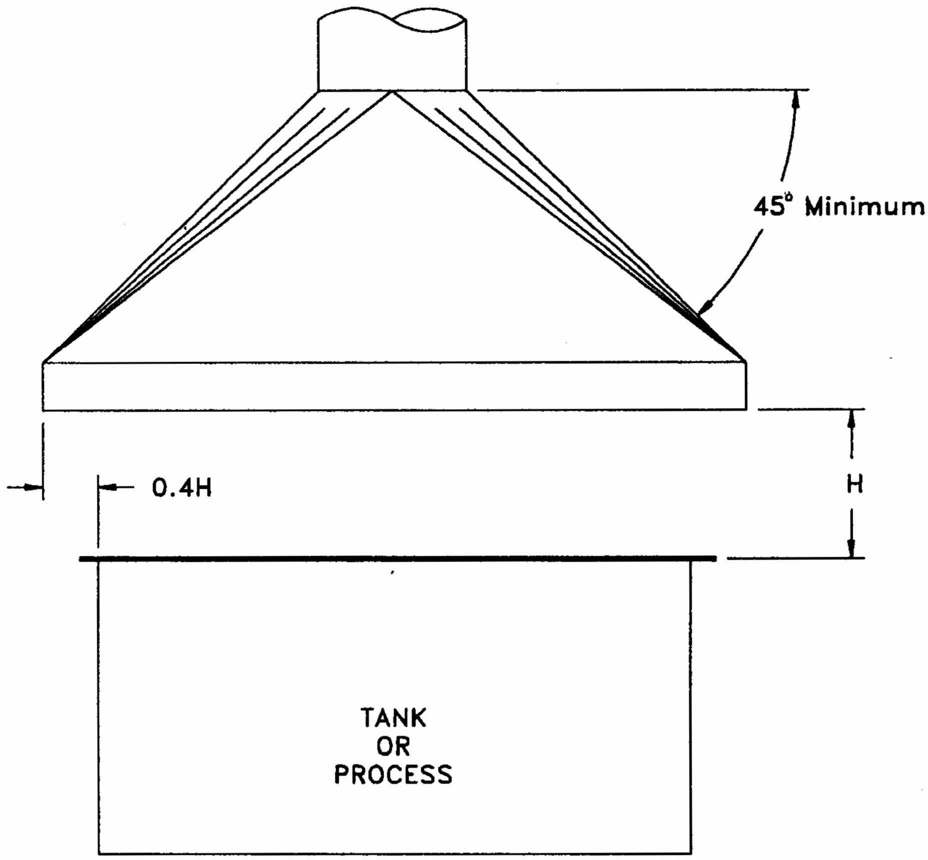


Not to be used where material is toxic and worker must bend over tank or process.
Side curtains are necessary when cross drafts are present.

Q = 1.4PHV	For open type canopy P = perimeter of tank, feet V = 50–500 fpm. See Chapter 3
Q = (W + L)HV	For two sides adjacent enclosed W & L are open sides of hood V = 50–500 fpm. See Chapter 3
Q = WHV or LHV	For three sides enclosed (booth) V = 50–500 fpm. See Chapter 3

$h_e = 0.25\ VP_d$
Duct velocity = 1000–3000 fpm

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	*CANOPY HOOD*		
	DATE 12-90	FIGURE VS-99-03	

tain control of the contaminant until it reaches the hood. External air motion may disturb the hood-induced air flow and require higher air flow rates to overcome the disturbing effects. Elimination of sources of external air motion is an important factor in achieving effective control without the need for excessive air flow and its associated cost. Important sources of air motion are

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

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

3.4.1 Capture Velocity: The minimum hood-induced air velocity necessary to capture and convey the contaminant into the hood is referred to as capture velocity. This velocity will be a result of the hood air flow rate and hood configuration.

Exceptionally high air flow hoods (example, large foundry side-draft shakeout hoods) may require less air flow than would be indicated by the capture velocity values recommended for small hoods. This phenomenon may be ascribed to:

- The presence of a large air mass moving into the hood.
- The fact that the contaminant is under the influence of the hood for a much longer time than is the case with small hoods.
- The fact that the large air flow rate affords considerable dilution as described above.

Table 3-1 offers capture velocity data. Additional information is found in Chapter 10.

3.4.2 Hood Flow Rate Determination: Within the bounds of flanges, baffles, adjacent walls, etc., air will move into an opening under suction from all directions. For an enclosure, the capture velocity at the enclosed opening(s) will be the exhaust flow rate divided by the opening area. The capture velocity at a given point in front of the exterior hood will be established by the hood air flow through the geometric surface which contains the point.

