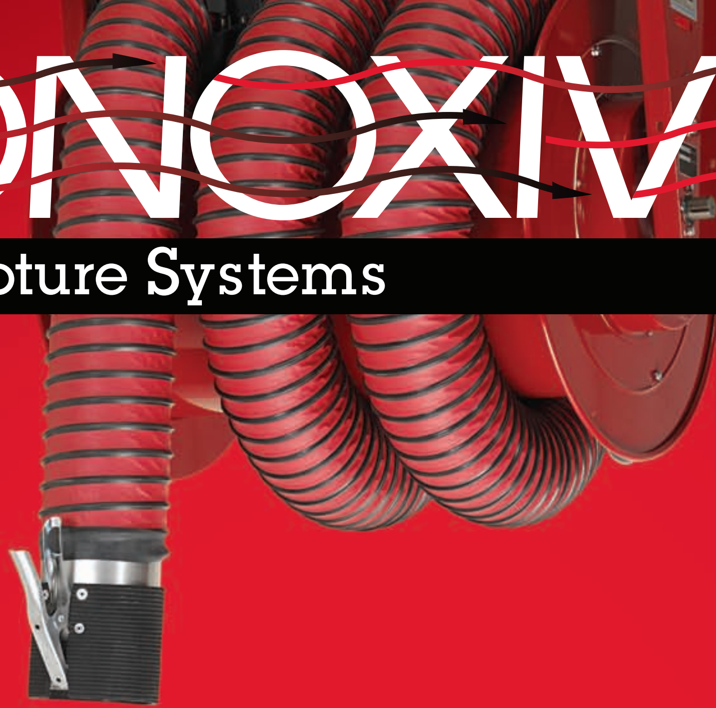
MONOXIVENT®

Source Capture Systems



Managing Indoor Air Quality

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Monoxivent's Guide to:
Managing Indoor Air Quality

Smart Solutions - Versatile, Cost Effective, and Eco-Friendly

Monoxivent is the air cleaning leader in the protection of workplace environments from noxious fumes and particulate. Monoxivent has been providing smart and innovative air cleaning solutions for customers since 1953. Monoxivent has the experience to provide source capture solutions from standard layouts to custom applications.

"Managing Indoor Air Solutions" is a manual compiled by Monoxivent to help educate building designers, owners, and end users. The intention of our manual is to give an overview of current regulations and solutions for clean indoor air.

Monoxivent Solution:

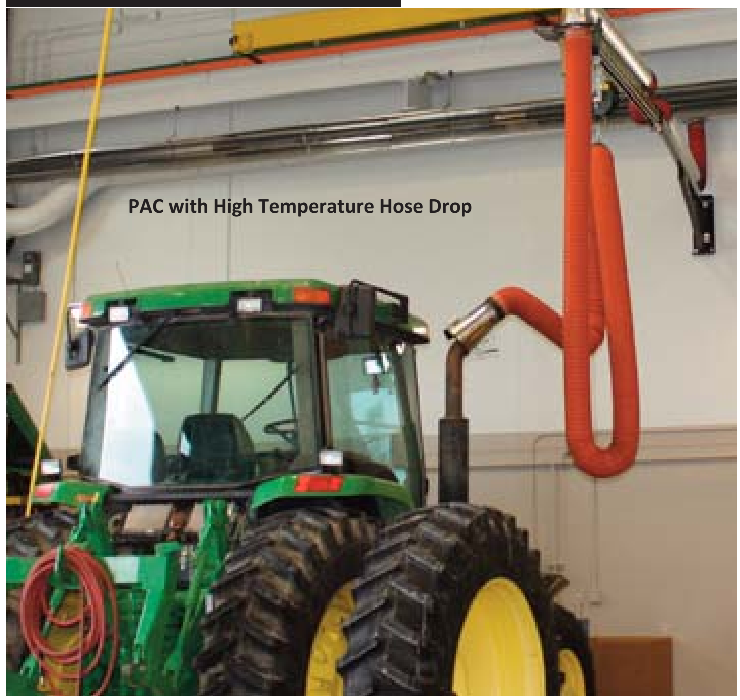
9000 Series Motor Hose Reel with High Temperature Hose

Table of Contents

Section 1:
Regulations & FAQ's

1.1 NIOSH (National Institute for Occupational Safety & Health) Report on Diesel Exhaust Fume Exposure

Monoxivent Solution:



Several studies over the past five years indicate that workers exposed to diesel exhaust over a number of years are more likely to contract lung cancer in addition to other maladies.

Earlier studies had only identified irritation of eyes and temporary breathing problems as being related to inhalation of diesel smoke, due to the difficulty of isolating the many other factors which contribute to other, more serious ailments. These include asbestos exposure and cigarette smoking. More recent studies controlled these factors and found a statistically significant number of cancers and tumors among such workers. Also, recent experiments in which rats and mice were exposed "confirm an association between the induction of cancer and exposure to whole diesel exhaust." The consistency in the findings of the worker histories and the animal experiments "suggests that a potential occupational carcinogenic hazard exists in human exposure to diesel exhaust."

Not only is the particulate matter associated with cancer: the gases in diesel exhaust are suspect as well. According to NIOSH Current Intelligence Bulletin 50, "The emissions from diesel engines consist of both gaseous and particulate fractions. The gaseous constituents include carbon dioxide, carbon monoxide, nitric oxide, nitrogen oxide, oxides of sulfer, and hydrocarbons (e.g., ethylene, formaldehyde, methane, benzene, phenol, 1, 3-butadiene, acrolein, and polynuclear aromatic hydrocarbons). Particulates (soot) in diesel exhaust are composed of solid carbon cores that are produced during the combustion process and that tend to form chain or cluster aggregates. More than 95% of these particulates are less than one micrometer in size. Estimates indicate that as many as 18,000 different substances from the combustion process can be absorbed onto diesel exhaust particulates. The absorbed material constitutes 15% to 65% of the total particulate mass and includes such compounds as polynuclear hydrocarbons (PAHs) several of which are carcinogens."

