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ACCESS BETTER THINKING

WHITE PAPER:

SEALING OUT HVAC SYSTEM LEAKS

DON'T OVERLOOK DOORS, LATCHES, HINGES AND GASKETS IN HVAC SYSTEM DESIGN

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SEALING OUT HVAC SYSTEM LEAKS

One of the most common issues that today's HVAC system manufacturers face is determining how to seal an HVAC unit to reduce air and moisture leakage.

As anyone knows who has designed the exterior casing of an HVAC unit, there's not a simple black and white answer to this issue. And that's because it can be incredibly complex.

Mechanical engineers need to not only consider how they will comply with various industry guidelines and regulations, but what types of materials they'll use, the cost of those materials, maintenance accessibility, and a host of other factors.

MAKING THE EXTERIOR HOUSING A PRIORITY

The problem often begins at the design stage. So much effort is made in designing the guts of the heating or cooling system that the exterior casing is often overlooked -- in particular, the access points such as doors and service panels, which are necessary to obtain access to maintain interior components.

Unfortunately, if poorly designed or spec'ed with lower quality components, doors and panels can become an HVAC unit's weakest link in terms of serving as a point of entry for moisture, (rain and humidity), or air that could contain unwanted contaminants or particles.

As a mechanical engineer specializing in HVAC equipment design, it boils down to an equation where product design needs must meet the demands of the customer today, but also anticipate new realities of building ownership, such as designing buildings that must adapt to climate change, and the growing number of extreme weather events occurring throughout our country.

For example, hurricanes that drop enough rain where it's measured in feet are forcing building developers and owners to consider installing HVAC systems that go well beyond local building codes to prevent damage to their buildings. For many years, the standard that most HVAC manufacturers used as acceptable criteria was no water intrusion at a pressure differential of six inches of water column. However, with the growing number of extreme rain events, particularly along Coastal regions, building specifications are requiring no leaks with pressure differentials as high 20 inches of water column (WC).

One standard that an increasing number of manufacturers are considering in their design is the Miami-Dade Hurricane Specification. The specification not only takes into account moisture, but also wind velocity (hurricanes). It's a standard used with increasing frequency throughout hurricane country along the Southeast Coast and Gulf Coast, and it's gaining traction in other parts of the country, too, including the Midwest, in response to large rain events and extreme weather such as tornadoes and straight-line wind events.

Another design consideration is the growing number of building owners embracing LEED green building certification. Throughout the country, we're seeing a decreased tolerance for contaminants and particles in the air stream of a building structure, as well as heat transfer through the doors and panels. As a result, we're seeing more building owners seeking to tighten up the performance of their HVAC systems.

TIGHTENING UP ACCESS POINTS

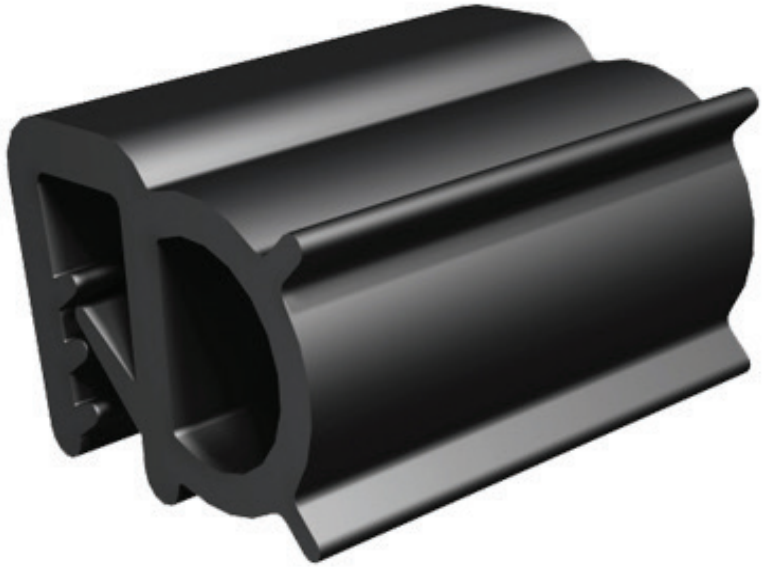
If access points are an HVAC system's Achilles tendon, what can be done?

Based on my experience in working with HVAC manufacturers, the answer rarely boils down to one fix. Rather, a combination of adjustments in design must be made while acknowledging factors such as manufacturing cost, cost of ownership, ease of maintenance, operating efficiency, and increasingly, security (terrorism, copper theft, etc.), too.

For example, clamping down the latches to increase the compression on the gasket around the perimeter of the door and adding more hinges may seem like the most logical fix. However, more may not be better.

The recommended clamping range is 30 to 50% of the relaxed bulb dimension of the gasket. The temptation is to go beyond 50% to obtain a really tight fit. The problem with that solution is you will increase the risk of the bulb not recovering properly, and in turn, you will increase the likelihood of air and moisture leakage.