As an example, for a theoretical unbounded point suction

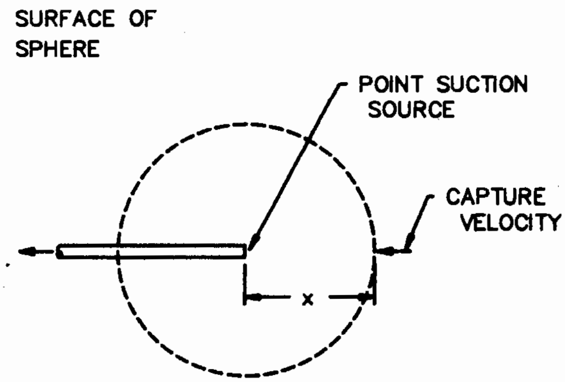


FIGURE 3–4 POINT SUCTION SOURCE

source, the point in question would be on the surface of a sphere whose center is the suction point (Figure 3-4).

The surface area of a sphere is $4\pi X^2$. Using $V = Q/A$ (Equation 1.3), the velocity at point X on the sphere's surface can be given by

$$Q = V(4\pi X^2) = 12.57VX^2 \qquad [3.1]$$

where:

Q = air flow into suction point, cfm

V = velocity at distance X, fpm

TABLE 3-1. Range of Capture Velocities[3.1,3.2]

Condition of Dispersion of Contaminant	Example	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 at very rapid air motion.	Grinding; abrasive blasting; tumbling	500–2000

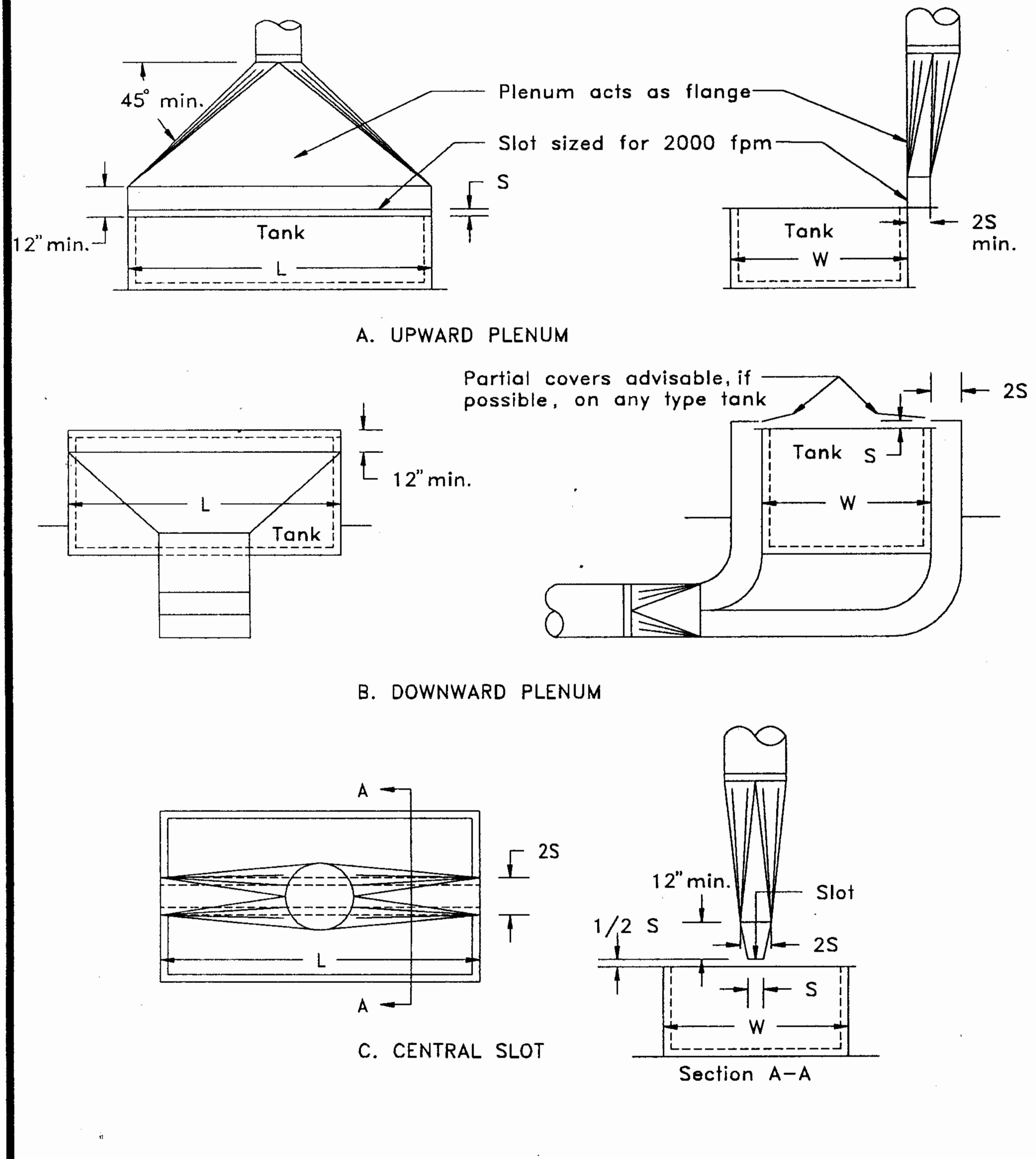
In each category above, a range of capture velocity is shown. The proper choice of values depends on several factors:

Lower End of Range

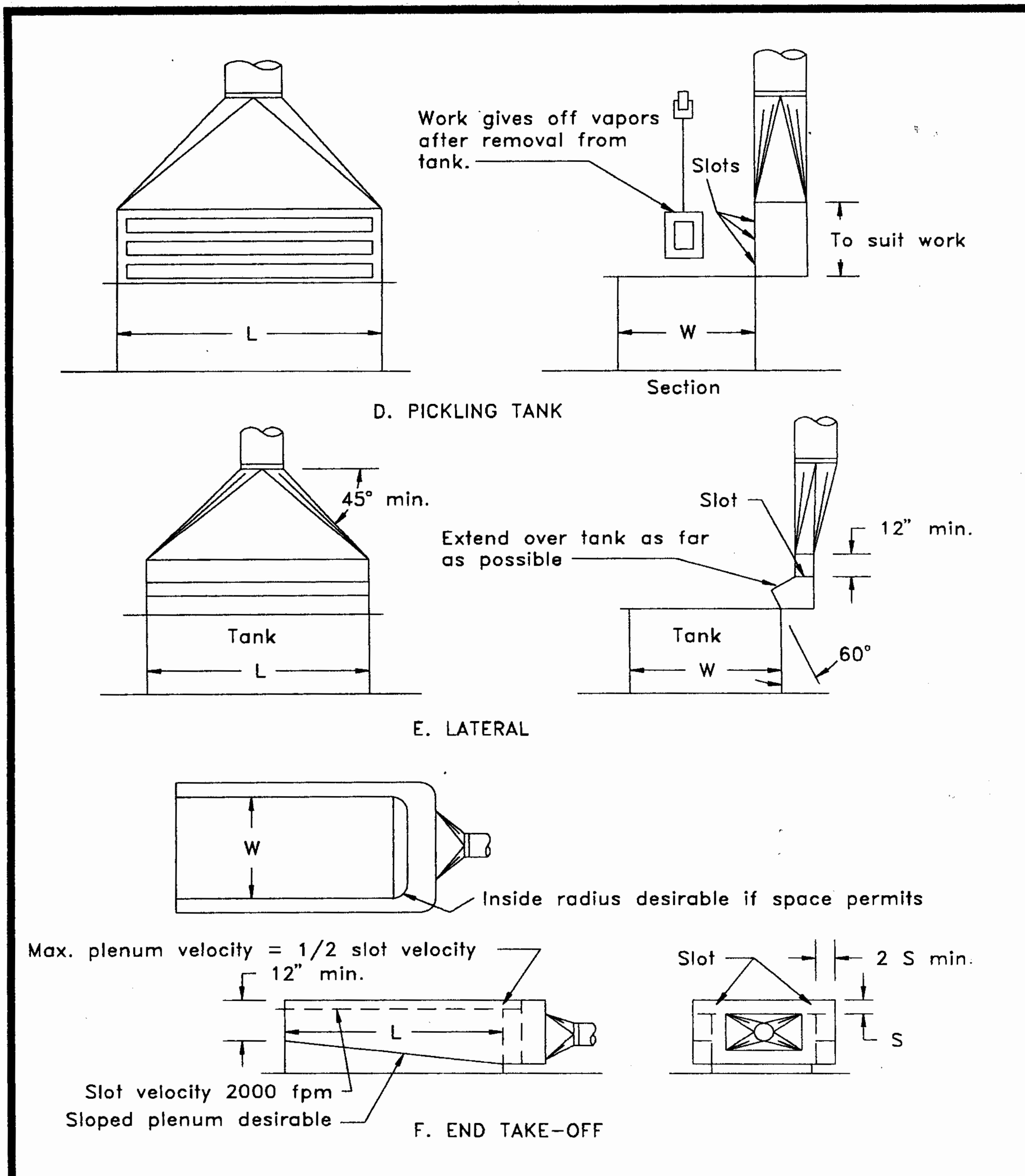
1. Room air currents minimal or favorable to capture.
2. Contaminants of low toxicity or of nuisance value only.
3. Intermittent, low production.
4. Large hood-large air mass in motion.