On the basis of these studies, NIOSH recommends that whole diesel exhaust be regarded as "a potential occupational carcinogen." Although current experimental data is not sufficient to quantify the risk one runs of contracting cancer from diesel exhaust, NIOSH assumes that reductions in exposure to diesel exhaust in the workplace would reduce the excess risk." NIOSH recommends that users of diesel-powered equipment inform their workers and that professional and trade associations and unions inform their members of the new findings of potential carcinogenic hazards of exposure to diesel engine emissions, and that all available preventitive efforts be vigorously implemented to minimize exposure of workers to diesel exhaust."

Those interested in receiving Current Intelligence Bulletin 50, entitled "Carcinogenic Effects of Exposure to Diesel Exhaust" may contact NIOSH at 513-533-8287 from 8:30 am - 4:40 pm (EST).

1.2 OSHA Hex Chrome Report

The Occupational Safety and Health Administration has published a final standard for exposure to hexavalent chromium (hex chrome). The standard covers occupational exposure to hex chrome.

Monoxivent Solution:

PHS Portable Collector (HEPA filter)

"OSHA has worked hard to produce a final standard that substantially reduces the significant health risks for employees exposed to hexavalent chromium. Our new standard protects workers to the extent feasible, while providing employers, especially small employers, adequate time to transition to the new requirements," said Jonathan L. Snare, acting assistant secretary for occupational safety and health.

Hexavalent Chromium: What It Is

Hexavalent Chromium Cr(VI) is a metal particle that can occur naturally in rocks but is most commonly produced by industrial process. It has the ability to gain electrons from other elements (a strong oxidizer), which means it can react easily with them. Because of its ability to react with other elements, it can produce hard coatings, which is why it is used in paints for cars, boats and airplanes. This property is also what makes hexavalent chromium a health hazard. Hexavalent chromium is often referred to as Hex Chrom, Hex Chrome, Chromium 6, HexaChrom, Cr(VI), HexChrome, etc.

OSHA Standard Overview

On February 28, 2006, the Occupational Safety and Health Administration (OSHA) published the final Hexavalent Chromium Cr(VI) Standard. The new permissible exposure limit (PEL) for Cr(VI) is 5µg/m3 (micrograms per cubic meter). There are three standards for different industries: General Industry, Construction, and Shipyards. The respiratory protection requirements for the three standards are similar. A respiratory protection program, including respirator selection, is required to follow OSHA 1910.134.

Main Industries and Applications Affected

The primary industries affected, according to OSHA, are Stainless Steel Fabrication, Heavy Duty Coatings and Paints (Automobile, Train Car, Airplane, Boats, Ships), electroplating and producers of chrome-based pigments. Welding (especially on stainless steel), spraying heavy-duty coatings and paints, and chrome plating are the primary applications affected.

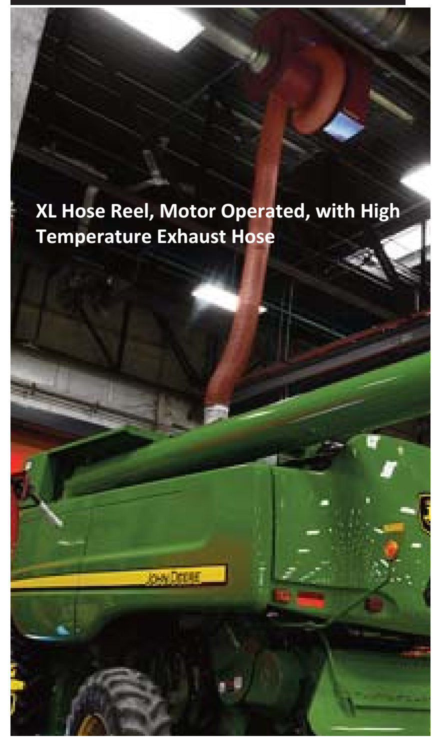
Monoxivent products providing capture of hex chrome include:

Portable (PHS/HEPA) Welding Arms, 15000 Series Arms, MNX Collectors with HEPA After Filter

1.3 World Health Organization-International Agency for Research on Cancer/IARC: Diesel Engine Exhaust Carcinogenic

Lyon, France, June 12, 2012 -- After a week-long meeting of international experts, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization (WHO), today classified diesel engine exhaust as carcinogenic to humans (Group 1), based on sufficient evidence that exposure is associated with an increased risk for lung cancer.

Monoxivent Solution:



Background

In 1988, IARC classified diesel exhaust as probably carcinogenic to humans (Group 2A). An Advisory Group which reviews and recommends future priorities for the IARC Monographs Program had recommended diesel exhaust as a high priority for re-evaluation since 1998. There has been mounting concern about the cancer-causing potential of diesel exhaust, particularly based on findings in epidemiological studies of workers exposed in various settings. This was re-emphasized by the publication in March 2012 of the results of a large US National Cancer Institute/National Institute for Occupational Safety and Health study of occupational exposure to such emissions in underground miners, which showed an increased risk of death from lung cancer in exposed workers (1).

Evaluation

The scientific evidence was reviewed thoroughly by the Working Group and overall it was concluded that there was sufficient evidence in humans for the carcinogenicity of diesel exhaust. The Working Group found that diesel exhaust is a cause of lung cancer (sufficient evidence) and also noted a positive association (limited evidence) with an increased risk of bladder cancer (Group 1).

The Working Group concluded that gasoline exhaust was possibly carcinogenic to humans (Group 2B), a finding unchanged from the previous evaluation in 1989.

Public health

Large populations are exposed to diesel exhaust in everyday life, whether through their occupation or through the ambient air. People are exposed not only to motor vehicle exhausts but also to exhausts from other diesel engines, including from other modes of transport (e.g. diesel trains and ships) and from power generators.

Given the Working Group's rigorous, independent assessment of the science, governments and other decision-makers have a valuable evidence-base on which to consider environmental standards for diesel exhaust emissions and to continue to work with the engine and fuel manufacturers towards those goals. Increasing environmental concerns over the past two decades have resulted in regulatory action in North America, Europe and elsewhere with successively tighter emission standards for both diesel and gasoline engines. There is a strong interplay between standards and technology – standards drive technology and new technology enables more stringent standards. For diesel engines, this required changes in the fuel such as marked decreases in sulfur content, changes in engine design to burn diesel fuel more efficiently and reductions in emissions through exhaust control technology.

