

until some later time when it finally appears in the air-stream entering the equipment. While it is true that some lag also is inherent in convective heat transfer and the time required to change the air in the conditioned space, this is usually of the order of a few minutes to perhaps half an hour. Heat storage in the interior furnishings and structure increases according to the proportion of the instantaneous heat gain which is in the form of radiation, and also as the thermal capacitance of the objects and materials involved is increased.

Constituents of the total instantaneous heat gain which have appreciable radiation components include those due to: glass areas, exposed walls and roofs, lighting, appliances, and people.

No comprehensive data are presently available for use in design load estimates to evaluate the interior load-lag effect. Hence, practical judgment and experience offer the only basis of procedure. Until the needed data become available, it is recommended that the non-continuous load be averaged over two or three hours previous to the time of maximum load, when determining the total instantaneous cooling load where a large portion of the heat gain is radiant. This suggestion applies only to conditions near the time of maximum heat gain, as the heat stored within the structure would necessarily appear in the cooling load eventually, but if it appears at a time when the gain from outside is relatively low the equipment will be able to maintain satisfactory conditions within the range of maximum capacity.

LOAD FROM INTERIOR PARTITIONS, CEILINGS, AND FLOORS

Whenever a conditioned space is adjacent to another space in which a different temperature prevails, the transfer of heat through the separating structural section must be considered. Calculations are made according to the relation

$$q = U_i A_i (t_x - t_i) \text{ Btu per hour.} \quad (14)$$

where U_i = Coefficient of over-all heat transfer between the adjacent and the conditioned space, Btu per (hour) (square foot) (Fahrenheit degree).

A_i = Area of separating section concerned, square feet.

t_x = Air temperature in adjacent space, Fahrenheit degrees.

t_i = Air temperature in conditioned space, Fahrenheit degrees.

Magnitudes of U_i may be obtained from Chapter 6. The temperature t_x may have any value over a considerable range, according to conditions in the adjacent space. Where nothing is known except that the adjacent space is of conventional construction and contains no heat sources, it is recommended that the difference $(t_x - t_i)$ be taken as the difference between the outdoor-air and conditioned-space design dry-bulb temperatures minus 5 Fahrenheit degrees. In some cases it may be that the air temperature in the adjacent space will correspond closely to the outdoor air temperature at all times. Under these latter conditions, the heat gain through the partition will be periodic in nature and the value of $(t_p - t_i)$ for Equation 9 should be used as for a shaded wall.

For floors directly in contact with the ground, or over an underground basement that is neither ventilated nor warmed, the heat transfer may be neglected for cooling-load estimates.

LOAD FROM OUTSIDE AIR - VENTILATION AND INFILTRATION

Ventilation. Data for determining the necessary ventilation rate have been presented previously in this chapter. Total requirements should

TABLE 21. INFILTRATION THROUGH 72-INCH REVOLVING DOOR AND 36-INCH SWINGING DOOR^{a,b,c}
(Cubic Feet per Person per Passage)

USAGE	FREELY-REVOLVING DOOR	DOOR EQUIPPED WITH BRAKE
Infrequent.....	75	60
Average.....	60	50
Heavy.....	40	40
36-Inch Swinging Door.....	100	

^aThese figures are based on the assumption that there is no wind pressure and that swinging doors are in use in one wall only. Any swinging doors in other walls should be kept closed to insure air conditioning in accordance with these recommended standards.

^bFor summer cooling, use Table 2 to calculate the requirements for both ventilation and infiltration, and use the larger quantity. The quantity of air should be not less than that required by local ordinance, nor less than that drawn from the space by any exhaust fans which may be used. For normal ceiling heights, the quantity of outside air supplied should be not less than one air change per hour.

^cFrom Application Engineering Standards for Air Conditioning for Comfort. Air Conditioning & Refrigerating Machinery Association, Inc., Washington, D. C. Used by permission.

be checked against the volume of the conditioned space, and in no case should the ventilation air rate be less than one air change per hour.

Infiltration. The principles of infiltration calculations have been discussed in Chapter 8, with emphasis on the heating season. For the cooling season, infiltration calculations are limited to doors and windows.

To compute cooling-load infiltration for windows, use the data of Table 2, Chapter 8, for a wind velocity of 10 mph. Note that for double-hung windows the length of crack is three times the width plus twice the height; while for metal-sash windows the crack length is the total perimeter of the movable or ventilating sections. In calculating window infiltration for an entire structure, it is not necessary to consider the total crack length on all sides of the building, for the wind would not act simultaneously on all sides at once. In no case, however, should less than half of the total crack length be figured. Consideration of the prevailing wind direction will aid judgment in this question.

Cooling-load infiltration for doors may be obtained from Table 21, shown above¹⁴. For conditions other than those covered, the notes appended to Table 21 will provide a basis for estimates. The tabulated data may also be used as the basis of estimates for interior doors between an air-conditioned and a non-air-conditioned space.

Infiltration load must be included whenever the new air introduced through the system is not sufficient to maintain excess pressure within the enclosure to overcome the infiltration. Whenever economically feasible it is desirable to introduce sufficient outdoor air through the air-conditioning equipment to maintain a constant outward escape of air and thus eliminate the infiltration portion of the load. The pressure maintained must, of course, be sufficient to overcome wind pressure through cracks and door openings. When this condition prevails it is not necessary to include any infiltration load.

Total Outside Air Load. To determine the design cooling load caused by the introduction of outside air, the maximum rate of outside-air entry is first established. In some applications the use of special exhausters from the conditioned space may add to the outdoor-air requirements in determining the maximum rate. Once this design quantity is established, and with the design indoor and outdoor air states known, the cooling load may be computed. There are several methods in use, the more accurate