Upper End of Range

1. Disturbing room air currents.
2. Contaminants of high toxicity.
3. High production, heavy use.
4. Small hood-local control only.



AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	*OPEN SURFACE TANKS*
	DATE *12-90* FIGURE *VS-70-01*



AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS	*OPEN SURFACE TANKS*
DATE 12-90	FIGURE VS-70-02

1. Establish process class by determining hazard potential from Tables 10.70.1 and 10.70.2; information from Threshold Limit Values, Solvent Flash Point, Solvent Drying Time Tables in Appendices A and B; and from Tables 10.70.5–10.70.8.
2. Process class can also be established directly from Tables 10.70.5–10.70.8 if process parameters are known.
3. From Table 10.70.3, choose minimum control velocity according to hazard potential, evolution rate (process class), and hood design (see Table 10.70.5 for typical processes).
4. From Table 10.70.4, select the cfm/ft^2 for tank dimensions and tank location.
5. Multiply tank area by value obtained from Table 10.70.4 to calculate required air volume.

EXAMPLE

Given: Chrome Plating Tank 6′ × 2.5′
High production decorative chrome.
Free standing in room.
No cross-drafts.

a. Tank Hood. See VS-70-01. Use hood "A" long 6′ side. Hood acts as baffle.

b. Component — Chromic Acid.

Hazard potential: A (from Table 10.70.1; from Appendix A, TLV = 0.05 mg/m^3; from Appendix B, Flash point = Negligible)
Rate of Evolution: 1 (from Table 10.70.2; from Table 10.70.6, Gassing rate = *high)*
Control Velocity = 150 fpm (from Table 10.70.3)
Minimum Exhaust Rate = 225 cfm/ft^2 (from Table 10.70.4; Baffled tank, W/L = 0.42)
Minimum Exhaust Flow Rate = 225 × 15 = 3375 cfm

c. Hood Design

Design slot velocity = 2000 fpm
Slot area = Q/V = 3375 cfm/2000 fpm = 1.69 ft^2
Slot width = A/L = 1.69 ft^2/6 ft = 0.281 ft = 3.375 in.
Plenum depth = (2)(slot width) = (2)(3.375) = 6.75 in.
Duct area = Q/V = 3375 cfm/2500 fpm = 1.35 ft^2
Use 16″ duct, area = 1.396 ft^2
Final duct velocity = Q/A = 3375/1.396 = 2420 fpm
Hood Sp = Entry loss + Acceleration
= 1.78 VP_s + 0.25 VP_d + 1.0 VP_d (see Chapter 3)
= (1.78 × 0.25″) + (0.25 × 0.37″) + 0.37″
= 0.45 + 0.09 + 0.37
Hood SP = 0.91″

REFERENCES

10.70.1 D.J. Huebener and R.T. Hughes: "Development of Push–Pull Ventilation," *Am. Ind. Hyg. Assoc. J.* 46: 262–267 (1985).

10.70.2 R.T. Hughes: "Design Criteria for Plating Tank Push–Pull Ventilation," *Ventilation '85*, Elsiever Press, Amsterdam, 1986.

10.70.3 V. Sciola: Private Communication, Hamilton Standard.

TABLE 10.70.1. Determination of Hazard Potential

Hazard Potential	HYGIENIC STANDARDS: Gas and Vapor (see Appendix A)	HYGIENIC STANDARDS: Mist (see Appendix A)	Flash Point (see Appendix B)
A	0–10 ppm	0–0.1 mg/m^3	—
B	11–100 ppm	0.11–1.0 mg/m^3	Under 100 F
C	101–500 ppm	1.1–10 mg/m^3	100–200 F
D	Over 500 ppm	Over 10 mg/m^3	Over 200 F

TABLE 10.70.2. Determination of Rate of Gas, Vapor, or Mist Evolution

Rate	Liquid Temperature (F)	Degrees Below Boiling Point (F)	Relative Evaporation* (Time for 100% Evaporation)	Gassing**
1	Over 200	0–20	Fast (0–3 hours)	High
2	150–200	21–50	Medium (3–12 hours)	Medium
3	94–149	51–100	Slow (12–50 hours)	Low
4	Under 94	Over 100	Nil (Over 50 hours)	Nil

*Dry Time Relation (see Appendix B). Below 5—Fast; 5–15—Medium, 15–75—Slow; 75–over — Nil.
**Rate of gassing depends on rate of chemical or electrochemical action and therefore depends on the material treated and the solution used in the tank and tends to increase with, 1) amount of work in the tank at any one time, 2) strength of the solution in the tank, 3) temperature of the solution in the tank, and 4) current density applied to the work in electrochemical tanks.

