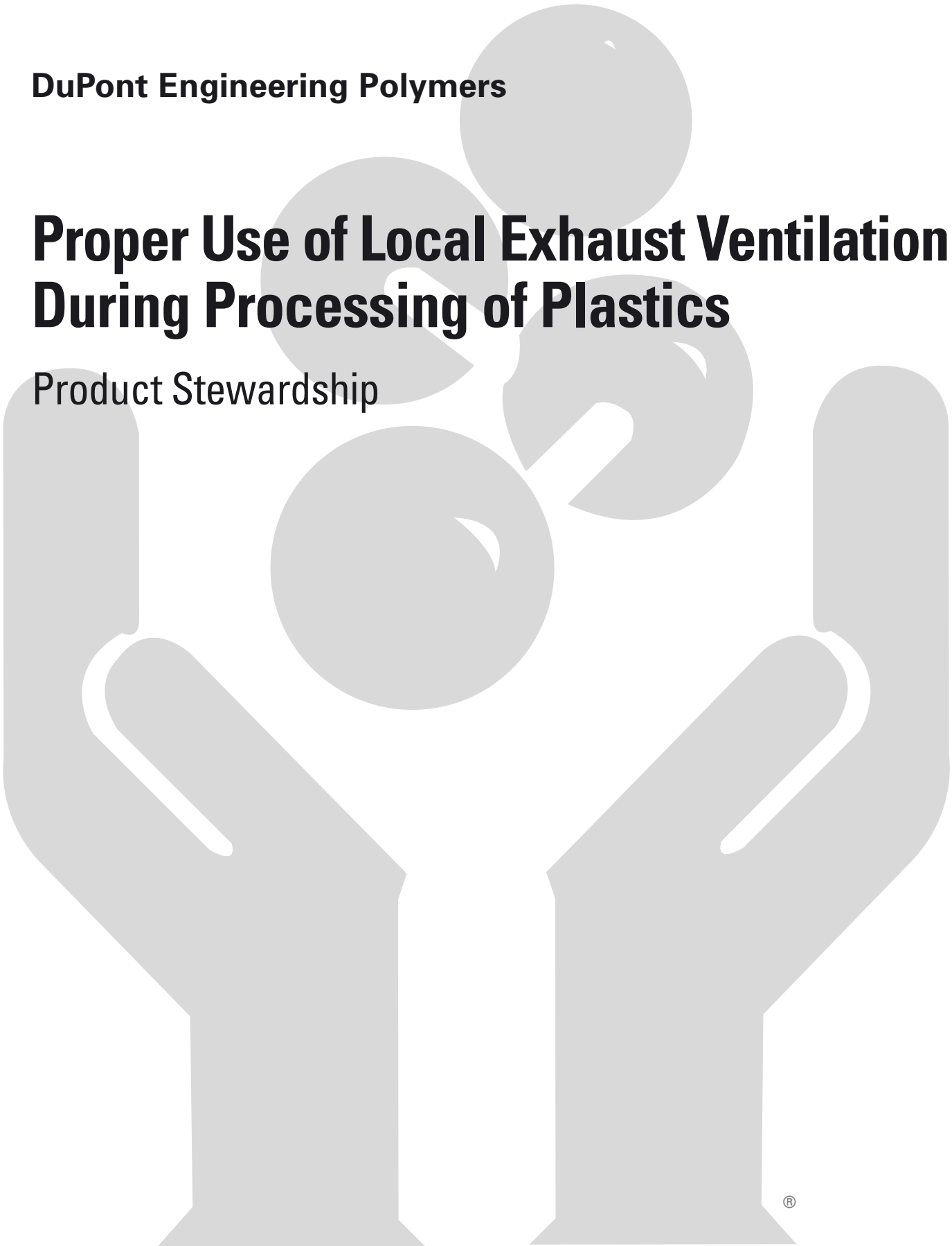
DuPont Engineering Polymers

Proper Use of Local Exhaust Ventilation During Processing of Plastics

Product Stewardship



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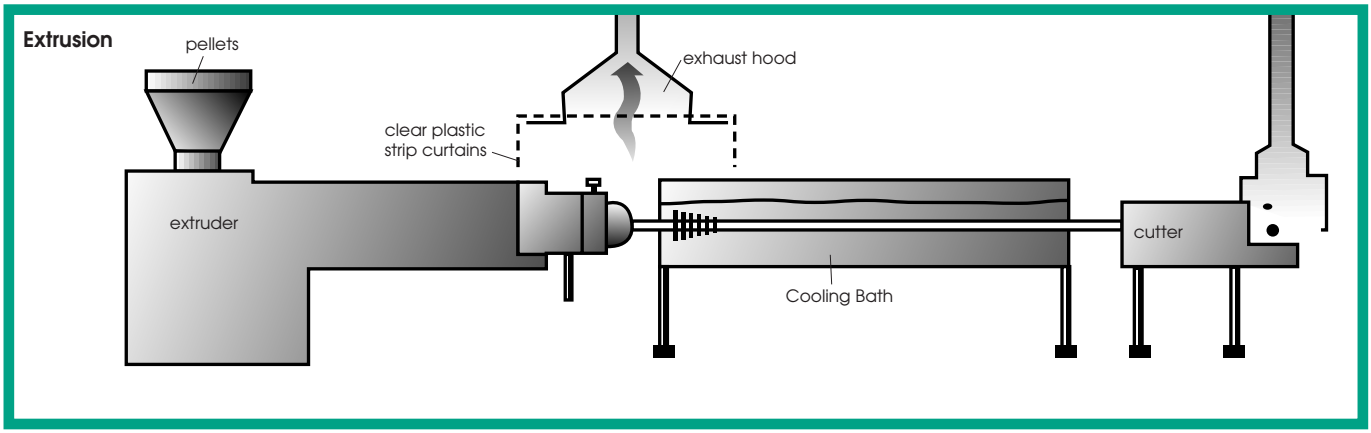
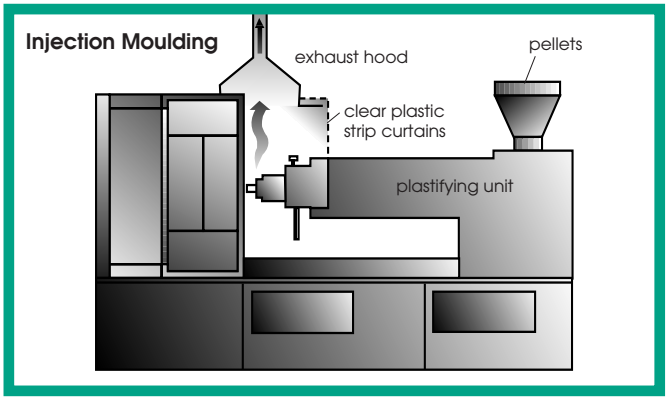
Proper Use of Local Exhaust Ventilation During Processing of Plastics – Introduction

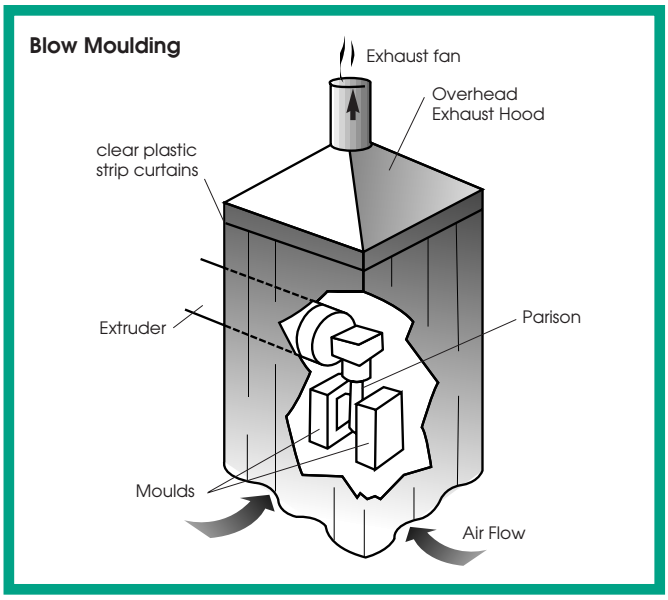
Melt processing of plastic resins (e.g. extrusion, blow moulding, injection moulding and wire and cable coating) and cleaning of metal parts by burning off plastic material, will release gases, vapours or fumes that may be harmful to your health or create undesirable odours.

Other operations, such as regrinding, handling of resin and additives, drying certain resin types, opening rotomoulded parts and grinding or buffing to remove trim or surface defects on parts can also release contaminants that may be harmful or cause nuisance dusts.

The most effective way to control these emissions is to "capture" them at the point of release and remove them by exhaust ventilation before they are dispersed into the air you may breathe. This "capture" technique is called local exhaust ventilation (LEV).

