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Publisher's version / Version de l'éditeur:

<https://doi.org/10.4224/40001189>

Technical Note (National Research Council of Canada. Division of Building Research), 1962-02-01

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NATIONAL RESEARCH COUNCIL OF CANADA

DIVISION OF BUILDING RESEARCH

No.

363

TECHNICAL NOTE

NOT FOR PUBLICATION

FOR INTERNAL USE

PREPARED BY A. G. Wilson

CHECKED BY

APPROVED BY NBH

DATE February 1962

PREPARED FOR Record purposes

SUBJECT CURRENT PRACTICE IN EVALUATING FACTORY SEALED
DOUBLE GLAZING

Over the past five years the Division of Building Research has been conducting a laboratory program on the evaluation of factory sealed (hermetically sealed) double glazing units. The program was initiated at the request of Central Mortgage and Housing Corporation for assistance in establishing a basis for evaluating hermetically sealed units. The basic considerations involved and preliminary work are described in NRC 5270. Present studies have two principal objectives: to develop acceptable laboratory test methods and criteria for evaluation of the degree of sealing provided by hermetically sealed units and ability to maintain a seal during service life; and to provide manufacturers with information which can be used as a basis of acceptance by CMHC.

In the initial stages of the present laboratory program there was little or no information on how units would perform under the conditions of test and CMHC had no basis for establishing criteria. It was decided that manufacturers would not be asked to pay the costs of the tests but would only provide the required specimens. All manufacturers requesting CMHC acceptance up to July 1959 were required by the Corporation to submit the number of specimens required for the tests to the Division of Building Research. Results of tests on these units were passed to the Corporation as they become available and were used in establishing a basis of acceptance.

By July 1959 the usefulness of the tests had been established, and sufficient background information was available to allow the Corporation to establish tentative criteria. Manufacturers wishing to participate in the laboratory test program since that date have dealt directly with the National Research Council and are charged in accordance with a fixed schedule of fees. The results of these tests become the property of the manufacturer, who in turn submits the results to CMHC in applying for acceptance. In other words, the tests are carried out on behalf of the manufacturer on a commercial test basis.

The present test program involves three principal groups of tests, all of interest to CMHC in connection with their acceptance requirements. For these tests 18 specimens, each 14 in. by 20 in., are required. The selection of this size of unit is arbitrary and is discussed in NRC 5270. The tests involve the following:

- (1) Measurement of initial dew-point temperatures and deflection tests in a vacuum chamber on all 18 units, as received. The test procedures are covered in the attached standard test report outline. CMHC requires a dew-point not in excess of 30°F and no loss of deflection (evidence of leakage) in the vacuum chamber. The Corporation allows one failure in 18 specimens. NRC charges are \$5. per unit or a total of \$90. for 18 units.
- (2) Measurements of dew-point and vacuum chamber deflection on 12 units exposed to laboratory weather. These tests are carried out only on units which pass the initial tests. The laboratory weathering apparatus in use at present is described briefly in NRC 5270. One surface of units under test is exposed in the laboratory at 73°F and 50 per cent relative humidity, while the other surface is exposed to laboratory weathering cycle conditions.

This cycle consists of heating to 120°F for 1 hr 50 min, cooling to 110°F for 10 min, water spraying at 75°F for 5 min, draining at 75°F for 15 min, and cooling to -20°F for 1 hr 40 min, the total cycle time being 4 hours. Units are removed every two weeks (80 cycles) and are stored in the laboratory for two weeks before reinstallation in the laboratory weathering apparatus. Prior to reinstallation dew-point and vacuum chamber deflection measurements are made.

In the case of units received prior to July 31, 1959, laboratory weathering tests have generally been continued until dew-point temperatures have risen above 30°F. In subsequent tests being carried out directly for manufacturers, laboratory weathering tests have been terminated after 320 cycles, since at present CMHC requires a dew-point not in excess of 30°F following this number of cycles. The Corporation allows one failure in the 12 units under test on this basis. NRC charge for the laboratory weathering tests at the rate of \$150. for each 2-week period on 12 units. The minimum charge is that for a 2-week period on six units or \$75.