TABLE 10.70.3. Minimum Control Velocity (FPM) for Undisturbed Locations

Class (see Tables 10.70.1 & 10.70.2)	Enclosing Hood: One Open Side	Enclosing Hood: Two Open Sides	Lateral Exhaust (see VS-70-01 & 70-02) (Note 1)	Canopy Hoods (see Figure 3-8 & VS-99-03): Three Open Sides	Canopy Hoods: Four Open Sides
A-1 and A-2 (Note 2)	100	150	150	Do not use	Do not use
A-3 (Note 2), B-1, B-2, and C-1	75	100	100	125	175
B-3, C-2, and D-1 (Note 3)	65	90	75	100	150
A-4 (Note 2) C-3, and D-2 (Note 3)	50	75	50	75	125
B-4, C-4, D-3 (Note 3), and D-4 — Adequate General Room Ventilation Required (see Chap. 2).					

Notes: 1. Use aspect ratio to determine air volume; see Table 10.70.4 for computation.
2. Do not use canopy hood for Hazard Potential A processes.
3. Where complete control of hot water is desired, design as next highest class.

TABLE 10.70.4. Minimum Rate, cfm/ft² of Tank Area for Lateral Exhaust

Required Minimum Control Velocity, fpm (from Table 10.70.3)	cfm/ft² to maintain required minimum control velocities at following $\frac{\text{tank width}}{\text{tank length}} \left(\frac{W}{L}\right)$ ratios				
	0.0 – 0.09	0.1 – 0.24	0.25 – 0.49	0.5 – 0.99	1.0 – 2.0 Note 2
Hood against wall or flanged (see Note 1 below and Section 10.70.1, Note 12. See VS-70-01 A and VS-70-02 D and E.					
50	50	60	75	90	100
75	75	90	110	130	150
100	100	125	150	175	200
150	150	190	225	[250] Note 3	[250] Note 3
Hood on free standing tank (see Note 1). See VS-70-01 B and VS-70-02 F.					
50	75	90	100	110	125
75	110	130	150	170	190
100	150	175	200	225	250
150	225	[250] Note 3	[250] Note 3	[250] Note 3	[250] Note 3

Notes: 1. Use W/2 as tank width in computing W/L ratio for hood along centerline or two parallel sides of tank. See VS-70-01 B and C and VS-70-02 F.
2. See Section 10.70.1, Notes 6 and 7.
3. While bracketed values may not produce 150 fpm control velocity at all aspect ratios, the 250 cfm/ft² is considered adequate for control.

TABLE 10.70.5. Typical Processes Minimum Control Velocity (fpm) for Undisturbed Locations

Operation	Contaminant	Hazard	Contaminant Evolution	Lateral Exhaust Control Velocity (See VS-70-01 & VS-70-02)	Collector Recommended
Anodizing Aluminum	Chromic-Sulfuric Acids	A	1	150	X
Aluminum Bright Dip	Nitric + Sulfuric Acids	A	1	150	X
	Nitric + Phosphoric Acids	A	1	150	X
Plating — Chromium	Chromic Acid	A	1	150	X
Copper Strike	Cyanide Mist	C	2	75	X
Metal Cleaning (Boiling)	Alkaline Mist	C	1	100	X
Hot Water (If vent desired)					
Not Boiling	Water Vapor	D	2	50*	
Boiling		D	1	75*	
Stripping — Copper	Alkaline-Cyanide Mists	C	2	75	X
Nickel	Nitrogen Oxide Gases	A	1	150	X
Pickling — Steel	Hydrochloric Acid	A	2	150	X
	Sulfuric Acid	B	1	100	X
Salt Solution					
(Bonderizing & Parkerizing)	Water Vapor	D	2	50*	
Not Boiling	Water Vapor	D	2	50*	
Boiling		D	1	75*	
Salt Baths (Molten)	Alkaline Mist	C	1	100	X

*Where complete control of water vapor is desired, design as next highest class.

TABLE 10.70.6. Airborne Contaminants Released by Metallic Surfaced Treatment, Etching, Pickling, Acid Dipping and Metal Cleaning Operations