However, while the amount of particulates and chemicals are reduced with these changes, it is not yet clear how the quantitative and qualitative changes may translate into altered health effects; research into this question is needed. In addition, existing fuels and vehicles without these modifications will take many years to be replaced, particularly in less developed countries, where regulatory measures are currently also less stringent. It is notable that many parts of the developing world lack regulatory standards, and data on the occurrence and impact of diesel exhaust are limited.

Conclusions

Dr Christopher Portier, Chairman of the IARC working Group, stated that "The scientific evidence was compelling and the Working Group's conclusion was unanimous: diesel engine exhaust causes lung cancer in humans." Dr Portier continued: "Given the additional health impacts from diesel particulates, exposure to this mixture of chemicals should be reduced worldwide."(2)

Dr Kurt Straif, Head of the IARC Monographs Program, indicated that "The main studies that led to this conclusion were in highly exposed workers. However, we have learned from other carcinogens, such as radon, that initial studies showing a risk in heavily exposed occupational groups were followed by positive findings for the general population. Therefore actions to reduce exposures should encompass workers and the general population."

Dr Christopher Wild, Director, IARC, said that "while IARC's remit is to establish the evidence-base for regulatory decisions at national and international level, today's conclusion sends a strong signal that public health action is warranted. This emphasis is needed globally, including among the more vulnerable populations in developing countries where new technology and protective measures may otherwise take many years to be adopted."

Summary evaluation

The summary of the evaluation will appear in The Lancet Oncology as an online publication ahead of print on June 15, 2012.

(1) JNCI J Natl Cancer Inst (2012) doi:10.1093/jnci/djs034
http://jnci.oxfordjournals.org/content/early/2012/03/05/jnci.djs034.abstract; and
JNCI J Natl Cancer Inst (2012) doi: 10.1093/jnci/djs035
http://jnci.oxfordjournals.org/content/early/2012/03/05/jnci.djs035.abstract

(2) Dr Portier is Director of the National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry at the Centers for Disease Control and Prevention (USA).

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Link to the audio file posted shortly after the media briefing:
http://terrance.who.int/mediacentre/audio/press_briefings/

About IARC

The International Agency for Research on Cancer (IARC) is part of the World Health Organization. Its mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control. The Agency is involved in both epidemiological and laboratory research and disseminates scientific information through publications, meetings, courses, and fellowships.

Annexes

Evaluation groups - Definitions

Group 1: The agent is carcinogenic to humans.

This category is used when there is sufficient evidence of carcinogenicity in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Group 2.

This category includes agents for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost sufficient, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals. Agents are assigned to either Group 2A (probably carcinogenic to humans) or Group 2B (possibly carcinogenic to humans) on the basis of epidemiological and experimental evidence of carcinogenicity and mechanistic and other relevant data. The terms probably carcinogenic and possibly carcinogenic have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with probably carcinogenic signifying a higher level of evidence than possibly carcinogenic.

- **Group 2A: The agent is probably carcinogenic to humans.**

This category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. In some cases, an agent may be classified in this category when there is inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of limited evidence of carcinogenicity in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

- **Group 2B: The agent is possibly carcinogenic to humans.**

This category is used for agents for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. It may also be used when there is inadequate evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent for which there is inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

Group 3: The agent is not classifiable as to its carcinogenicity to humans.

This category is used most commonly for agents for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals.Exceptionally, agents for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans.

Agents that do not fall into any other group are also placed in this category.

An evaluation in Group 3 is not a determination of non-carcinogenicity or overall safety. It often means that further research is needed, especially when exposures are widespread or the cancer data are consistent with differing interpretations.

Group 4: The agent is probably not carcinogenic to humans.
This category is used for agents for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals. In some instances, agents for which there is inadequate evidence of carcinogenicity in humans but evidence suggesting lack of carcinogenicity in experimental animals, consistently and strongly supported by a broad range of mechanistic and other relevant data, may be classified in this group.

Evidence for studies in humans - Definition
As shown previously, the evidence relevant to carcinogenicity is evaluated using standard terms. For studies in humans, evidence is defined into one of the following categories:

Sufficient evidence of carcinogenicity: The Working Group considers that a causal relationship has been established between exposure to the agent and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence. A statement that there is sufficient evidence is followed by a separate sentence that identifies the target organ(s) or tissue(s) where an increased risk of cancer was observed in humans. Identification of a specific target organ or tissue does not preclude the possibility that the agent may cause cancer at other sites.

Limited evidence of carcinogenicity: A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

Inadequate evidence of carcinogenicity: The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

Evidence suggesting lack of carcinogenicity: There are several adequate studies covering the full range of levels of exposure that humans are known to encounter, which are mutually consistent in not showing a positive association between exposure to the agent and any studied cancer at any observed level of exposure. The results from these studies alone or combined should have narrow confidence intervals with an upper limit close to the null value (e.g. a relative risk of 1.0). Bias and confounding should be ruled out with reasonable confidence, and the studies should have an adequate length of follow-up. A conclusion of evidence suggesting lack of carcinogenicity is inevitably limited to the cancer sites, conditions and levels of exposure, and length of observation covered by the available studies. In addition, the possibility of a very small risk at the levels of exposure studied can never be excluded.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

1.4 IMC-International Mechanical Code; BOCA-Building Officials & Code Administrators

Vehicle Exhaust Guidelines:
2012
IMC (International Mechanical Code)
BOCA (Building Officials & Code Administrators)

M-1605.4.1 - Motor vehicle operation: In areas where moving and stationary motor vehicles operate for a period of time exceeding 10 seconds, the ventilation return air shall be exhausted. Additionally, areas in which stationary motor vehicles are operated for periods of time exceeding 10 seconds shall be provided with a source capture system that connects directly to the motor vehicle exhaust systems. Such source capture systems shall comply with section M-311.0: In motor vehicle repair areas, an exhaust system shall be provided to connect directly to the motor vehicle exhaust.

