

TABLE 2. INFILTRATION THROUGH WINDOWS
Expressed in Cubic Feet per Foot of Crack per Hour

TYPE OF WINDOW	REMARKS	WIND VELOCITY, MILES PER HOUR					
		5	10	15	20	25	30
Double-Hung Wood Sash Windows (Unlocked)	Around frame in masonry wall—not calked ^b	3.3	8.2	14.0	20.2	27.2	34.6
	Around frame in masonry wall—calked ^b	0.5	1.5	2.6	3.8	4.8	5.8
	Around frame in wood frame construction ^b	2.2	6.2	10.8	16.6	23.0	30.3
	Total for average window, non-weatherstripped, $\frac{1}{8}$ -in. crack and $\frac{1}{4}$ -in. clearance ^c . Includes wood frame leakage ^d	6.6	21.4	39.3	59.3	80.0	103.7
	Ditto, weatherstripped ^d	4.3	15.5	23.6	35.5	48.6	63.4
	Total for poorly fitted window, non-weatherstripped, $\frac{1}{8}$ -in. crack and $\frac{1}{4}$ -in. clearance ^c . Includes wood frame leakage ^d	26.9	69.0	110.5	153.9	199.2	249.4
	Ditto, weatherstripped ^d	5.9	18.9	34.1	51.4	70.5	91.5
Double-Hung Metal Windows ^f	Non-weatherstripped, locked	20	45	70	96	125	154
	Non-weatherstripped, unlocked	20	47	74	104	137	170
	Weatherstripped, unlocked	6	19	32	46	60	76
Rolled Section Steel Sash Windows ^k	Industrial pivoted, $\frac{1}{4}$ -in. crack	52	108	176	244	304	372
	Architectural projected, $\frac{1}{4}$ -in. crack ^h	15	36	62	86	112	139
	Architectural projected, $\frac{1}{4}$ -in. crack ^h	20	52	88	116	152	182
	Residential casement, $\frac{1}{4}$ -in. crack ⁱ	6	18	33	47	60	74
	Residential casement, $\frac{1}{4}$ -in. crack ⁱ	14	32	52	76	100	128
	Heavy casement section, projected, $\frac{1}{4}$ -in. crack ^j	3	10	18	26	36	48
	Heavy casement section, projected $\frac{1}{4}$ -in. crack ^j	8	24	38	54	72	92
Hollow Metal, vertically pivoted window ^f		30	88	145	186	221	242

^aThe values given in this table are 20 per cent less than test values to allow for building up of pressure in rooms, and are based on test data reported in the papers listed at the end of this chapter.

^bThe values given for frame leakage are per foot of sash perimeter as determined for double-hung wood windows. Some of the frame leakage in masonry walls originates in the brick wall itself and cannot be prevented by calking. For the additional reason that calking is not done perfectly and deteriorates with time, it is considered advisable to choose the masonry frame leakage values for calked frames as the average determined by the calked and not-calked tests.

^cThe fit of the average double-hung wood window was determined as $\frac{1}{8}$ -in. crack and $\frac{1}{4}$ -in. clearance by measurements on approximately 600 windows under heating season conditions.

^dThe values given are the totals for the window opening per foot of sash perimeter and include frame leakage and so-called *elsewhere* leakage. The frame leakage values included are for wood frame construction but apply as well to masonry construction assuming a 50 per cent efficiency of frame calking.

^eA $\frac{1}{4}$ -in. crack and clearance represents a poorly fitted window, much poorer than average.

^fWindows tested in place in building.

^gIndustrial pivoted window generally used in industrial buildings. Ventilators horizontally pivoted at center or slightly above, lower part swinging out.

^hArchitectural projected made of same sections as industrial pivoted except that outside framing member is heavier, and refinements in weathering and hardware. Used in semi-monumental buildings such as schools. Ventilators swing in or out and are balanced on side arms. $\frac{1}{4}$ -in. crack is obtainable in the best practice of manufacture and installation. $\frac{1}{4}$ -in. crack considered to represent average practice.

ⁱOf same design and section shapes as so-called *heavy section casement* but of lighter weight. $\frac{1}{4}$ -in. crack is obtainable in the best practice of manufacture and installation, $\frac{1}{4}$ -in. crack considered to represent average practice.

^jMade of heavy sections. Ventilators swing in or out and stay set at any degree of opening. $\frac{1}{4}$ -in. crack is obtainable in the best practice of manufacture and installation, $\frac{1}{4}$ -in. crack considered to represent average practice.

^kWith reasonable care in installation, leakage at contacts where windows are attached to steel framework and at mullions is negligible. With $\frac{1}{4}$ -in. crack, representing poor installation, leakage at contact with steel framework is about one-third, and at mullions about one-sixth of that given for industrial pivoted windows in the table.

sash are applied to well fitted windows, very little reduction in infiltration is secured, but the application of the sash does give an air space which reduces the heat transmission and helps prevent the frosting of the windows. When storm sash are applied to poorly fitted windows, a reduction in leakage of 50 per cent may be secured.

DOOR LEAKAGE

Doors vary greatly in fit because of their large size and tendency to warp. For a well fitted door, the leakage values for a poorly fitted double-hung wood window may be used. If poorly fitted, twice this figure should be used. If weatherstripped, the values may be reduced one-half. A single door which is frequently opened, such as might be found in a store, should have a value applied which is three times that for a well fitted door. This extra allowance is for opening and closing losses and is kept from being greater by the fact that doors are not used as much in the coldest and windiest weather.

In the case of infiltration through swinging and revolving doors engineers are not in full agreement at the present time regarding the allowances for cooling load determinations. Some references to recently published data are given at the end of this chapter.

SELECTION OF WIND VELOCITY

Although all authorities do not agree upon the value of the wind velocity that should be chosen for any given locality, it is common engineering practice to use the average wind velocity during the three coldest months of the year. Until this point is definitely established the practice of using average values will be followed. Average wind velocities for the months of December, January and February for various cities in the United States and Canada are given in Table 2, Chapter 7.

In considering both the transmission and infiltration losses, the more exact procedure would be to select the outside temperature and the wind velocity corresponding thereto, based on Weather Bureau records, which would result in the maximum heat demand. Since the proportion of transmission and infiltration losses varies with the construction and is different for every building, the proper combination of temperature and wind velocity to be selected would be different for every type of building, even in the same locality. Furthermore, such a procedure would necessitate a laborious cut-and-try process in every case in order to determine the worst combination of conditions for the building under consideration. It would also be necessary to consider heat lag due to heat capacity in the case of heavy masonry walls, and other factors, to arrive at the most accurate solution of the problem. Although heat capacity should be considered wherever possible, it is seldom possible to accurately determine the worst combination of outside temperature and wind velocity for a given building and locality. The usual procedure, as already explained, is to select an outside temperature based on the lowest on record and the average wind velocity during the months of December, January and February.

The direction of prevailing winds may usually be included within an