Process	Type	Notes	Component of Bath Which May be Released to Atmosphere (13)	Physical and Chemical Nature of Major Atmospheric Contaminant	Class (12)	Usual Temp. Range F
Surface Treatment	Anodizing Aluminum		Chromic-Sulfuric Acids	Chromic Acid Mist	A-1	95
	Anodizing Aluminum		Sulfuric Acid	Sulfuric Acid Mist	B-1	60–80
	Black Magic		Conc. Sol. Alkaline Oxidizing Agents	Alkaline Mist, Steam	C-1	260–350
	Bonderizing	1	Boiling Water	Steam	D-2,1 (14, 15)	140–212
	Chemical Coloring		None	None	D-4	70–90
	Descaling	2	Nitric-Sulfuric, Hydrofluoric Acids	Acid Mist, Hydrogen Fluoride Gas, Steam	B-2,1 (15)	70–150
	Ebonol		Conc. Sol. Alkaline Oxidizing Agents	Alkaline Mist, Steam	C-1	260–350
	Galvanic-Anodize	3	Ammonium Hydroxide	Ammonia Gas, Steam	B-3	140
	Hard-Coating Aluminum		Chromic-Sulfuric Acids	Chromic Acid Mist	A-1	120–180
	Hard-Coating Aluminum		Sulfuric Acid	Sulfuric Acid Mist	B-1	120–180
	Jetal		Conc. Sol. Alkaline Oxidizing Agents	Alkaline Mist, Steam	C-1	260–350
	Magcote	4	Sodium Hydroxide	Alkaline Mist, Steam	C-3,2 (15)	105–212
	Magnesium Pre-Dye Dip		Ammonium Hydroxide-Ammonium Acetate	Ammonia Gas, Steam	B-3	90–180
	Parkerizing	1	Boiling Water	Steam	D-2,1 (14,15)	140–212
	Zincete Immersion	5	None	None	D-4	70–90
Etching	Aluminum		Sodium Hydroxide-Soda Ash-Trisodium Phosphate	Alkaline Mist, Steam	C-1	160–180
	Copper	6	Hydrochloric Acid	Hydrogen Chloride Gas	A-2	70–90
	Copper	7	None	None	D-4	70
Pickling	Aluminum		Nitric Acid	Nitrogen Oxide Gases	A-2	70–90
	Aluminum		Chromic, Sulfuric Acids	Acid Mists	A-3	140
	Aluminum		Sodium Hydroxide	Alkaline Mist	C-1	140
	Cast Iron		Hydrofluoric-Nitric Acids	Hydrogen Fluoride-Nitrogen Oxide Gases	A-2,1 (15)	70–90
	Copper		Sulfuric Acid	Acid Mist, Steam	B-3,2 (15)	125–175
	Copper	8	None	None	D-4	70–175
	Duralumin		Sodium Flouride, Sulfuric Acid	Hydrogen Fluoride Gas, Acid Mist	A-3	70
	Inconel		Nitric, Hydrofluoric Acids	Nitrogen Oxide, HF Gases, Steam	A-1	150–165
	Inconel		Sulfuric Acid	Sulfuric Acid Mist, Steam	B-2	160–180
	Iron and Steel		Hydrochloric Acid	Hydrogen Chloride Gas	A-2	70
	Iron and Steel		Sulfuric Acid	Sulfuric Acid Mist, Steam	B-1	70–175
	Magnesium		Chromic-Sulfuric, Nitric Acids	Nitrogen Oxide Gases, Acid Mist, Steam	A-2	70–160
	Monel and Nickel		Hydrochloric Acid	Hydrogen Chloride Gas, Steam	A-2	180
	Monel and Nickel		Sulfuric Acid	Sulfuric Acid Mist, Steam	B-1	160–190
	Nickel Silver		Sulfuric Acid	Acid Mist, Steam	B-3,2 (15)	70–140
	Silver		Sodium Cyanide	Cyanide Mist, Steam	C-3	70–210
	Stainless Steel	9	Nitric, Hydrofluoric Acids	Nitrogen Oxide, Hydrogen Fluoride Gases	A-2	125–180
	Stainless Steel	9,10	Hydrochloric Acid	Hydrogen Chloride Gas	A-2	130–140
	Stainless Steel	9,10	Sulfuric Acid	Sulfuric Acid Mist, Steam	B-1	180
	Stainless Steel Immunization		Nitric Acid	Nitrogen Oxide Gases	A-2	70–120
	Stainless Steel Passivation		Nitric Acid	Nitrogen Oxide Gases	A-2	70–120

TABLE 10.70.6. Airborne Contaminants Released by Metallic Surfaced Treatment, Etching, Pickling, Acid Dipping and Metal Cleaning Operations (con't)