M-1602.1 General - The following words and terms ... definitions shown herein:

Source Capture System - A mechanical exhaust system designed and constructed to capture air contaminants and to exhaust such contaminants to the outdoors. Such systems eliminate the release of contaminants into the space in which the source of contamination is located.

Federal Standards - To protect workers, the Department of Labor's Occupational Safety and Health Administration has set permissible levels of the carbon monoxide gas in the workplace. Averaged over an eight hour workday, these may not exceed 50 ppm. Exposures higher than 100 parts per million are serious violations; 500 ppm and over is a state of imminent danger.

OSHA has adopted a proposal from the National Institute of Occupational Safety and Health to lower the average permissible exposure to 35 ppm, to forbid any exposure over 200 ppm, and to require other protective measures.

Visit BOCA on the web. http://www.bocai.org

1.5 FAQ's About Indoor Air within The Workplace

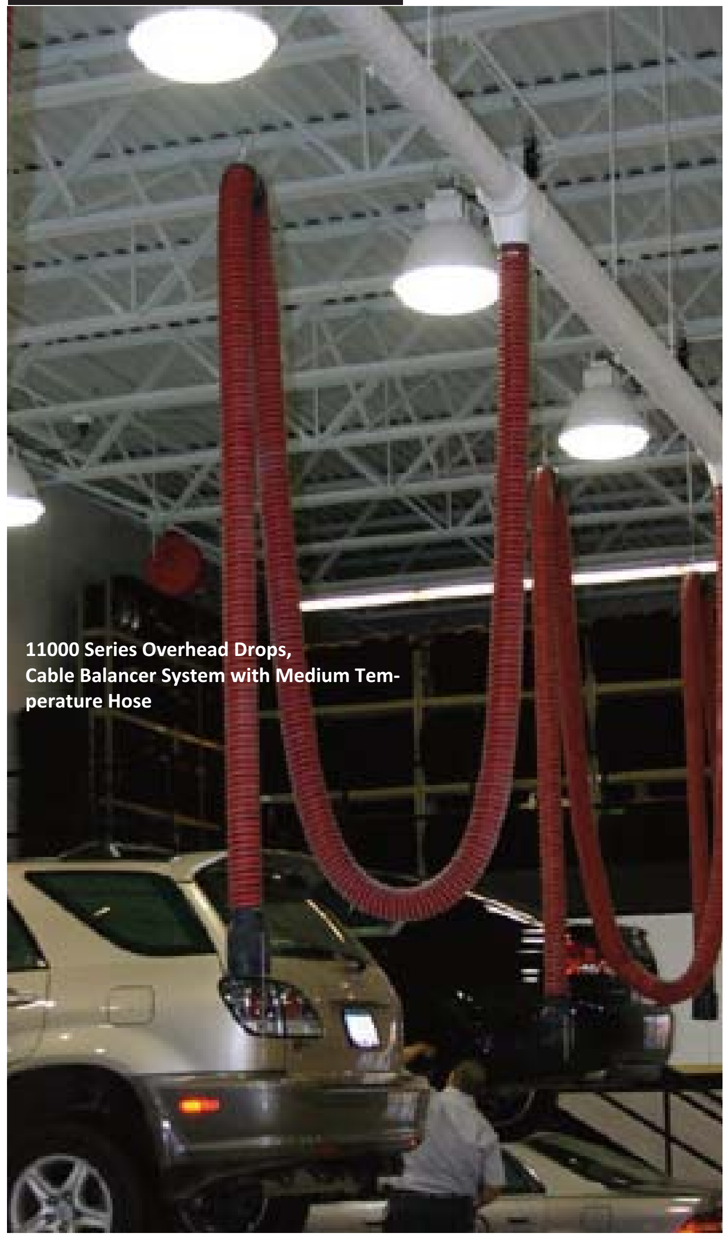
Why should I be concerned about Indoor Air Quality in the Work Place?

Indoor air is dirtier and more polluted than outdoor air. Health issues such as cancer, headaches, respiratory problems and fatigue can be caused by indoor air contaminants. These risks greatly increase in industrial settings where significant amounts of dust, fumes, exhausts are a part of the work environment.

Won't an open window give enough ventilation?

No.
In an industrial setting, the dust, fumes and exhaust generated in fields such as welding, vehicle production and woodworking pose such great health risks that merely opening a door/window is not a sufficient removal system.
Not to mention leaving a window or door open wastes money and energy on cooling/heating systems.

Monoxivent Solution:



11000 Series Overhead Drops, Cable Balancer System with Medium Temperature Hose

What is a Micron?

A micron is a micrometer- a measurement unit equivalent to one millionth of a meter. A human hair is about 100 microns wide whereas dust particles and red blood cells are about 7 microns in diameter.

What are Particulates?

In relation to air quality, particulates refer to tiny particles suspended in the air. As a general rule, the smaller the particle, the longer it stays in the air. Inhalation of particulate matter has been linked to asthma, lung cancer, cardiovascular problems and early death.

What is Source Capture?

Source capture systems are used when a process (such as welding / running a vehicle indoors / soldering) releases particulate matter (dust / exhaust / mist) into the air. An arm, hose or back-draft is attached or placed near the source to collect the particulate matter immediately. The air is then filtered and clean air is cycled back into the room or is discharged to the outside through a ducted system.

What is an Air Filter?

A device that removes particulates from the air.

FAQ’s About Indoor Air within The Workplace, continued

What is HEPA?

A High-Efficiency Particulate Air (HEPA) filter removes a minimum of 99.97% of air particles 0.3 microns in size.

How are Air Filters rated?

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has established international standards for air filters.

What is the difference between ASHRAE 52.1 and 52.2?

Standard 52.1 (1992): Describes an air filter in terms of a general efficiency percentage.
Standard 52.2 (1999): Assigns MERV rating.

What is a MERV rating?

The Minimum Efficiency Reporting Value (MERV) Rating is based on the efficiency of an air filter to remove particle of various sizes at different airflow rates.

