High-Performance Exterior Doors
Raising the Bar

by Peter Yost and Martin Solomon

We ask even more of our doors than we do our windows; we use them more, slam them more, load their thresholds with feet (human, pet, and even piano...), and typically secure them at just one point (the lockset) along their longest dimension. We expect sustained performance and security, and we would like them to have good insulation value and keep drafts out as well.

Relevant issues surrounding door choice increase in number and complexity when considering the many different types of doors, including sliding and revolving doors. This article will focus on hinged, or swinging, exterior doors—both commercial and residential.

Most green building and energy programs are not terribly demanding when it comes to exterior doors, in large part because their total area compared to the total surface area of the building is quite small. In a small home, two code-compliant exterior doors make up just over 1% of total surface area of the building—and in larger commercial buildings, it’s often not much different. That said, the overall U-factor and air leakage of a hinged exterior door should be as low as possible to prevent energy waste in an otherwise well-insulated and airtight building.

Stand-out commercial door:
Curries Trio-E

One of the highest-performing commercial exterior hinged doors is the new hollow-core, steel-stiffened Trio-E from Curries, a brand of Assa Abloy. The keys to its performance are the Curries’ Thermal Break Frame and the Pemko Thermal Barrier Saddle threshold. These combine to give the lowest U-factor and air leakage numbers in the business (U-factor is the inverse of R-value, so a lower number is better).

Be aware, though, that numbers can be deceiving: thermal performance testing is a source of tension in the door industry. The testing protocol of the National Fenestration Rating Council (NFRC) allows...
computer modeling to predict the door’s U-factor based on the design of the door and the materials used, while the other method (“operable” performance test, ASTM C1363) measures actual tested performance in a guarded hot-box, the same device used to measure insulation materials (see “How R-Value Is Calculated,” EBN June 2011). The operable performance test is more expensive and time consuming and generally returns higher U-factors. However, the numbers earned are more indicative of actual performance than those in the computer-calculated test, ASTM C518.

Curries rises above this controversy, displaying both calculated and tested numbers. With the thermal break frame, the Trio-E door earns a calculated U-factor of 0.09 (R-value 11.0), a performance U-factor of 0.29 (R-value 3.4), and a tested air tightness of 0.04 cfm/ft².

The Trio-E uses steel, which has high recycled content and low emissions as a matter of course. The door is also Greenguard Children & Schools-certified to meet California’s Section 01350 emissions standards for indoor air quality; while attaining this level of certification may not be hard for a steel door, emissions certification is still uncommon for door manufacturers and is something we hope to see more of, particularly for doors made with composite materials or other potentially high-emitting materials and finishes.

Stand-out residential doors: Pazen and Natural

In general, German-made Passive House doors are not widely available and are much more expensive than the best North American-made residential doors. However, the performance differences between the two are too striking to ignore, and we could not justify labeling any standard residential door “high-performance” in light of the Pazen Fenstertechnik Enersign (all-glass) and Natural (opaque and lited) doors.

What sets these doors apart is the alignment of the threshold and jamb gasketing, the triple-point closure (no thermal bowing), the stepped multiple weatherstripping, and the durable, designed-for-replacement silicone or synthetic rubber (ethylene propylene diene monomer, or EPDM) seals. These features combine to give not only superior thermal performance and water protection but durability as well.

When closed, Passive House doors look like normal—albeit modern—doors. Swung open, however, the thickness (4.5”–5.5” instead of the standard 1.75” for residential doors) and mass of the door will be clear, as will the stepped weatherstripping and three-point lockset. Instead of the door edge being flat, it has steps to accommodate the multiple individual seals, a feature that significantly increases airtightness.

Too few Natural and Enersign doors are imported into North America to justify the manufacturers paying for NFRC testing. However, the U-factor of the opaque Natural is measured at 0.11 (0.65 W/m²K) using the European EN/ISO 10077 standard. While measured air leakage ratings were not available from Pazen, the company says they meet a stringent Passive House door airtightness standard of 2.25 m³/hr/m² at 100 pascals.

The Pazen Fenstertechnik doors are certified for responsible wood use and indoor air quality. The wood used is certified by the Programme for the Endorsement of Forestry Certification Schemes (PEFC), an international umbrella system that recognizes Sustainable Forestry Initiative (SFI) and American Tree Farm System (ATFS) as affiliates in the U.S. Forest Stewardship Council-certified (FSC) wood can be requested to replace the PEFC wood. The paints and finishes used on the door are all certified for low emissions by Blue Angel, a well-established German environmental certification.

Installation and maintenance

Sustained water- and airtightness of exterior doors is a function of the type and quality of weatherstripping. Doors with EPDM or silicone seals (versus PVC-backbone seals) are more durable. Seals inserted into a kerf in the doorstop, rather than being installed with adhesive, perform better initially and are much easier to replace when they eventually fail.

In addition to maintenance, quality installation based on manufacturers’ instructions is critical for high-performing doors. Hardware is important for sustained performance. There are several ASTM tests used for door hardware, testing everything from lateral wear on the hinges to how much pressure it takes for the latch to engage as the door closes. The hardware on the Trio-E and the Pazen doors, typically Grade I, is recognized by the Builders Hardware Manufacturers Association and ANSI as the highest-grade and most durable hardware available.

While some commercial and residential doors stand out as high performers, there is much room for improvement. As buildings are built with better insulation and air sealing, the generally poor thermal performance of doors will be harder to overlook. Thanks to Passive House and companies like Curries, we know better options exist, and we look forward to seeing them put to use more widely.

For more information:

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Curries, an Assa Abloy brand
www.curries.com

Pazen Fenstertechnik
www.enersign.com