Process	Type	Notes	Component of Bath Which May be Released to Atmosphere (13)	Physical and Chemical Nature of Major Atmospheric Contaminant	Class (12)	Usual Temp. Range F
Acid Dipping	Aluminum Bright Dip		Phosphoric, Nitric Acids	Nitrogen Oxide Gases	A-1	200
	Aluminum Bright Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Cadmium Bright Dip		None	None	D-4	70
	Copper Bright Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Copper Semi-Bright Dip		Sulfuric Acid	Acid Mist	B-2	70
	Copper Alloys Bright Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Copper Matte Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Magnesium Dip		Chromic Acid	Acid Mist, Steam	A-2	190–212
	Magnesium Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Monel Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Nickel and Nickel Alloys Dip		Nitric, Sulfuric Acids	Nitrogen Oxide Gases, Acid Mist	A-2,1 (15)	70–90
	Silver Dip		Nitric Acid	Nitrogen Oxide Gases	A-1	70–90
	Silver Dip		Sulfuric Acid	Sulfuric Acid Mist	B-2	70–90
	Zinc and Zinc Alloys Dip		Chromic, Hydrochloric Acids	Hydrogen Chloride Gas (If HCl attacks Zn)	A-4,3 (15)	70–90
Metal Cleaning	Alkaline Cleaning	11	Alkaline Sodium Salts	Alkaline Mist, Steam	C-2,1 (15)	160–210
	Degreasing		Trichloroethylene-Perchloroethylene	Trichloroethylene-Perchloroethylene Vapors	B (16)	188–250
	Emulsion Cleaning		Petroleum-Coal Tar Solvents	Petroleum-Coal Tar Vapors	B-3,2 (15)	70–140
					(17)	70–140
	Emulsion Cleaning		Chlorinated Hydrocarbons	Chlorinated Hydrocarbon Vapors	(17)	70–140

Notes:
1 Also Aluminum Seal, Magnesium Seal, Magnesium Dye Set, Dyeing Anodized Magnesium, Magnesium Alkaline Dichromate Soak, Coloring Anodized Aluminum.
2 Stainless Steel before Electropolishing.
3 On Magnesium.
4 Also Manodyz, Dow-12.
5 On Aluminum.
6 Dull Finish.
7 Ferric Chloride Bath.
8 Sodium Dichromate, Sulfuric Acid Bath and Ferrous Sulfate, Sulfuric Acid Bath.
9 Scale Removal.
10 Scale Loosening.
11 Soak and Electrocleaning.
12 Class as described in Chapter 2 for use in Table 10.70.3 based on hazard potential (Table 10.70.1) and rate of evolution (Table 10.70.2) for usual operating conditions. Higher temperatures, agitation or other conditions may result in a higher rate of evolution.
13 Hydrogen gas also released by many of these operations.
14 Rate where essentially complete control of steam is required. Otherwise, adequate dilution ventilation may be sufficient.
15 The higher rate is associated with the higher value in the temperature range.
16 For vapor degreasers, rate is determined by operating procedure. See VS-70-20.
17 Class of operation is determined by nature of the hydrocarbon. Refer to Appendix A.

TABLE 10.70.7. Airborne Contaminants Released by Electropolishing, Electroplating and Electroless Plating Operations

Process	Type	Notes	Component of Bath Which May be Released to Atmosphere (19)	Physical and Chemical Nature of Major Atmospheric Contaminant	Class (18)	Usual Temp. Range F
Electropolishing	Aluminum	1	Sulfuric, Hydrofluoric Acids	Acid Mist, Hydrogen Flouride Gas, Steam	A-2	140–200
	Brass, Bronze	1	Phosphoric Acid	Acid Mist	B-3	68
	Copper	1	Phosphoric Acid	Acid Mist	B-3	68
	Iron	1	Sulfuric, Hydrochloric, Perchloric Acids	Acid Mist, Hydrogen Chloride Gas, Steam	A-2	68–175
	Monel	1	Sulfuric Acid	Acid Mist, Steam	B-2	86–160
	Nickel	1	Sulfuric Acid	Acid Mist, Steam	B-2	86–160
	Stainless Steel	1	Sulfuric, Hydrofluoric, Chromic Acids	Acid Mist, Hydrogen Flouride Gas, Steam	A-2,1 (20)	70–300
	Steel	1	Sulfuric, Hydrochloric, Perchloric Acids	Acid Mist, Hydrogen Chloride Gas, Steam	A-2	68–175
Strike Solutions	Copper		Cyanide Salts	Cyanide Mist	C-2	70–90
	Silver		Cyanide Salts	Cyanide Mists	C-2	70–90
	Wood's Nickel		Nickel Chloride, Hydrochloric Acid	Hydrogen Chloride Gas, Chloride Mist	A-2	70–90
Electroless Plating	Copper		Formaldehyde	Formaldehyde Gas	A-1	75
	Nickel	2	Ammonium Hydroxide	Ammonia Gas	B-1	190
Electroplating Alkaline	Platium		Ammonium Phosphate, Ammonia Gas	Ammonia Gas	B-2	158–203
	Tin		Sodium Stannate	Tin Salt Mist, Steam	C-3	140–170
	Zinc	3	None	None	D-4	170–180
Electroplating Fluoborate	Cadmium		Fluoborate Salts	Fluoborate Mist, Steam	C-3,2 (20)	70–170
	Copper		Copper Fluoborate	Fluoborate Mist, Steam	C-3,2 (20)	70–170
	Indium		Fluoborate Salts	Fluoborate Mist, Steam	C-3,2 (20)	70–170
	Lead		Lead Fluoborate-Fluoboric Acid	Fluoborate Mist, Hydrogen Fluoride Gas	A-3	70–90
	Lead-Tin Alloy		Lead Fluoborate-Fluoboric Acid	Fluoborate Mist	C-3,2 (20)	70–100
	Nickel		Nickel Fluoborate	Fluoborate Mist	C-3,2 (20)	100–170
	Tin		Stannous Fluoborate, Fluoboric Acid	Fluoborate Mist	C-3,2 (20)	70–100
	Zinc		Fluoborate Salts	Fluoborate Mist, Steam	C-3,2 (20)	70–170
Electroplating Cyanide	Brass, Bronze	4,5	Cyanide Salts, Ammonium Hydroxide	Cyanide Mist, Ammonia Gas	B-4,3 (20)	60–100
	Bright Zinc	5	Cyanide Salts, Sodium Hydroxide	Cyanide, Akaline Mists	C-3	70–120
	Cadmium	5	None	None	D-4	70–100
	Copper	5,6	None	None	D-4	70–160
	Copper	5,7	Cyanide Salts, Sodium Hydroxide	Cyanide, Alkaline Mists, Steam	C-2	110–160
	Indium	5	Cyanide Salts, Sodium Hydroxide	Cyanide, Alkaline Mists	C-3	70–120
	Silver	5	None	None	D-4	72–120
	Tin-Zinc Alloy	5	Cyanide Salts, Potassium Hydroxide	Cyanide, Alkaline Mists, Steam	C-3,2 (20)	120–140
	White Alloy	5,8	Cyanide Salts, Sodium Stannate	Cyanide, Alkaline Mists	C-3	120–150
	Zinc	5,9	Cyanide Salts, Sodium Hydroxide	Cyanide, Alkaline Mists	C-3,2 (7)	70–120

