openings are kept to a minimum size and are placed away from the natural path of the contaminant travel wherever possible. Inspection and maintenance openings are provided with doors whenever practicable.

Capture Velocities and Air Volume Exhausted

Only after the hood design has been determined can exhaust volume requirements be calculated. With enclosures, volumes are calculated from the known open area of the hood and the selection of the capture or indraft velocity sufficient to prevent outward escapement. Where enclosure of the process is impracticable, the air flow pattern in front of the hood must be such that selected capture velocities will be maintained in the area of generation, conveying the contaminant to the hood opening.

Usual capture velocities for typical operations are listed in Table 1 and

Table 1. Minimum Air Velocities Required at Point of Origin to Capture Contaminant Effectively

Condition of Generation of Contaminant	Minimum Capture Velocity, FPM	Process
Released without noticeable movement	50–100	Evaporation of vapors, exhaust from pickling, washing, degreasing, plating, welding, etc.
Released with low velocity	100–200	Paint spraying in booth; inspection, sorting, weighing, packaging, low speed (less than 200 fpm) conveyor transfer points, blending, mixing, barrel filling.
Active generation	200–500	Foundry shakeout, high speed (over 200 fpm) conveyor transfer points, crushers, screens.
Released with great force	500–2000	Grinding, tumbling mills, abrasive cleaning.

refer in the case of remote hoods to the air movement required at the zone of air contaminant generation. Required capture velocities for any operation will vary with the magnitude of the air volume handled, with uncontrolled air movement in the area, and oftentimes with the location of the process or operation and size of the workroom. Larger remote hoods exhausting large air volumes will provide effective control at lower maintained capture velocities than in the case of small remote hoods handling lower exhaust volumes. A hood at one end of a small narrow room with air supply at opposite end will provide control with lower capture velocities than that required from the same hood in a large room where no perceptible air flow will be obtained except in the immediate area of the hood.

The method for determining, approximately, the quantity of air that must be exhausted from an unobstructed hood, without flanges, to produce these capture velocities at the point of origin, is given in Equation 1:

$$Q = V(10X^2 + A) \tag{1}$$

where

Q = quantity of air exhausted, cubic feet per minute.
V = air velocity in feet per minute at X distance in feet from the hood and on the centerline of the hood.
X = distance in feet, along the hood centerline, from the face of the hood to the point where the air velocity is V feet per minute.
A = area in square feet of the hood opening.

Fig. 1 shows lines of equal velocities (velocity contours) for a rectangular hood opening with a side ratio of one-half. The velocities are expressed as percentages of the velocity at the opening. Studies have established the principle of *similarity of contours* which states that the positions of the velocity contours for any hood (when the contours are expressed in terms of the average velocity at the hood opening) are purely functions of the shape of the hood. Extensive studies[2, 11, 12] have revealed variations in values of such velocity contours for long narrow slots and for hoods with one or more planes shielded against air flow.

For smaller hoods, flanges which are usually 3 to 6 in. wide surrounding the hood opening usually will improve the air flow in front of the hood

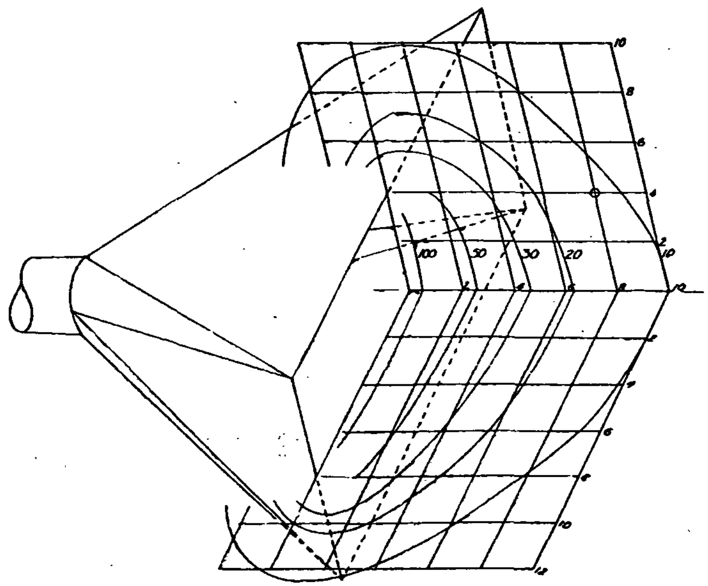

Fig. 1. Velocity Contours for Rectangular Opening with a Side Ratio of One-Half. Contours are Expressed as Percentages of the Velocity at the Opening

and will reduce the air volume required to provide desired capture velocity by as much as 25 percent.

Special Exhaust Requirements

It is important to note that certain operations may require exhaust volumes in excess of the quantities based on design data from Table 1 and Equation 1. Typical reasons for increased ventilation rates include:

1. Induced air flow caused from falling granular material in large quantities through considerable height, or from internal rotating parts like some types of crushers, knives, macerators.

2. Induced air flow caused by the thermal or stack effect from sources of extreme heat.