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TOOLS & TECHNIQUES

Testing of Air Barrier Systems

Air leakage through the building envelope can lead to problems; an air barrier system is required to control it. The system should be assembled from airtight materials, either those that make up the fabric of the building or materials that have been added specifically to improve airtightness, combined using leak-free joints.

To provide long-term control of air leakage, the system must also be capable of withstanding the forces produced by air pressure differences, especially wind loading, across the building envelope.

Both air leakage control and structural performance must, therefore, be assessed in any evaluation of the performance of air barrier systems.

IRC has developed a laboratory test procedure for evaluating air barrier systems for low-rise buildings. The apparatus (see photo) accepts a 2.44 m × 2.44 m test specimen and conforms, in general, to the apparatus specified in ASTM test procedures for air leakage (ASTM E 283) and structural performance (ASTM E 330).

Air leakage is measured at pressure differences between 10 Pa and 100 Pa, a range of pressures that is typical for low wind or calm conditions.

Structural performance is assessed in two stages. Sustained wind loading is simulated by subjecting the specimen to three pressure differences (250, 500 and 1000 Pa) for one hour each.

Gust wind loading is simulated by subjecting the specimen to three pressure differences (1500, 2000 and 2500 Pa) for 5 to 10 seconds each. These pressure differences are based on values and procedures documented in the Supplement to the National Building Code. Air leakage and structural performance are tested with both positive and negative pressure differences.

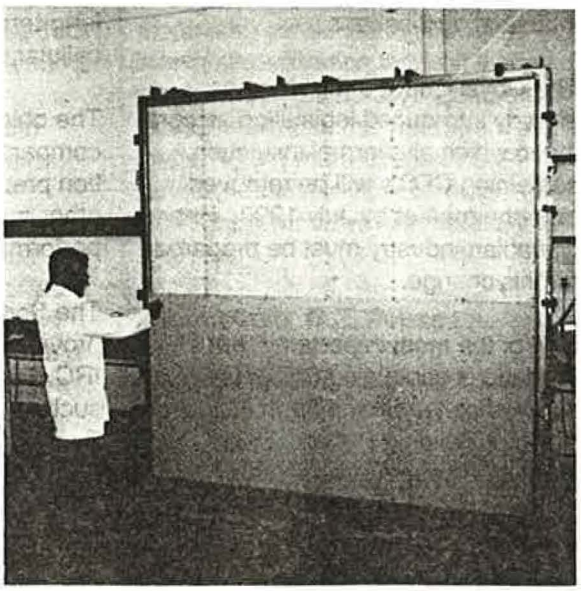
A flow–pressure equation is fitted to the data from the air leakage test and from the sustained load structural performance test. From this equation, the air flow rate at any pressure difference can be calculated. It can then be estimated whether or not this air flow rate is acceptable.

Following each structural performance test, the specimen is examined for structural damage, and the air flow rate is remeasured as a further check for changes to the system. From this information, it can be estimated whether or not the system can meet the structural performance requirements of the location at which it is to be installed.

The test procedure has been used to evaluate the performance of a number of air barrier systems for wood frame walls. Ten were evaluated under contract to Canada Mortgage and Housing Corporation and were documented in a report that is available from CMHC.

There are plans to extend the procedure to air barrier systems for non-residential construction and, further down the road, to the joints between air barrier system assemblies (e.g., between walls and windows). There are also plans to develop a procedure that will evaluate air barrier systems under non-isothermal conditions.

Information: W.C. Brown



Air barrier test apparatus