TABLE 10.70.7. Airborne Contaminants Released by Electropolishing, Electroplating and Electroless Plating Operations (con't)

Process	Type	Notes	Component of Bath Which May be Released to Atmosphere (19)	Physical and Chemical Nature of Major Atmospheric Contaminant	Class (18)	Usual Temp. Range F
Electroplating Acid	Chromium		Chromic Acid	Chromic Acid Mists	A-1	90–140
	Copper	10	Copper Sulfate, Sulfuric Acid	Sulfuric Acid Mist	B-4,3 (20,21)	75–120
	Indium	12	None	None	D-4	70–120
	Indium	13,14	Sulfamic Acid, Sulfamate Salts	Sulfamate Mist	C-3	70–90
	Iron		Chloride Salts, Hydrochloric Acid	Hydrochloric Acid Mist, Steam	A-2	190–210
	Iron	12	None	None	D-4	70–120
	Nickel	3	Ammonium Fluoride, Hydrofluoric Acid	Hydrofluoric Acid Mist	A-3	102
	Nickel and Black Nickel	12,15	None	None	C-4 (22)	70–150
	Nickel	9,12	Nickel Sulfate	Nickel Sulfate Mist	B-2	70–90
	Nickel	13,14	Nickel Sulfamate	Sulfamate Mist	C-3	75–160
	Palladium	15	None	None	D-4	70–120
	Rhodium	12,17	None	None	D-4	70–120
	Tin		Tin Halide	Halide Mist	C-2	70–90
	Tin	12	None	None	D-4	70–120
	Zinc		Zinc Chloride	Zinc Chloride Mist	B-3	75–120
	Zinc	12	None	None	D-4	70–120

Notes:
1 Arsine may be produced due to the presence of arsenic in the metal or polishing bath.
2 Alkaline Bath
3 On Magnesium
4 Also Copper-Cadmium Bronze
5 HCN gas may be evolved due to the acidic action of CO_2 in the air at the surface of the bath
6 Conventional Cyanide Bath
7 Except Conventional Cyanide Bath
8 Albaloy, Spekwhite, Bonwhite (Alloys of Copper, Tin, Zinc)
9 Using Insoluble Anodes
10 Over 90 F
11 Mild Organic Acid Bath
12 Sulfate Bath
13 Sulfamate Bath
14 Air Agitated
15 Chloride Bath
16 Nitrite Bath
17 Phosphate Bath
18 Class as described in Chapter 2 for use in Table 10.70.3 based on hazard potential (Table 10.70.1) and rate of evolution (Table 10.70.2) for usual operating conditions. Higher temperatures, agitation, high current density or other conditions may result in a higher rate of evolution.
19 Hydrogen gas also released by many of these operations.
20 The higher rate is associated with the higher value in the temperature range.
21 Baths operated at a temperature of over 140 F with a current density of over 45 amps/ft^2 and with air agitation will have a higher rate of evolution.
22 Local exhaust ventilation may be desired to control steam and water vapor.