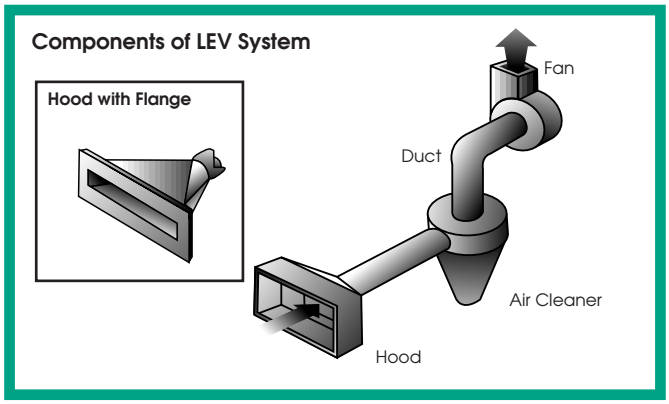






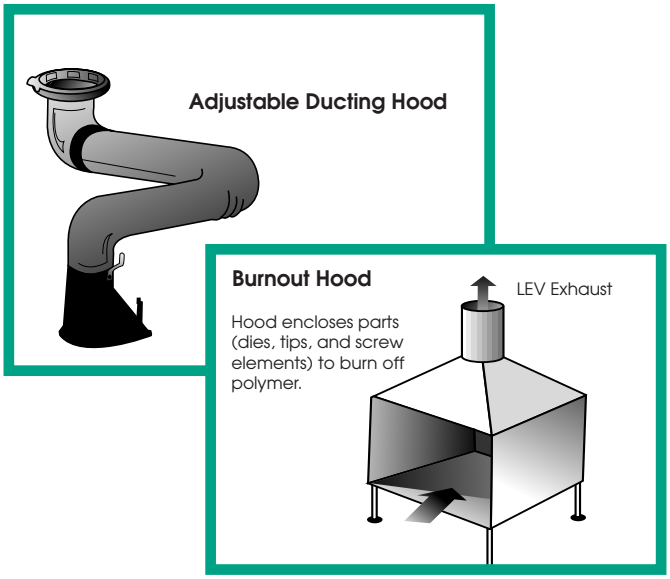
The Reasons LEV Is so Effective Are:

- only a relatively small volume of air is required to capture and remove airborne contaminants released at a point source compared to the very large volumes required to try to change the air in an entire area of a building, and
- capture of contaminants at the source point can virtually eliminate any exposure of workers to the contaminants.



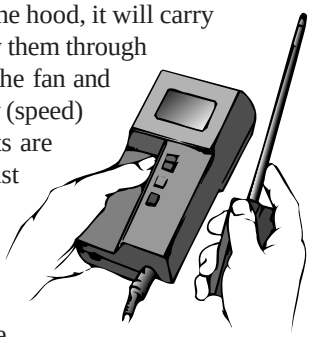
Some Principles to Follow in Using LEV

1. The LEV system is made up of an exhaust fan, which pulls air and contaminants into the exhaust hood and through the ducting and an air cleaner, before exhausting air outdoors (see illustration above).



2. The hood should be shaped to enclose the source as far as is practical yet still allow access to the equipment for normal operation. The hood should be removable or connected to an adjustable duct that can be moved aside from extrusion or moulding equipment for maintenance or trouble-shooting. Adjustable ducting of this type is commercially available. Care should be taken to avoid kinking or excessive length of flexible tubing.

3. When exhaust air enters the hood, it will carry contaminants with it and convey them through the ducting and air cleaner to the fan and the exhaust point. The air velocity (speed) at the point where contaminants are released should usually be at least 0,5 meters per second. This is termed "capture velocity", that is the air velocity that will capture contaminants at the source and pull them into the hood.



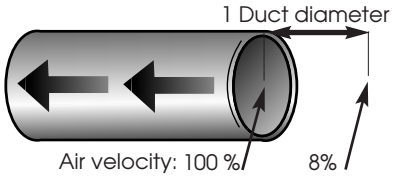
This capture velocity can be measured with a special flow meter as shown above.

