HOOD DESIGN DATA
TABLE 1
RANGE OF CAPTURE VELOCITIES

Condition of Dispersion of Contaminant	Examples	Capture Velocity, fpm
Released with practically no velocity into quiet air.	Evaporation from tanks, degreasing, etc.	50 - 100
Released at low velocity into moderately still air.	Spray booths; intermittent container filling; low speed conveyor transfers; welding; plating; pickling	100 - 200
Active generation into zone of rapid air motion.	Spray painting in shallow booths; barrel filling; conveyor loading; crushers	200 - 500
Released at high initial velocity into zone of very rapid air motion.	Grinding; abrasive blasting, tumbling	500 - 2000

In each category above, a range of capture velocity is shown. The proper choice of values depends on several factors:

Lower End of Range	Upper End of Range
1. Room air currents minimal or favorable to capture.	1. Disturbing room air currents.
2. Contaminants of low toxicity or of nuisance value only.	2. Contaminants of high toxicity.
3. Intermittent, low production.	3. High production, heavy use.
4. Large hood--large air mass in motion.	4. Small hood--local control only.

Hood Design Procedure

Effective control of a contaminant producing process is brought about by first eliminating or minimizing all air motion about the process and then capturing the contaminated air by causing it to flow into the exhaust hood. Flow toward the suction opening must be sufficiently high to maintain the necessary capture velocity and to overcome opposing air currents.

Elimination of sources of air motion as a first step in hood design is an important factor in cutting down the required air volume and the corresponding power consumption. Important sources of air motion are:

1. Thermal air currents, especially from hot processes or heat-generating operations.
2. Motion of machinery, as by a grinding wheel, belt conveyor, etc.
3. Material motion. as in dumping or container filling.
4. Movements of the operator.
5. Room air currents (which are usually taken at 50 fpm minimum and may be much higher).
6. Spot cooling and heating equipment.

The shape of the hood, its size, location and rate of air flow are important design considerations.

The hood should enclose the operation as much as possible. If enclosure is not practicable, the hood should be located as close as possible to the source and shaped to control the area of contamination.

Flanges should be used whenever possible to eliminate exhausting air from ineffective areas (see table 1) and also to decrease the hood entry loss.

Hood Entry Coefficient and Static Pressure

If by creating suction air enters an opening, a typical flow pattern results , see table 2. Maximum convergence of the air stream occurs at a short distance downstream at the plane of the vena contracta where the diameter of the jet is smaller than the diameter of the duct.

The formation of the vena contracta is accompanied by a conversion of static pressure to velocity pressure and from velocity pressure back to static pressure. A loss of about 2% in static pressure results from the conversion of static to velocity pressure and a much greater loss in static pressure results from the conversion of velocity pressure at the vena contracta to static pressure as the air fills the duct. The area of the air stream at the vena contracta will vary with the shape of the hood or duct opening and for most hood shapes will range from 70% to 100% of the duct area.

Minimum Design Duct Velocity

For systems handling particulate, a minimum design velocity is required to prevent settling and plugging of ductwork. On the other hand, excessively high velocities are wasteful of power and may cause rapid abrasion of ductwork. Minimum design velocities are higher than theoretical and experimental values to protect against various practical contingencies such as:

1. Plugging or closing one or more branch will reduce the total volume in the system and correspondingly will reduce the velocities in al least some sections of the duct system

2. Damage to ductwork, by denting for example, will increase the resistance and decrease the volume and velocity in the damaged leg of the system.

3. Leakage of ductwork will increase volume and velocity downstream of the leak but will decrease upstream and in other legs of the system.

4. Corrosion or erosion of the fan wheel or even slipping in a fan belt drive will reduce volumes and velocities.

5. Velocities must be adequate to pick up or re-entrain dust which may have settled due to the improper operation of the exhaust system.

The designer is cautioned that for some conditions such as sticky materials, condensing conditions in the presence of dust, strong electrostatic effects, etc., velocity alone may not be sufficient to prevent plugging and other special measures my be necessary.

Table 2. RANGE OF DESIGN VELOCITIES

Nature of Contaminant	Examples	Design Velocity
Vapors, gases, smoke	All vapors gases and smokes	Any desired velocity (economic optimum velocity usually 1000 - 1200 fpm)
Fumes	Zinc and aluminum oxide fumes	1400 - 2000
Very fine light dust	Cotton lint, wood flour, litho powder	2000 - 2500
Dry Dusts and Powders	Fine rubber dust, Bakelite molding powder dust, jute lint, cotton dust, shavings (light), soap dust, leather shavings	2500 - 3500
Average Industrial Dust	Sawdust (heavy and wet), grinding dust, buffing lint (dry), wool jute dust (shaker waste), coffee beans, shoe dust, granite dust, silica flour, general material handling, brick cutting, clay dust, foundry (general), limestone dust, packaging and weighing asbestos dust in textile industries.	3500 – 4,000
Heavy Dusts	Metal turnings, foundry tumbling barrels and shakeout, sand blast dust, wood blocks, hog waste, brass turnings, cast-iron boring dust, lead dust	4000 – 4,500
Heavy or Moist Dusts	Lead dust with small chips, moist cement dust, asbestos chunks from transite pipe cutting machines, buffing lint (sticky), quick-lime dust	4500 and up