is exposed to the equivalent of 8-inches of rain per hour. A failure is when water penetrates the inner most plane of the opening. The structural test is also rated in pounds per square foot. The test loads are held for 10 seconds positive and negative. Deflection measurements are made at several applied pressures and after the test is complete it is confirmed that the products returns to its original dimension within test criteria.

Forced entry test is pass or fail; it includes a lock strength and security test.

The role of doors for lighting and ventilation

According to a study by the U.S. Department of Energy (DOE), the use of natural daylight in place of artificial lighting during the day can reduce energy consumption by about 10 percent. As a part of the whole house design, the strategic placement of doors can accommodate both general and task lighting needs. When creating a home with sustainable design it is important to balance the aesthetics of the home with the practical use of the home, and using doors to reduce the need for artificial light can help achieve that balance.

Air conditioners consume 5 percent of all electricity generated in the U.S. The use of incandescent bulbs can contribute to heat build-up and add to the homes cooling load during summer months. Using natural daylight can reduce energy use, prolong life of the cooling equipment and provide a more comfortable living space.