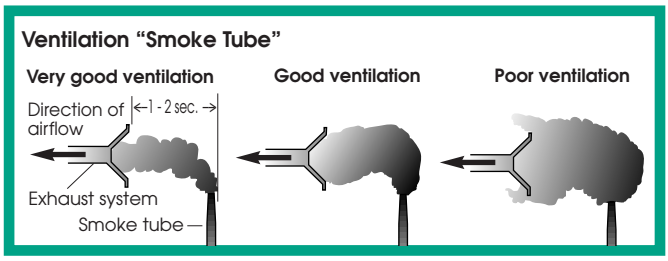
4. The hood is the most critical part of the LEV system and a simple check of its effectiveness can be made by using a ventilation "smoke tube" to produce a stream of dense white chemical "smoke" at the location where contaminants are released. The smoke will follow the air flow and should be rapidly captured (within 1-2 seconds) by the exhaust air and swept into the hood (see illustration Ventilation "Smoke Tube".

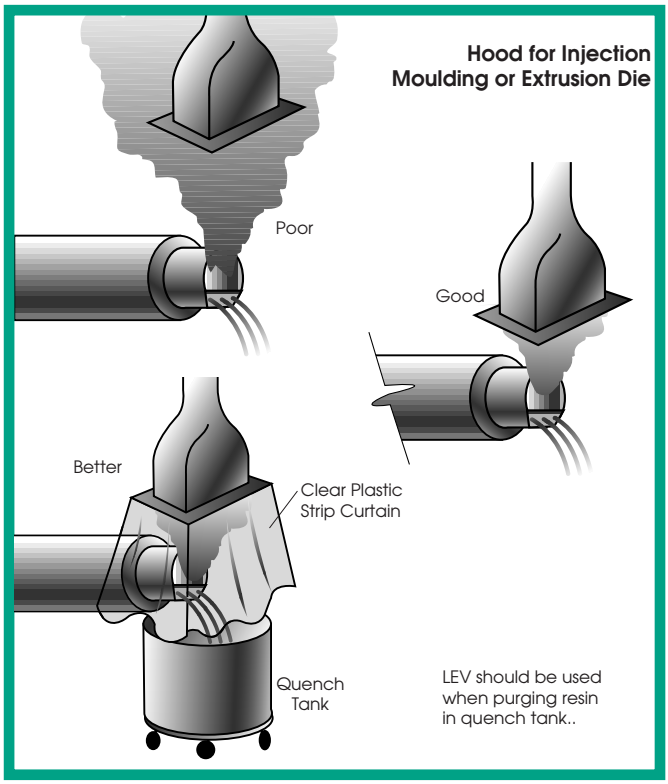
If smoke escapes the hood and moves into the surrounding air, then some adjustment of hood location and/or air velocity will be needed. Additional enclosure around the hood may also be considered, for example, by adding heavy plastic strip curtains (see illustration Hood for Injection Moulding or Extrusion Die).

Note: keep plastic curtains away from hot surfaces. High temperatures cause the plastic to become brittle and discoloured.

REMEMBER: The hood should be as close to the source as is practical. Tests have shown that the air velocity diminishes rapidly as the distance from the hood opening is increased (see sketch below).







5. The capture effectiveness of a hood can be improved by using flanges (see Components of LEV System sketch). The flanges restrict airflow from behind and from the sides of the hood and maximize airflow from the front.

Materials released from extruder barrel vents should be captured by LEV.

6. Air cross-currents around the area where contaminants are generated can disperse the contaminants into surrounding air before they are captured by the hood. Portable fans, open windows or air from ceiling diffusers can cause cross-drafts which interfere with the LEV system.

You can improve this situation by shielding the operation from cross-currents, for example by using a partial enclosure with plastic strip curtains. Never locate portable fans so that air flows over hot polymer towards workers. Air should always carry contaminants away from workers.

7. If the contaminants contain dusts, mists or fumes, the air velocity in the ducting must be high enough to prevent these materials from settling out in the ducting – typically in the range 12,5 – 25 m/s. The product Material Safety Data Sheet will provide information on the contaminants expected to be produced during processing or thermal decomposition.

Pressure Gauges

Dwyer Mark II

Series 2000 Meter

8. Airflow in LEV ducting can vary, for example, with changes in fan operation, plugging of filters in air cleaners, build-up of deposits in the ducting, addition of extra branches and hoods to the LEV system, etc.

A simple way to monitor the system performance, once it is working properly, is to install a gauge to measure the static pressure in the exhaust duct. Workers can check the gauge for changes in static pressure – in either direction – which mean that the airflow has changed and, therefore, a maintenance check of the fan, duct or air cleaner is needed.

Periodic checks with a smoke tube near the hood inlet will also indicate significant airflow changes.

