

Sealing the Deal

Today's Door Systems Require High-Performing Door Seals


by Craig Lund

Failure isn't anything a door manufacturer wants to consider—but it's always a possibility. And we all know

exterior door seals are a critical component to the performance of entry doors. Door manufacturers can avoid most potential causes of

failure by selecting the door weatherseal that meets the level of long-term protection required for the entry door system's life.

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There are several criteria to consider when choosing a door weatherseal or when evaluating an existing one. These include UV effects and compression.

Let's take a look at the typical environmental causes of door weatherseal failure and identify the need for material performance criteria.

Door weatherseal failure can be due to a variety of environmental factors, including exposure to ultraviolet radiation. UV-radiation is the part of the solar spectrum that has a wavelength of less than 400 nanometers. Combined with oxygen and water, it is responsible for a wide range of deleterious effects generally referred to as weathering. Ozone and other pollutants also contribute to the degradation, and ultimately, this weathering is the primary cause of seal failure.

Evidence of Failure

The first evidence of weathering is a loss in aesthetics. The seal will exhibit a shift in color, fading or gloss. Initially, the seal still functions but, with continued use weathering, chalking, and/or surface crazing become apparent. Physical properties of the cladding or outer surface, including its tensile strength and tear strength, also will begin to diminish. The surface also may crack and split during winter months, as the seal's resistance to low temperatures is compromised.

Finally, the seal will exhibit a complete loss of physical properties. The cladding will appear brittle and many times literally will flake off, exposing the non-ultraviolet (UV) stable foam core. If the seal is not replaced at this point, the degradation will continue until the foam core is completely disintegrated, leaving no seal in the door.

To prevent weathering, weatherseal manufacturers incorporate UV stabilizing additives into the polymer matrix. These additives disrupt the photochemical process described previously or absorb UV radiation preferentially. The choice of additives depends on the type of polymer being protected and the

relative value the formulator wants the final product to have. The presence of these critical additives can be detected only through complex chemical analyses.

The Consumer's Wake-Up Call

Otherwise, it is not until the seal fails that the consumer finds out that adequate protection was not formulated into the product. The use of additives, such as UV stabilizers, also can impact the cost of the weatherseal product—the higher the level of UV stabilization, the greater the impact. If the weatherseal is stabilized properly, you can guarantee that it will meet the performance requirements for the life of the exterior door system.

The weatherseal's outer cladding or surface is vital to its performance. It is in continuous contact with the operating components of the door while under exposure to the various elements of the weather. Proper formulation of the weatherseal's outer cladding or surface is critical to ensuring product performance. This material is the barrier—the first defense against the elements—particularly UV radiation. The optimum material offers the following characteristics:

- A low-friction surface allowing the seal to act as both a compression and a sliding seal;
- Durability for the life of the end product, including puncture and tear-resistant properties; and
- A surface that is impervious to paint, solvents or water-based finishing treatments.

In addition to resistance to weathering, the following other criteria need to be considered in selecting the best seal material for an entry system.

Avoiding Compression

One of the greatest dangers is permanent compression set caused by thermal expansion and contraction of door and window

construction materials. Heat expands their materials, which compresses seals. Cooling contracts the materials and releases pressure on the seals, which must spring back into positive contact or lose effectiveness. The loss of functional height is quick and permanent. While many materials are available, we believe urethane foam weatherseals typically offer the most flexibility, durability and dynamic range of motion to accommodate thermal gradients and warping found in exterior applications. The typical urethane foam door weatherseal consists of a molded foam core bonded to an extruded single- or multi-durometer mechanical retention device with an outer cladding. The retention device may be either wrapped or left exposed.

Polyurethane foam offers significant benefits over alternative materials. Door seals must be firm enough to provide a good seal, yet soft enough for ease of performance. Polyurethane can be formulated in a broad range of compression load deflection formulations and has very low compression set properties of less than 10 percent, which means it can withstand repeated cycles of use over time without loss of structural integrity of performance. Polyurethane molded products harden by cross-linking, forming a permanent three-dimensional molecular structure. Subsequent heat and pressure cannot soften and deform them.

Door weatherseals are intended to be invisible. Compare long-term performance data, including weatherometer testing for effects of UV radiation, to determine the weathering performance and compression set characteristic of door weatherseals. |

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