WAR STORIES

How to Pass a Building Enclosure Test with Overhead Doors

By Mike Peak

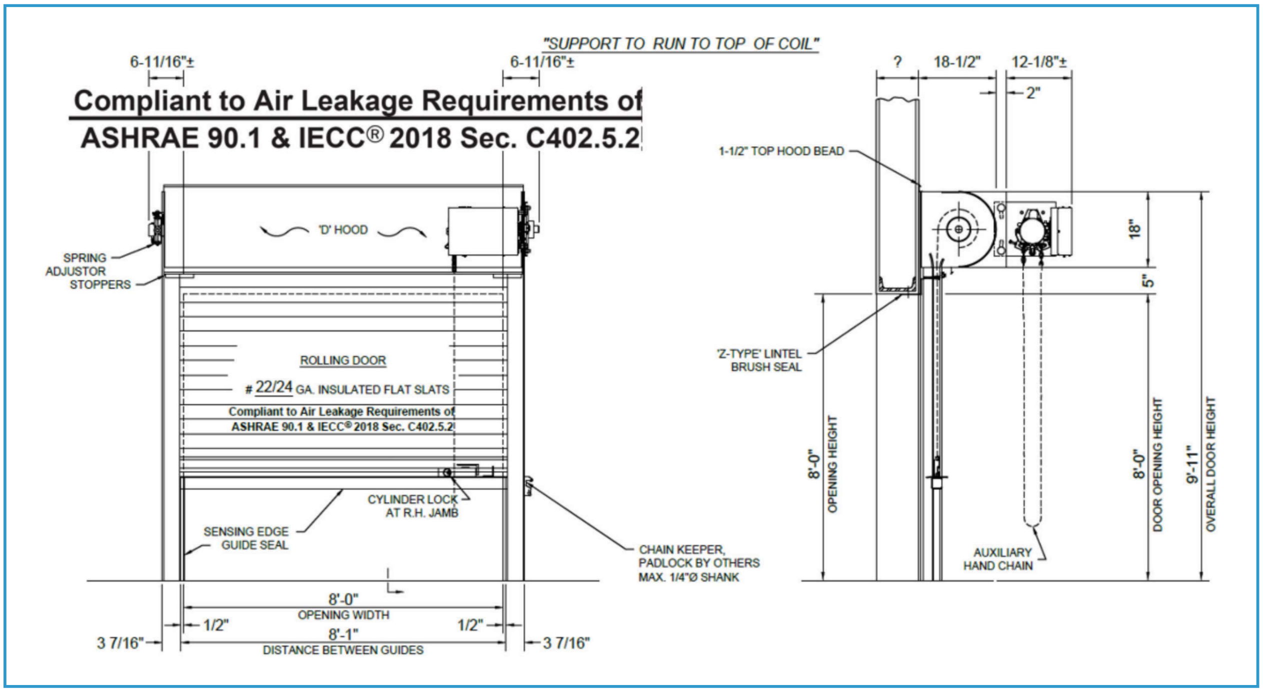
About a month ago, I was presented with an interesting challenge. As a building enclosure testing agency, we do plenty of building enclosure tests on an array of different types of construction. From massive warehouses to schools, all the way down to little coffee shops. You see, in Washington state, a building enclosure test is required for every commercial building as a part of their energy code to get a final certificate of occupancy. So, when we were asked to come out to the Rocky Reach Dam outside of Wenatchee, Washington to conduct a building enclosure test on a large mechanical shop, it was a common request. However, when we found out that they had a twenty-two by thirty-foot coil door, we collectively sighed and loaded every fan we own into a trailer, assuming automatically it would fail. I have tested several warehouses with coil doors, and I am the farthest thing from a door expert, but I do know one thing: nearly every warehouse I have tested with coil doors has failed. The reason these projects do so poorly is because non-insulated coil doors are specified, which have no air leakage rating. Coil doors have a large gap at the top that allows the door to uncoil to the closed position. On non-insulated, non-rated coil doors, that gap is generally unsealed, or sealed with nothing more than a brush which only partially contacts the slats. This amounts to a large opening that easily allows air to pass by under the pressure of a building enclosure test.

As the failing tests mounted on projects with coil doors, we saw a problem coming down the road. The updated energy code in Washington state was going to require all buildings to pass a building enclosure test at a given leakage rate to receive a certificate of occupancy. Two associations were taking this seriously, and that's when we were approached by the Metal

Building Manufacturers Association (MBMA) and the Door and Access Systems Manufacturers Association (DASMA) to provide some additional testing. As mentioned previously, this project had a large twenty-two by thirty-foot coil door, along with another smaller eight by eight-foot coil door, and four fourteen by fourteen-foot sectional panel doors. We were asked to conduct a baseline test to satisfy the Washington state energy code, then perform three additional tests. One with all the coil and sectional doors sealed, one with just the large coil door unsealed and finally one with both coil doors unsealed. This would tell us the net leakage of the sectional doors and the individual leakage of the coil doors.