What is the difference between a Cartridge and a Cyclone Dust Collector

Cartridge dust collectors have perforated metal cartridges with pleated filtering media to increase the surface area, increasing the filtering capability and reducing the overall collector size.
Cyclone dust collectors use a cyclonic action to separate dust particles from the air.

What is a Down Draft Table?

A workstation with built-in ventilation that sucks particulates into a filtering system before dispersing into the air.

How do I select the right Source Capture System?

Contact Monoxivent. We can help you assess your specific application and help you choose the best system that fits your needs. Monoxivent also offers custom source capture solutions for even the most unique situations.

What is the difference between Exhaust Fumes and Exhaust Particulate?

Exhaust fumes are comprised of toxic chemicals (i.e. NO_2 emissions) that are not readily filtered.
Exhaust particulate is larger in size (i.e. Hydro-Carbons) and can be captured by an air filter.

Section 2:
Monoxivent Design, Solutions

2.1 Calculating Engine Exhaust CFM

CFM = Cubic Inches/Conversion Factor x Efficiency Factor x Constant x Exhaust Temp/Ambient Temp x rpm/2

CFM = in3/1728 x 0.80 x 1.06 x (459 + TE)/(459 + TI) x rpm/2

Conversion Factor = 1728 cubic inches/cubic foot

Efficiency Factor = airflow efficiency less frictional losses

Efficiency = 0.80 for standard diesel engines

Efficiency = 0.90 for diesel engines with turbo-charger

NOTE: Turbo-charger reduces exhaust temperature for diesel engines. Turbo-charger increases exhaust temperature for gasoline engines.

Temperature measured in °F convert to (°K) Absolute scale = °F + 460 = °K

rpm/2 : for a 4 cycle engine

NOTE: For 2 cycle enginers, do not divide rpm in half. Calculation indicates exhaust volume (cfm) generated by the engine.

GENERAL GUIDELINES:

Cars	235 cfm
Trucks	600 cfm
Engines > 900 cubic inches	Utilize calculation x 2

2. Airflow design value: cfm = engine idle exhaust volume x 2

3. To prevent engine exhaust from overwhelming fan sizing, design airflow must exceed engine cfm generated by a minimum of 20% at maximum rpm.

2.2 Vehicle Ventilation, 23rd Edition - Industrial Ventilation Guide (10.85)

Selected Exerpts

“The objective of providing ventilation for vehicles in an environment is to keep worker’s exposure to toxic exhaust fumes and gases below TLV, both the TWA and STEL, or other appropriate standards.”

“The alternate to dilution ventilation is to capture the contaminant at the source by installing local exhaust ventilation. For stationary vehicles in service garages, effective systems are shown in VS-85-01 (overhead) and VS-85-02 (underfloor). The systems should be connected directly to the vehicle exhaust and should terminate outdoors above the roof. The design procedure outlined in Chapter 5 must be followed. For friction loss data of flexible ducts, manufacturers should be contacted. As with all flexible systems, the length of flexible duct must be minimized, and non-collapsible duct should be used. Unnecessary and/or sharp bends should be avoided. Exhaust requirements for automobiles are shown in VS-85-02 and for diesel engines in VS-85-03.”

2.3 Exhaust Requirements

MONOXIVENT® Source Capture Systems

4 Cycle Diesel, No Turbo

Required Exhaust CFM

Cubic Inch Displacement	RPM	No Load	Light Load	Full Load
200	750	60	70	90
	1500	150	170	230
	2100	240	290	390
350	750	100	110	150
	1500	250	300	410
	2100	420	510	680
500	750	450	160	220
	1500	360	430	590
	2100	600	730	980
600	750	180	190	260
	1500	440	520	700
	2100	720	870	1170

4 Cycle Diesel, With Turbo

Required Exhaust CFM

Cubic Inch Displacement	RPM	No Load	Light Load	Full Load
500	750	140	180	250
	1500	480	700	1000
	2100	900	1380	2100
650	750	180	240	300
	1500	630	910	1290
	2100	1180	1790	2700
800	750	220	290	370
	1500	770	1120	1590
	2100	1450	2200	3330
950	750	260	340	440
	1500	910	1330	1880
	2100	1720	2620	3950
1200	750	330	430	550
	1500	1150	1680	2380
	2100	2170	3300	4990

Please Note!

The charts, herein represent a range of potential operating conditions and may be used as a guide for developing systme requirements. However, individual requirements vary from application to application. Therefore, it is imperative to determine the range of vehicles to be tested and the specific parameters

4 Cycle Diesel, No Turbo

Required Exhaust CFM

Cubic Inch Displacement	RPM	No Load	Light Load	Full Load
50	1000	20	30	40
	3000	60	90	130
	6000	150	210	300
100	1000	40	50	80
	3000	130	180	260
	6000	310	410	600
200	1000	80	110	150
	3000	260	360	520
	6000	620	820	1210
300	1000	110	160	230
	3000	390	540	780
	6000	930	1230	1810
350	1000	130	190	270
	3000	450	630	920
	6000	1080	1440	2110
450	1000	170	240	350
	3000	580	810	1180
	6000	1390	1850	2720

Definitions

No Load: Vehicle is running for short periods without hydraulics or dyno.

Light Load: Engine is revving for longer periods of time for tune up applications.

* Full Load: For dyno applications or hydraulic testing.

* For all full load applications, please consult factory for specific requirements.

Note: These charts show the exhaust CFM that Monoxivent recommends. An allowance for bleed-in air for cooling is incorporated into these numbers.

These values are the total CFM required for the engine - for dual exhaust the CFM per hose would be half of this value.

For 2 Cycle engines, the exhaust requirement should be doubled.

