

Controlling Air Velocities

Exact determinations of hood control velocities are not available, but it is safe to assume that for most dusty operations velocities should not be less than 200 fpm at the point of origin. Recommended air velocities through hood openings for various processes are given in Table 5. For granite dust generated by pneumatic devices, velocities from 150 to 200 fpm, depending on the type of hood used, are recommended as sufficient for safe control⁵. Considering the character of the industry, air velocities of this order may be extended to similar dusty operations. The method for approximately determining these velocities in terms of the velocity at the hood opening is given in Equation 3.

No set rule can be given regarding the shape of a hood for a particular operation, but it is well to remember that its essential function is to create an adequate velocity distribution. The fact that the zone of greatest

TABLE 4. BRANCH PIPE SIZES FOR GRINDING AND BUFFING HOODS

TYPE OF WHEEL	WHEEL SIZE DIAMETER, IN.		MAXIMUM		BRANCH PIPE MINIMUM DIAMETER, IN.
	Min.	Max.	Width In.	Area Sq In.	
Grinding	9	9	1	30	3
	18	18	3	175	4
	24	24	4	300	5
	30	30	5	500	6
	30	36	6	700	7
Disc Grinding	20	20	----	300	4
	20	30	----	-----	5
Buffing, Polishing and Scratch Brushing	8	8	2	50	3½
	16	16	3	150	4
	24	24	4	300	5
	24	30	6	600	6

effectiveness does not extend laterally from the edges of the opening may frequently be utilized in estimating the size of hood required. Where complete enclosure of a dusty operation is contemplated, it is desirable to leave enough free space to equal the area of the connecting duct. Hoods for grinding, polishing and buffing should fit closely, but at the same time should provide an easy means for changing the wheels. It is advisable to design these hoods with a removable hopper at the base to capture the heavy dust and articles dropped by the operator. Such provisions are of assistance in keeping the ducts clear. Air volumes used to control many dust discharges may often be reduced by effective baffling or partial enclosure of an operation. This procedure is strongly urged where dusts are directed beyond the zone of influence of the hood.

Axial Velocity Formula for Hoods

When the normal flow of air into a hood is unobstructed, Equation 3 may be used to determine the air velocity at any point along the axis⁶:

⁵Control of the Silicosis Hazard in the Hard Rock Industries. I. A Laboratory Study of the Design of Dust Control Systems for Use with Pneumatic Granite Cutting Tools, by Theodore Hatch, Philip Drinker and Sarah P. Choate. (*Journal of Industrial Hygiene*, Vol. XII, No. 3, March, 1930).

⁶The Control of Industrial Dust, by J. M. DallaValle (*Mechanical Engineering*, Vol. 55, No. 10, October, 1933).

$$V = \frac{0.1 Q}{x^2 + 0.1 A} \quad (3)$$

where V = velocity at point, feet per minute.

Q = volume of air handled, cubic feet per minute.

x = distance along axis, feet.

A = area of opening, square feet.

Velocity Contours

It is possible by use of a specially constructed Pitot tube⁷ to map contours of equal velocity in any axial plane located in the field of influence. It has been found that the positions of these contours for any hood can be expressed as percentages of the velocity at the hood opening and are purely functions of the shape of the hood⁸.

Further, the velocity contours are identical for similar hood shapes when the hoods are reduced to the same basis of comparison. These facts are applicable to all hood problems so that when the velocity contour

TABLE 5. RECOMMENDED AIR VELOCITIES THROUGH OPENINGS IN HOODS ENCLOSING OPERATIONS OR LOCATED OVER ZONES OF GENERATION OF DUSTS, FUMES, VAPORS AND GASES RELEASED IN CERTAIN MANUFACTURING PROCESSES

CONDITION OF GENERATION OF CONTAMINANT	MINIMUM AIR 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, sort- ing, weighing, packaging, low speed conveyor transfer points, rotating mix- tures, barrel filling.
Active generation.....	200-500	Foundry shakeout, high speed conveyor transfer points, crushers, screens.
Released with great force....	500-2000	Grinding, tumbling mills, abrasive clean- ing.

distribution is known, the air flow required can be determined. Fig. 1 shows the contour distribution in two axial planes perpendicular to the sides of a rectangular hood with a side ratio of one-half. The distribution shown is identical for all openings with a similar side ratio provided the mapping is as shown in the figure. The contours, of course, are expressed as percentages of the velocity at the opening.

Low Velocity Systems

On multiple installations of the same operation it is often possible to institute a great saving in power cost by designing an exhaust system using low velocities in the main ducts. Such a system for use in grinding and shaping porcelain has been described⁹. In these operations, the separate machines are grouped around a central plenum chamber and exhausted by means of a low pressure fan connected to the plenum. In this case a power saving of over 90 per cent was obtained. A similar design technique¹⁰ has been described for use in ventilating plating tanks.

⁷Studies in the Design of Local Exhaust Hoods, by J. M. DallaValle and Theodore Hatch (*A.S.M.E. Transactions*, Vol. 54, 1932).

⁸Velocity Characteristics of Hoods under Suction, by J. M. DallaValle (*A.S.H.V.E. TRANSACTIONS*, Vol. 38, 1932, p. 387).

⁹Low Velocity Exhaust Systems, by Theodore Hatch (*Heating and Ventilating*, October, 1940, p. 27).

¹⁰Tank Ventilating Power Costs Cut by Low Velocity Systems, by William B. Harris (*Heating and Ventilating*, July, 1942, p. 42).