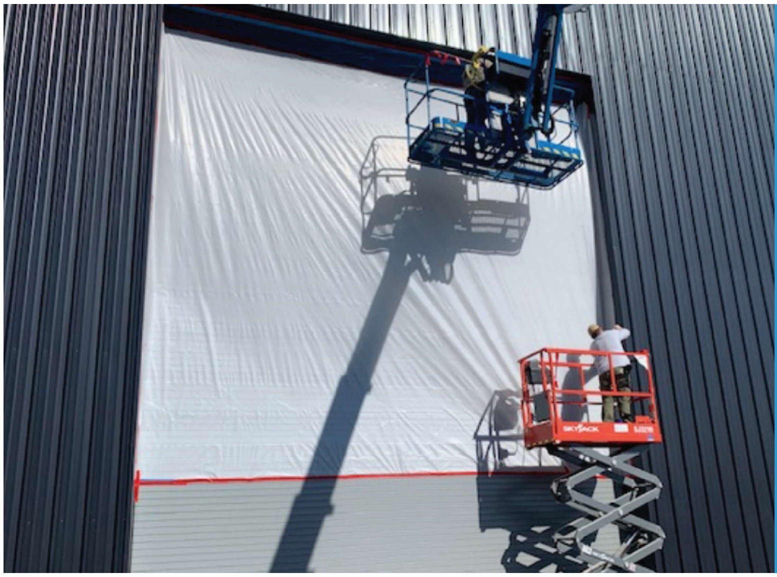
I thought to myself "What a great idea, now we can quantify the leakage between sectional doors (which do pretty well during the building enclosure test) and coil doors." Why didn't I think of this? So, I set off to Wenatchee with all my fans in tow to meet a couple of engineers out of Ohio– Vincent Sagan of MBMA and Dave Monsour of DASMA. After inspecting the doors with Dave, I set up fans and fired them off fully expecting the building to fail (I even recall prognosticating such in our pretest conversation), but much to my surprise, the building passed easily. I had to start pulling fans out of the door because they were running too slow to get accurate flows! With my brow furrowed, I started entering numbers into my calculator thinking I made some kind of mistake. "These projects never go this well" I said to myself, but the numbers were right. So, I tugged on Dave's coat and asked, "What's going on here? What kind of doors are these?"

On this project, the architect specified insulated flat slat coil doors with a lintel brush seal that pressed firmly up against the door when closed. With a gasket at the base and gaskets up the vertical rails, these doors claimed that they were compliant with the air leakage requirements of ASHRAE 90.1 and IECC 2018 Sec. C402.5.2, and much to my delight they were just that.



This building–a metal building system with rigid insulation panels on the roof and walls–had a surface area of 79,810 square feet with an allowable leakage of 31,924 CFM based on the acceptance criteria of 0.40 cfm/ft2 at a test pressure of 0.30 inches of water gauge (2.0 L/s at 75 Pa). This building was tested using the NEBB version of the ASTM E779 linear regression test, and tested in both directions. The initial baseline test showed an average leakage of 12,055 CFM at a test pressure of 75 Pa. This equated to a leakage rate of 0.15 which is good enough to pass the more stringent leakage rate of 0.25 that went into effect under the 2018 Washington energy code.

With the baseline test completed, we sealed up all the overhead doors and retested the building. With the overhead doors sealed, the building leakage fell to 8,259 CFM at a test pressure of 75 Pa, bringing the leakage rate down to 0.10 cfm/ft^2. This test indicated that the overhead doors contributed 3,796 CFM (31%) to the overall leakage of the building. With roughly 1,508 square feet of overhead doors on this project, this equated to 2.5 cfm/ft^2.



The next step was to unseal the large coil door and retest. With the large coil door unsealed, the building leakage came in at 10,490 CFM at a test pressure of 75 Pa. This indicated that at this test pressure the large coil door contributed 2,231 CFM (18.5%) of the overall leakage during the baseline test, equating to 3.38 cfm/ft^2.

Following this test, we unsealed the smaller coil door and retested the building. With both coil doors unsealed, the building leakage came in at 10,920 CFM at a test pressure of 75 Pa, indicating that both coil doors contributed 2,661 CFM (22%) to the overall leakage of the building. The smaller coil door contributed 430 CFM (3.5%) to the overall leakage of the building, which equates to 6.7 cfm/ft^2.

With these tests behind us, we determined that the net of leakage for the sectional doors came in at 1,135 CFM, representing 9% of the overall leakage of the building, or 1.45 cfm/ft^2.

The sectional doors came in much better than the coil doors. We knew that would be the case going into this test, as sectional doors have far less gaps than the dozens of slats that make up the coil doors. They can also easily be sealed along all four sides when closed. But these coil doors performed very well.

Bear in mind that this is a field test subject to uncontrollable factors–one being the installation of the individual doors. The larger door performed better in terms of leakage per square foot. However, both doors performed much better than a standard coil door that is not designed with air leakage in mind. Given the leakage differences between both coil doors, one might conclude that most of the leakage occurs around the perimeter of the door. The perimeter of the small coil door is a much greater percentage of its area (32/64 = 50%) compared to the big coil door (104/660 = 16%). Regardless of the reason, unforeseen variables exist in the field and are revealed during testing.

With the Washington state energy code requiring buildings to pass a minimum leakage rate going forward, I had a lot of concerns about using coil doors on any building until testing this project. And I have learned that not all doors are the same. I'm delighted to see that manufacturers are seriously taking to heart energy conservation in the design of the exterior components of our buildings and strive to meet higher energy efficiency standards.

Is your state or local jurisdiction considering adopting a building enclosure testing requirement? If so, carefully considering what type of doors you select in your design can make all the difference in passing or failing. ●