The units are installed in the laboratory weathering apparatus without glazing compound so that the edges are exposed to weathering conditions. They are mounted so that no stress is induced in the units by the method of fastening.

- (3) Exposure of 6 specimens outdoors to actual weather conditions. In these measurements the units are mounted in a vertical position on a plywood support, facing south with the edges unprotected as in the laboratory weather apparatus. There is a space of 3/4 in. between the units and the plywood and no stress is induced by the mounting arrangement. This test provides exposure to ultra violet radiation, which is not included in the laboratory weathering. Stressing of the seal is induced by the temperature fluctuations from normal weather conditions. The units are brought into the laboratory every 6 months for dew-point and vacuum chamber deflection measurements. The results of the outdoor tests are compared with those of laboratory weathering.

No charges are made for these outdoor weathering tests, since they are of a long term nature and are intended to assist in the further development of criteria for the laboratory weathering apparatus as well as to provide information on the performance of the units. CMHC requires the results of these tests for their acceptance purposes, although they have not as yet developed specific criteria.

It has not been possible to deal immediately with all of the units submitted for tests in the laboratory weathering apparatus. Four 4-week periods (approximately 4 months) are required to complete 320 aging cycles on any one specimen, assuming that the unit does not fail at less than 320 cycles.

The apparatus available at present accommodates 24 specimens, so that during this period it would be possible to complete the test on 12 specimens for four manufacturers. Since 24 manufacturers were involved in the first test series (prior to July 31, 1959) and since there has been a continuing demand for space on the apparatus there is a problem of scheduling the tests so as to be fair to all. Two units only from each manufacturer are therefore selected for laboratory weathering tests at any one time. These are installed during alternate 2-week periods.

Some of these units have failed in the laboratory weathering apparatus at less than 80 cycles, while others have been exposed to more than 1000 cycles without failure. All but one set of units have shown some rise in dew-point within 1000 cycles. Altogether about 43 makes of units have passed the initial dew-point and vacuum chamber tests and about 20 have failed the laboratory weathering tests to date. A number of units received prior to July 31, 1959 are still involved in the laboratory weathering program.

CMHC is, of course, entirely responsible for decisions with regard to acceptance under the terms of the National Housing Act. To this date provisional acceptances have been issued on the basis of the results of the initial dew-point and vacuum chamber deflection tests. These acceptances have subsequently been withdrawn if more than two units fail on the laboratory weathering test. The Corporation now intends to require successful results for the laboratory weathering test on at least two of the 12 specimens before issuing provisional acceptance and to withdraw acceptance if and when further testing shows more than one failure. Any manufacturer wishing to obtain CMHC acceptance should contact the Corporation to determine the details of the current requirements prior to arranging for tests with NRC.

Because of the limited number of units that can be accommodated in the laboratory weathering apparatus, consideration is being given to the construction of a simpler temperature cycling chamber, which would accommodate a large number of units. All units would be tested following the initial dew-point and vacuum chamber deflection tests. Only those that successfully withstood conditions in the temperature cycling chamber would then be tested on the laboratory weathering apparatus.

Recent reports on the work of the Norwegian Building Research Institute on hermetically sealed glazing units indicate that the Norwegians have been using a relatively small number of temperature cycles, but with a very large

number of fluctuating pressure cycles to represent wind pressure fluctuations. Failures in their test appear to be due mainly to the latter. It is not at all clear whether stresses due to wind pressure are a major cause of leakage failures in most Canadian climates, but it is hoped to provide some information on the effect of wind pressures on sealing and on glazing compound performance in future work. It is also intended to extend the Division's studies to include the development of information on the performance of larger units, both glazed and unglazed, in the laboratory weathering apparatus.