THE CALCULATION OF HOUSE INFILTRATION RATES

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INTRODUCTION

The ASHRAE crack and air change methods (1) for estimating infiltration heating load are probably adequate for sizing of heating systems, but are not suitable for carrying out hourly energy analysis of buildings. As the infiltration load is a significant component of the overall heating load, there is a need for a method that is easy to use, but takes into account all of the significant factors that determine the rates of air infiltration.

During 1960-1962, DBR/NRC conducted air leakage measurements on two single-story houses (2) built during the nineteen fifties using the tracer gas technique. It was followed several years later in 1967-1968 by the measurement of the air leakage characteristics of their enclosures using the house pressurization technique (3). The results of these tests on the two houses were used to develop a procedure for calculating infiltration rates similar to the one recently developed for high-rise buildings (4). Also, research needs were identified so that the calculation procedure can be applied to houses of different design, construction and wind exposure.

A computer model (not the subject of this paper) for houses with oil furnaces was also developed by DBR/NRC which complement this study (5).

TEST DATA ON THE TWO HOUSES

The description of the two houses, both 5-room bungalows located in the residential area of Ottawa, are given in Table 1 and Fig. 1 and 2 (the house numbers are the same as those in Ref 2 and 3 except for House No. 2 which is designated as House No. 3 in Ref 3). There are single-story houses adjacent to the two test houses except for the one side wall of House No. 1 which faces a wooded region.

Tracer Gas Test

The infiltration rates were measured using the tracer gas technique with helium as the tracer gas. It was injected into the supply air duct of the warm air system and the decay in its concentration was measured in the return air duct with an NBS type of katharometer (6). The results of the tests are reproduced in Tables 2 and 3.

In addition to the tracer gas test, pressure differences across the outside walls were measured with pressure taps located in each wall of the test houses. They indicated that the pressure differences across the windward wall facing the backyard for both houses were about 50% of the velocity head of the on-site wind measured 7.6 m (25 ft) above ground. Also, the pressure differences across the exterior walls measured during calm periods in winter indicated that the neutral pressure levels were located 0.25 m (10 in.) above the ceiling of House No. 1 and 0.41 m (1 ft 4 in.) below the ceiling of House No. 2.

Measurements of CO_2 concentration in the flue gas with the furnace operating indicated that the flow rates up the chimney, including that of the diluent air through the barometric damper,

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