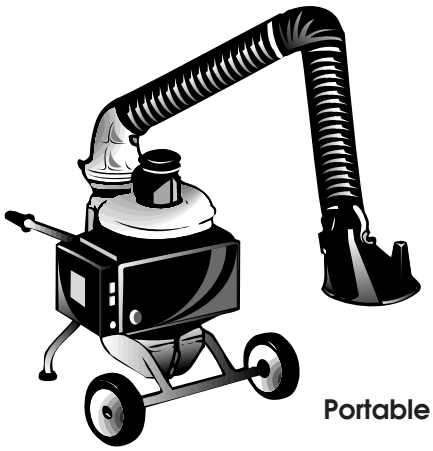
9. Air discharged outdoors must comply with any applicable regulations or permits for acceptable concentrations of chemical contaminants. As a responsible practice, it is recommended that exhaust air be treated by an air-cleaning device to remove all or most of the contaminant gases, vapours, dusts, mists or fumes present in the air, before discharge.

Locate exhaust stack as far away from air intakes as possible. A distance of 15 meters is usually considered to be adequate.

10. An LEV system will only work effectively when sufficient “make-up” or supply air is brought into the building to replace that exhausted outdoors. This is a particular concern when LEV systems are retrofitted in cold climates requiring indoor heating.

Use of Portable Equipment

For such applications as small-scale grinding or trim removal on plastics parts, a commercially available, portable LEV unit may be satisfactory. These units are available in various sizes and incorporate a fan, air cleaner, ducting and an exhaust hood to capture contaminants and remove them before exhausting the cleaned air back into the workplace. Such units can be recommended for capture and removal of low-toxicity dusts from plastic parts. In cases where toxic or irritating gases or vapours are released, it is important to ensure that the air cleaning device is the correct type to remove the contaminants, so that the exhaust air can be safely returned to the operating area (see illustration below). If there is uncertainty about air cleaning effectiveness, the exhaust air should be vented outside.



Portable LEV Unit

Design of LEV Systems

This brochure is intended to assist you in understanding how LEV can improve your operation. However, it is important to obtain professional assistance in designing a LEV system to ensure that it will meet your expectations for performance, cost, maintenance, noise level and compliance with local workplace and environmental regulations or permits. For example, worker exposure to airborne contaminants should always be maintained below regulated or recommended exposure limits. It is usually more economical to install a single fan, blower and ducting to service a number of similar operations (e.g. several extruders or moulding machines) than to install a separate system for each operation.

The principles of design are described in standard texts and handbooks – see following listings.

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References and Sources for Further Information

The list below provides references to some standard texts and publications as well as commercial sources of equipment and test devices. These are a few examples of available sources and DuPont does not specifically endorse them. Other sources not mentioned here are also available.

Publications

1. **"Industrial Ventilation: A Manual of Recommended Practice".** Published by American Conference of Governmental Industrial Hygienists (ACGIH). This manual, which is updated regularly, contains detailed information on all aspects of industrial ventilation and provides many hood designs for specific operations, together with guidance on air-cleaning methods (in English).
2. **"Industrial Ventilation Workbook".** Published by IVE Inc. This practically-oriented text has minimal theory and many examples and is appropriate for those with little background knowledge in ventilation (in English).
3. **"Taschenbuch für Heizung, Lüftungs- und Klimatechnik".** Author: Recknagel. Published by Springer Verlag (in German).

Trade Associations for Contractors who Fabricate and Supply Ventilation Systems and Services

In the United States:

1. Mechanical Contractors' Association of America (MCAA) – Tel: (301) 869-5800.
2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) – Tel: (703)-803-2980.
3. National Environmental Balancing Bureau (a joint program of MCAA & SMACNA) – Tel: (301) 977-3698. Has a free listing of certified contractors who provide ventilation system testing and balancing services.

Equipment and Devices

1. **Ventilation Smoke Tubes** to visually check air currents around an exhaust hood.

Available from:
M.S.A., National Drager.

2. **Air Velocity Meters** (Anemometers) to measure airflow velocity.

Available from:
In North America – Alnor Instruments, Sierra Instruments, T.S.I.
In Europe – Testoterm, Wilhelm Lambrecht.

3. **Static Pressure Gauges** to monitor airflow in ducts.

Available from:
Alnor Instruments, Dwyer Instruments.

4. **Portable LEV Units**:

Available from:
In North America – Nederman, Plymovent, Tykron Industries.
In Europe – Kiekens.

5. **Adjustable Ducting Systems**

Available from:
In North America – Nederman, Rumelin.
In Europe – Norfi.

For additional information we suggest contacting your local Occupational Health and Environmental Safety Supplier.

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