2.4 Exhaust System Design Worksheet

MONOXIVENT®
Source Capture Systems

**** PLEASE CIRCLE THE ANSWER WHICH BEST DESCRIBES YOUR DESIGN PARAMETERS***

SECTION - #1

PRIVATE PASSENGER VEHICLES

Please Circle the Type of Vehicle: Cars Vans Pick-up Trucks High Performance Other ____________

Make & Model of Vehicles: ____

____

Please Circle if Dynometer Testing is Performed: Yes No
If Yes, is it: Engine Dyno Chassis Dyno Single Exhaust Dual Exhaust
Special Exhaust Configurations (See #4)

COMMERCIAL & INDUSTRIAL VEHICLES

Please Circle the Type of Vehicle: Truck Bus Construction Eqmt. Military Vehicle Other ____________

Make & Or Model Number of Vehicles: ____

____

Please Circle if Dynometer Testing is Performed: Yes No
If Yes, is it: Engine Dyno Chassis Dyno

Are Natural Gas Vehicles Incorporated: Yes No

Type of Exhaust Pipe, Circle All That Apply: Single Exhaust Dual Exhaust Horizontal Exhaust
Raincap Curved Stack Straight Stack
Special Exhaust Configurations (See #4)

SECTION - #2

ENGINE DATA

Please Circle, Whichever Best Describes: Diesel Gas 2 Cycle 4 Cycle

Engine Mfg.		Model #		C.I.D. or Liters	
	_______________		_______________		_______________
	_______________		_______________		_______________
	_______________		_______________		_______________
	_______________		_______________		_______________

Are Engines Turbocharged? Yes No If Yes, What is the Maximum Boost Pressure? __________ p.s.i.

Maximum Rated RPM of Engine __________ Maximum Operating RPM of Engine __________

MONOXIVENT®
Source Capture Systems

**** PLEASE CIRCLE THE ANSWER WHICH BEST DESCRIBES YOUR DESIGN PARAMETERS***

SECTION - #3

BUILDING CONSIDERATIONS

The Building is an (circle) Existing or New Structure   Type ____

Number of Bays ________________

Overhead Crane?   Yes   No

Electrical Requirements _____/_____/_____

Other Potential Obstructions: ____

____

____

SECTION - #4

PLEASE SKETCH ANY SPECIAL REQUIREMENTS OR SUGGESTED DESIGN

2.5 CFM Requirements for Common Metal Working Machines

(Based on 4500 FPM Branch and 4000 FPM Main Velocities)

Surface Grinders: (with good collection hood) - Hard Wheels

WHEEL DIA.	MAX WIDTH	DUCT DIA.	CFM
6”-7”	1”	4”	400
8”-10”	1.5”	5”	600

Grinding Wheels: With Good Enclosures (75% of Wheel)

	MAX.	MAX. CONT.	SPEEDS <6500 SFM		SPEEDS >6500 SFM	
DIAMETER	WIDTH	SURFACE	DUCT DIA.	CFM	DUCT DIA.	CFM
To 5” (Incl.)	1”	16 Sq. In.	3”	220	4”	390
6”-10” (Incl.)	1.5”	47 Sq. In.	3”	220	5”	610
11”-14” (Incl.)	2”	88 Sq. In.	4”	350	5”	610
15”-16” (Incl.)	2”	100 Sq. In.	4”	390	6”	880
17”-20” (Incl.)	3”	188 Sq. In.	5”	810	7”	1200
21”-24” (Incl.)	4”	301 Sq. In.	5”	810	7”	1200

Cut Off Wheels: Enclose saw and area under table - Use 250 CFM per Sq. Ft. of Face Opening and 4000 FPM in ducting.

Buffing and Polishing Wheels: With Good Enclosure (75% of Wheel)

	MAX.	MAX. CONT.	HARD WHEEL		SOFT WHEEL & WIRE BRUSH	
DIAMETER	WIDTH	SURFACE	DUCT DIA.	CFM	DUCT DIA.	CFM
To 9” (Incl.)	2”	57 Sq. In.	3”	200	4”	350
10”-16” (Incl.)	3”	151 Sq. In.	5”	546	5”	546
17”-19” (Incl.)	4”	239 Sq. In.	5”	546	6”	786
20”-24” (Incl.)	5”	377 Sq. In.	6”	786	7”	1070

Note: When maximum wheel surface exceeds 679 Sq. In. increase size of branch and hood connection area by one Sq. In. for each additional 17 Sq. In. of wheel contact surface.

Disc Grinders

Horizontal Single Spindle			Vertical Single Spindle		
To 12” (Incl.)	3” Duct	225 CFM	To 20” (Incl.)	5” Duct	546 CFM
13”-19” (Incl.)	4” Duct	390 CFM	21”-30” (Incl.)	2”-4” Ducts	700 CFM
20”-30” (Incl.)	5” Duct	610 CFM	31”-53” (Incl.)	2”-6” Ducts	1560 CFM
31”-36” (Incl.)	6” Duct	880 CFM	54”-72” (Incl.)	2”-8” Ducts	2800 CFM

Backstand Idler Polishing Machine (Belts) and Grinding Belts

BELT	GOOD ENCLOSURE		POOR ENCLOSURE	
WIDTH	DUCT DIA.	CFM	DUCT DIA.	CFM
1.5”	3”	220	4”	390
2”	4”	390	5”	614
3”	5”	614	6”	880
5”	6”	880	7”	1200
6”	7”	1200	8”	1571

↑ Less than 25” of Wheel Exposed

2.6 CFM Requirements for Common Wood Working Machines

(Based on Velocities of 4000 FPM)

Radial Saws	10” to 16”	5” dia. duct	550 CFM
Table and Circular Saws	18” to 20”	6” dia. duct	800 CFM
Disc Sanders	To 12” (Incl.)	4” Duct	350 CFM
	13” to 18” (Incl.)	5” Duct	550 CFM
	19” to 26” (Incl.)	5” Duct	550 CFM
	27” to 32” (Incl.)	2”-4” Duct	700 CFM
Multiple Drum Sanders	To 30” wide	1”-5” Duct	550 CFM
(Over the Table)	31”-48” wide	1”-6” Duct	800 CFM

Note: One additional branch of equal size may be used on “Feed Side” and one 4” on discharge and for cleaning bed cushion or cleaning brush (Rotary Type). *Each drum

Single Drum and Spindle Sanders	To 49 Sq. In.	1”-3” Duct	200 CFM
	50-199 Sq. In.	1”-4” Duct	350 CFM
	200-399 Sq. In.	1”-5” Duct	550 CFM

Belt Sanders - Vertical and “Top Run” horizontal (with both pulleys and rear or bottom enclosed)

	To 6” (Incl.)	1”-4” Duct	350 CFM
	6” to 9” (Incl.)	1”-5” Duct	550 CFM
	9” to 14” (Incl.)	1”-6” Duct	800 CFM

Note: If belt direction is reversible, use drive duct sizing at both pulleys.