Instead, we recommend a "hard stop" (independent of the latch adjustment) to maintain the ideal gasket compression as designed at the factory.



SPECIFYING THE RIGHT GASKETING IS CRITICAL TO PREVENTING LEAKAGE THROUGH SERVICE DOORS AND PANELS.

Gasketing by Allegis Corporation specifically designed for HVAC units (P/N 427008) offers a clamping range of 1-3 mm and offers a temperature range of -40 degree to 212 degree Fahrenheit. It features an EPDM carrier (edge trim) and EPDM sealing lip or bulb.

Another component that's critical in our goal of reducing opportunities for leakage is the hinge. The location of the axis of rotation of the hinge, determines how the door comes to rest in the frame. For example, if we put the access of rotation too close to the seam between the door and the casing, we risk destroying the gasket every time the service tech needs to open and close the door. By moving the axis up and away from the seam, the door approaches the opening at less of an angle and reduces the chance of "wiping" the gasket away from the frame.

CHOOSING THE RIGHT HINGE FOR HVAC UNITS: *This zinc die-cast and plated 3-axis adjustable hinge for insulated doors (P/N 321158) by Allegis Corporation provides a 180-degree opening. Because it can be adjusted for X, Y and Z axis, it offers the flexibility that mechanical engineers designing HVAC systems need to reduce leakage while maintaining ease-of-maintenance for service techs.*

Or, if the panel or door skin is too thin (typically done to reduce costs), we won't have enough material for the latch or hinge to grab onto, which will actually create costly headaches for the service tech who will find themselves creating a makeshift repair to reinforce a door or panel that won't open or close properly or leaks.

This may seem trivial to some, but there's also the factor to consider of whether to use a metal or plastic handle.

As we know, metal conducts heat, so a metal handle acts as a thermal bridge, which both reduces efficiency and can cause sweating and condensation on the latch. And yet, despite the science, year after year, manufacturers continue to demand metal handles.

STOP CONDENSATION WITH A THERMALLY BROKEN LATCH.

This locking Klimaflex 2 thermally broken assembly for insulated doors by Allegis Corporation does not conduct heat, which in turn, reduces the chance of condensation. The locking mechanism requires a key to open/lock it, which increases security and safety.

To solve this issue, our company, Allegis Corporation, has patented a thermally broken handle that stops conductivity of heat and reduces incidences of condensation.

As a side note, HVAC design engineers should not overlook the growing number of city and state building codes that call for a locking handles, which require a tool to lock or open a door or panel where there is an energy source behind it. These codes are being put in place both to enhance safety for the service tech, but also to thwart thieves and terrorists.

BOTTOM LINE: DON'T OVERLOOK YOUR HVAC SYSTEM DOORS

Don't let service doors and panels become the weakest link in the design of your HVAC system.

It's easy to take doors and service panels for granted. But with the growing demands being placed on HVAC systems due to climate fluctuations and stronger building codes, it's more important than ever to challenge your thinking when it comes to access points and the actual componentry that HVAC service techs use day-in and day-out to service both industrial, office building, retail and residential HVAC systems.

As you work toward designing your next HVAC system, I invite you to ask yourself these key questions:

- *What is the most stringent building code that this HVAC system may need to meet? Should it meet the Miami-Dade Hurricane Specification even though it might be used in a place such as Fargo, North Dakota?*
- *What would happen to this HVAC unit if it were exposed to 100 mph winds and more than five feet of rain (60+ inches of rain were recorded in parts of Houston during Hurricane Harvey)?*
- *Is this HVAC unit going to be located in places known for high levels of theft?*
- *How can we achieve a tighter fit within our budget?*
- *Are we making it more difficult for a service tech to access an HVAC unit?*

Keeping these factors in mind during the design process will add value, comfort and peace of mind to the end user, while eliminating unnecessary warranty and service claims. Keep the conditioned air inside the unit, where it belongs, and the weather outside.

ABOUT THE AUTHOR:

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Carl Craven is HVAC Industry Market Engineer/Engineering Manager for Allegis Corporation, a Minneapolis-based custom supplier and distributor of latches, hinges, gaskets, and other access products. Craven has more than 25 years experience in the HVAC industry as a mechanical engineer and as a industry market engineer. Craven joined Allegis Corporation 12 years ago where he specializes in working with HVAC system manufacturers in developing solutions to their manufacturing challenges. Prior to Allegis, Craven worked with Southco Inc., and Modine Manufacturing. Craven is the curator of the Klima-Flex Users Group. Craven earned a Bachelor of Science degree in mechanical engineering from Michigan Technological University.

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Contact us to learn more about designing access to your HVAC system, or to access the thinking of Allegis Corporation, a Minneapolis-based custom supplier and distributor of access systems and parts.

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