HPAC data sheet

Nomograph estimates air infiltration, heat removal

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The nomograph on the following page estimates air infiltration due to wind and the amount of heat removed by any quantity of heated air. It supplements the September HPAC Data Sheet on air infiltration into buildings due to temperature differences (stack effect).

The following equation can be used to calculate the amount of infiltration caused by wind:*

$$Q = EAV \quad (1)$$

where

Q = air flow, cfm
E = effectiveness of openings (0.50 to 0.60 for perpendicular winds and 0.25 to 0.35 for diagonal winds)
A = free (open) area of inlet openings, sq ft (do not consider more than two building sides)
V = average wind velocity, fpm

Actual flow rates depend on the location of inlets and outlets and therefore may be greater or less than the values given in the formula. Inlets should directly face the prevailing wind, and outlets should be placed at one of the following building locations: 1) the side directly opposite the prevailing wind, 2) the side adjacent to windward face where low pressure areas occur, 3) in a monitor on the side opposite the wind, and 4) roof ventilators or stacks.

Wind velocity data for locations in the United States and Canada may be obtained from Table I, Chapter 33, of the reference for Equation 1.

The amount of heat removed by air heated to a desired temperature difference is:

$$H = Q \times C_p \times \rho \times 60 \times \Delta t \quad (2)$$

where

H = heat removed, Btuh
C_p = specific heat of air at constant pressure, Btu per lb
ρ = density of air, lb per cu ft
Δt = temperature difference between indoor and outdoor air, F

For standard air, ρ is equal to 0.075 and C_p is equal to 0.24. Equation 2 then becomes:

$$H = 1.08 \times Q \times \Delta t \quad (2a)$$

The nomograph on the following page quickly solves Equations 1 and 2a.

Example 1

How much air will enter a building through 100 sq ft of openings if the average wind velocity is 2.5 mph, and the wind is blowing perpendicular to the walls?

Solution: Draw a line from 2.5 on the V scale to 0.55 on the E scale and read the answer as 121 cfm per sq ft or a total air flow of 12,100 cfm at the point of intersection on the Q/A scale.

Example 2

How much heat is removed by heating 12,100 cfm of air 70 F?

Solution: Extend a line from 12,100 on the Q/A scale to 70 on the Δt scale and read the answer as 910,000 Btuh at the point of intersection on the H scale. (Both the Q/A and H scales may be simultaneously multiplied by 10, 100, etc.)

**ASHRAE Handbook of Fundamentals*, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York, N.Y., 1972, p. 344.

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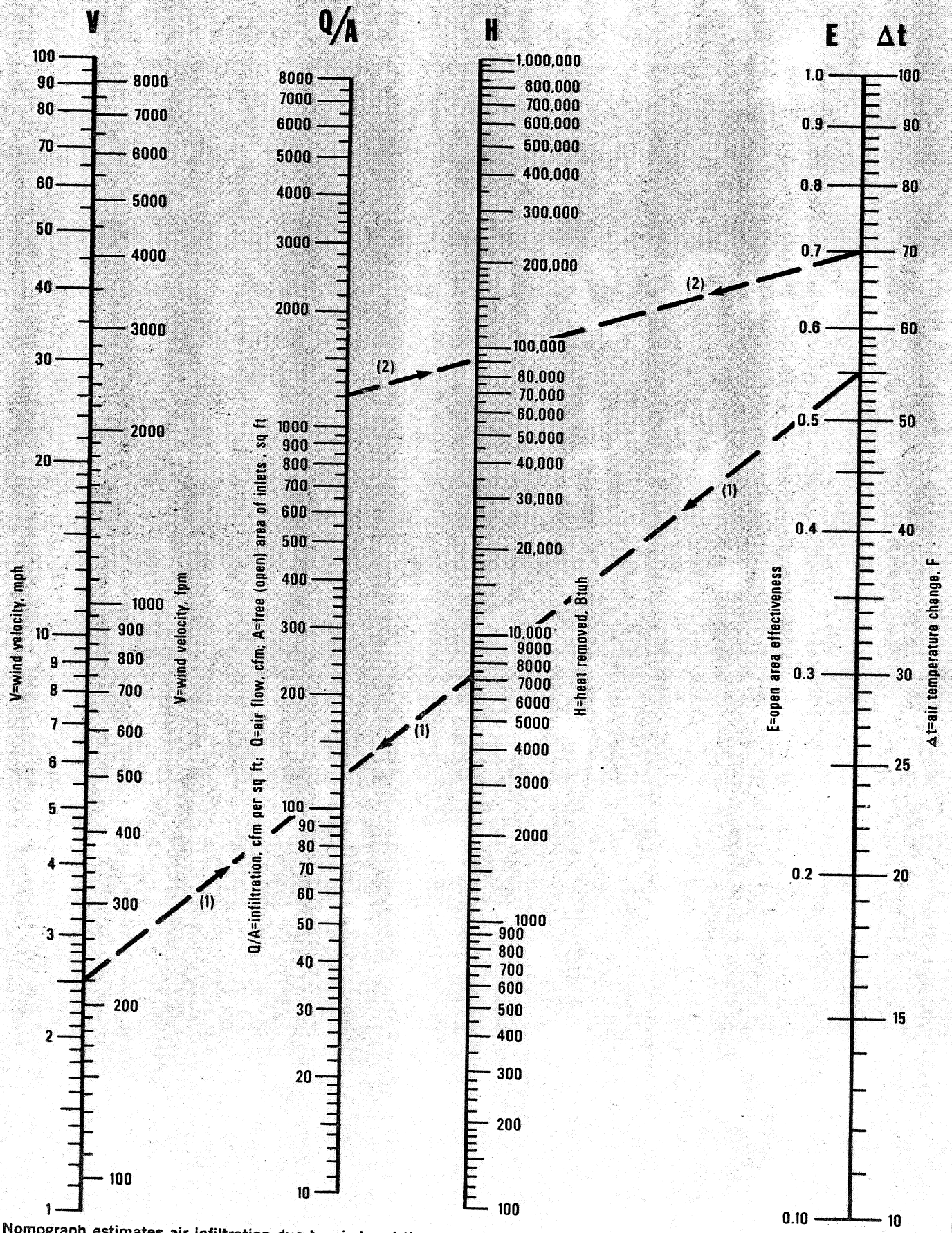

Nomograph estimates air infiltration due to wind and the amount of heat removed by any quantity of heated air. Numbers on broken lines refer to example problems in text. Range of nomograph may be increased by simultaneously multiplying by 10, 100, etc., the Q/A and H scales.