Planers or Surfacers	To 20” (Incl.)	1”-6” Duct	800 CFM
Single (Top)	21” to 26” (Incl.)	1”-7” Duct	1100 CFM
	27” to 32” (Incl.)	1”-8” Duct	1400 CFM

Note: On “light duty” applications a 30% reduction in CFM is often permissible.

Jointers	To 6” (Incl.)	1”-4” Duct	350 CFM
	7”-12” (Incl.)	1”-5” Duct	550 CFM
	13”-20” (Incl.)	1”-6” Duct	800 CFM

Band Saws	14” to 20”	3” dia. duct	Below Table	200 CFM
	21” to 35”	2”-4” dia. duct	Below Table & Back	700 CFM

Wood Lathes (non-automatic) - For “rotation dust control” use 1”-4” Duct, 350 CFM and a suspended hood.

Floor Sweeps	5” Duct	546 CFM
	6” Duct	785 CFM
	(Do not include in System CFM requirement)	

CNC Routers 4” Dia., 500 CFM per head and 5” Dia., 750 CFM per head @ 10”-12” SP
Check manufacturer’s recommendations

NOTE: Miscellaneous woodworking, and metalworking, equipment and their CFM requirements are covered in “Industrial Ventilation: Manual of Recommended Practice”

(American Conference of Governmental Hygienists) - System must conform to all appropriate local codes and NFPA standards.

2.7 Source Capture, Welding Arms - Selection and Sizing

From Monoxivent's product catalog:

A. Based upon the application, determine the style arm most suited to give maximum coverage. Source capture arms are available in 6" and 8" diameters with a choice of multiple lengths.

B. Select the CFM requirements for the application. The most widely used CFM rating for 6" diameter arms is 600 CFM and for 8" diameter arms is 800-1000 CFM.

C. Once the CFM has been determined, please consult the graphs (within this catalog) for the static pressure calculations based upon the arm diameter and length that has been selected.

D. A suggested formula for central duct static pressure loss can be based on the following information:
First, calculate the length of the main duct from the fan to the duct end and multiply the length by 0.006. This yields the approximate loss in the main duct.
Second, calculate the amount of bends or elbows in the main duct and multiply this figure by 0.020. Next, add the loss for one arm, main, and elbows. This yields a close estimation for total static loss in the system.

E. Fan selection should be based upon the above information gathered. Fan CFM should be calculated by multiplying the total arms needed by the CFM selected for each arm. (6 Arms x 600 CFM Each = 3600 CFM)

F. To assist in sizing the main duct, the following table may be used. When sizing, begin with the drop furthest from the fan.

0-400 CFM	6" Main	2351-3530 CFM	14" Main
401-825 CFM	8" Main	3531-4700 CFM	16" Main
826-1470 CFM	10" Main	4701-5900 CFM	18" Main
1471-2350 CFM	12" Main	5901-6600 CFM	20" Main

Connecting duct from the 6" arm to the main duct is 6", while connecting duct from the 8" arm to the main is 8".

Whenever possible, use a sweeping fitting from the connecting duct to the main duct.

NOTE: The above information should be used as guidelines only.

2.8 Source Capture, Slotted Fume Hoods - Selection and Sizing

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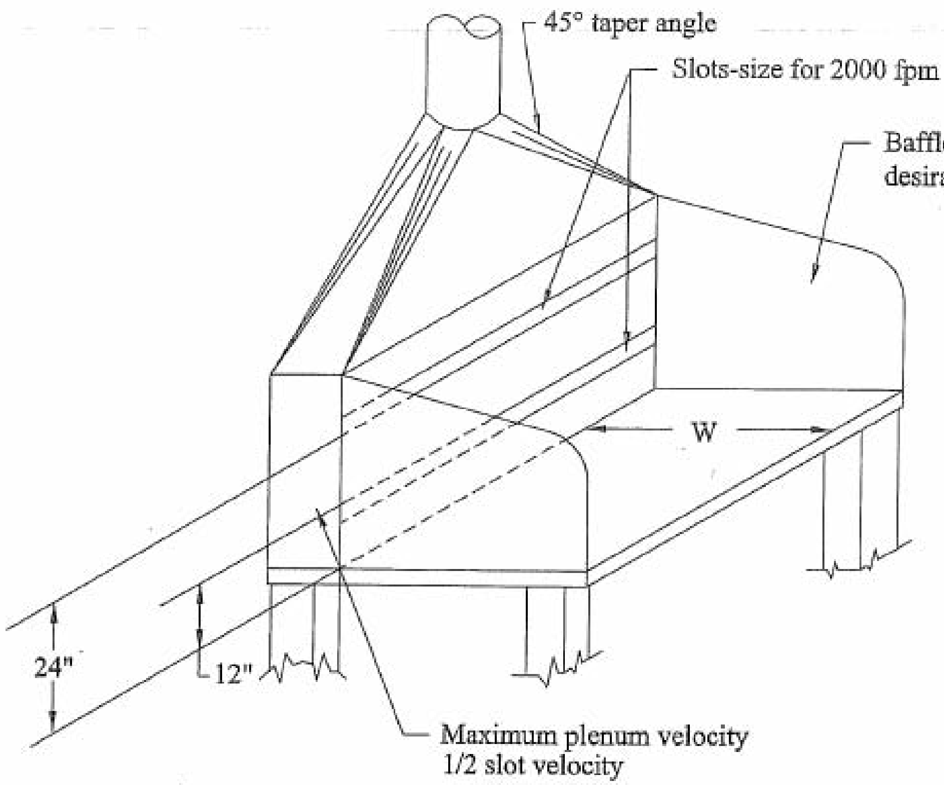

Q = 350 cfm/ft of hood length
Hood length = required working space
W = 24" maximum, if W greater than 24" see Chapter 3
Minimum duct velocity = 2000 fpm
$h_e = 1.78\ VP_s + 0.25\ VP_d$

General ventilation, where local exhaust cannot be used:

Rod, dia.	cfm/welder
5/32	1000
3/16	1500
1/4	3500
3/8	4500

or

A. For open areas, where welding fume can rise away from the breathing zone:
cfm required = 800 × lb/hour rod used

B. For enclosed areas or positions where fume does not readily escape breathing zone:
cfm required = 1600 × lb/hour rod used

For toxic materials higher airflows are necessary and operator may require respiratory protection equipment.

Other types of hoods

Local exhaust: See VS-90-02
Booth: For design see VS-90-30
Q = 100 cfm/ft^2 of face opening
MIG welding may require precise air flow control.

2.9 Capture Velocities for Exhaust Hoods

2.10 Minimum Duct Velocities for Conveying Materials

Capture Velocities (or Airflow) For Exhaust Hoods

Exhaust hoods are critical devices used to protect workers from pro-cess fumes or dust. Exhaust hoods induce airflow from the work station to the hood to remove contaminants or particles from the work area. The "capture velocity" is the air velocity required to move the contaminants from the work station to the hood. Capture velocities and hood designs depend on the type of fume or dust being removed. Hood designs include canopy hoods, downdraft hoods, booth-type hoods, slot hoods, etc. The chart at right shows the capture velocity and hood design for a given process.

Note: The flow rates and velocities shown in the charts on this page are based on standard air density. For conditions not at standard density such as high temperature, moisture or elevation, convert the operating conditions to standard air conditions using the correction factors found in the Temperature and Altitude Correction Chart on page 4.

PROCESS	TYPE OF HOOD	AIRFLOW OR CAPTURE VELOCITY
Abrasive Blasting	Downdraft Hood Crossdraft Hood	60-100 CFM/ft^2 of Floor 100 CFM/ft^2 of Wall
Auto Parking Garage	2 Level	500 CFM/Parking Space
Bag Loading for Grain Elevators, Feed Mills, Flour Mills	Canopy Hood	100 CFM/ft^2 Open Face Area 500 FPM Maximum
Ceramic: Dry Pan Dry Press Spraying (Lead Glaze)	Enclosure Hood Local at Die Local at Die At Supply Bin Booth Hood	200 FPM Thru All Openings 500 CFM 500 CFM 500 CFM 400 FPM (Face)
Cooling Tunnels (Foundry)	Enclosure Hood	75-100 CFM Per Running Foot of Enclosure
Core Sanding (on Lathe)	Downdraft Hood Under Work	100 FPM at Source
Crushers & Grinders	Enclosure Hood	200 FPM Thru Openings
Degreasing; Evaporation From Tanks	Canopy Hood	50-100 FPM
Forge (Hand)	Booth Hood	200 FPM at Face
Furniture Stripping Tank	Slot Hood	45 CFM/ft^2 of Tank Area
Metal Cutting Bandsaw	Booth Hood	225 CFM/ft^2 of Open Area
Metal Spraying	Booth Hood	a) 150 CFM/ft^2 of Face Area, Non-toxic b) 200 CFM/ft^2 of Face Area, Toxic
Outboard Motor Test Tank	Side Draft Hood	200 CFM/ft^2 of tank openings
Packaging Machines	Booth Hood Downdraft Hood Complete Enclosure	50-100 FPM at Face 95-150 FPM Down 100-400 FPM Opening
Paper Machine	Canopy Hood	200-300 FPM at Face
Pickling Metals	Canopy Hood	200-250 FPM
Plating Metals	Canopy Hood	225-250 FPM
Restaurant Range	Hood Against Wall Island Type Hood	80 CFM/ft^2 of Hood Area 125 CFM/ft^2 of Hood Area
Spray Booth	Booth Hood	a) 200 CFM/ft^2 for Face Area Up To 4 ft^2 b) 150 CFM/ft^2 for Face Area Over 4 ft^2
Steam Kettles	Canopy Hood	150 FPM at Face
Varnish Kettles	Canopy Hood	200-250 FPM at Face
Wire Impregnating	Covered Tanks	200 CFM/ft^2 of Opening

From American Conference of Governmental Industrial Hygienists: *Industrial Ventilation* (ACGIH®): *A Manual of Recommended Practice, 22nd Ed.*

Minimum Duct Velocities For Conveying Materials

After the exhaust hood removes the fumes or dust from the work station, the velocity downstream of the hood must be high enough to prevent the material from clogging the ductwork. The velocity downstream of the hood is defined as the *minimum duct velocity* and is determined by the type of material being conveyed through the duct. The table at right shows typical duct velocities for various materials.

MATERIAL	AVG. VELOCITY TO CONVEY MATERIAL (FPM)
VERY FINE LIGHT DUST: Cotton Lint, Wood Flour, Litho Powder	2500–3000
DRY DUSTS & POWDERS: Fine Rubber Dust, Jute Lint, Cotton Dust, Light Shavings, Soap Dust	3000–4000
AVERAGE INDUSTRIAL DUST: Grinding Dust, Buffing Lint-Dry, Wool Jute Dust-Shaker Waste, Shoe Dust, Granite Dust, Silica Flour, General Material Handling, Brick Cutting, Clay Dust, Foundry-General, Limestone Dust, Packaging & Weighing Asbestos Dust in Textile Industries	3500–4000
HEAVY DUSTS Sawdust-Heavy & Wet, Metal Turnings, Foundry Tumbling Barrels & Shake-Out, Sandblast Dust, Wood Blocks, Brass Turnings, Cast Iron Boring Dust, Lead Dust	4000–4500
HEAVY OR MOIST: Lead Dusts with Small Chips, Moist Cement Dust, Asbestos Chunks From Transite Pipe Cutting Machines, Buffing Lint-Sticky, Quick-Lime Dust	4500 & Up

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