Industrial Ventilation – Installation and Maintenance (General) Fact Sheet

WHAT ARE SOME CONSIDERATIONS FOR A NEW INDUSTRIAL VENTILATION SYSTEM (IVS)?

The installation, testing, and maintenance of IVS must be done by specialized and competent professionals including industrial hygienists, ventilation engineers and other qualified personnel. All industrial ventilation systems should be designed to provide enough air at each hood to properly protect the worker from excessive contaminant exposure. If the system is not properly designed, installed and maintained, it may not be effective in eliminating airborne contaminants, which may result in adverse health effects, or safety and operations problems. An installation and start-up evaluation procedure must be written and made available to all plant personnel. Such procedures must be followed to ensure that, the system is properly balanced before the start-up.

The following are some helpful tips to ensure proper functioning of an IVS:

- Review all design and installation documents including requirements for fire and explosion protection, minimum hood and duct velocities.
- Review operating conditions and verify locations for test ports, dampers, balance valves and fittings.
- Review the ventilation system design to ensure that all access doors are closed and that duct interferences have been checked and eliminated.
- Review the operating requirements of the fan, motor and drive system.
- Verify that all compressed air, water, or other auxiliary connections to the system and control device are in operation and functioning to specification.
- Examine the system for other functional deficiencies that would make adjusting and balancing in the future more difficult.

NOTE: It should be the responsibility of the installing contractor to ensure that all wiring, starters and controls are in place. In addition, the fan should be observed to ensure that rotation direction is correct. The intent is to have a complete and working system before the start-up is begun. For example, a system may be started and after proportional balancing of all ducts, total flow may only be at 80% of the design requirement when the fan damper is fully open. This obviously would require some change to the system (speed change for fan, motor change, ductwork changes etc.) in order to achieve the designed specifications.

What to check to ensure the effectiveness of the IVS?

Most of ventilation system problems can be avoided by periodic monitoring of air speed and pressure in the system and maintenance. The airflow at the hood can be

visually checked with inexpensive smoke generators (smoke tubes) or measured with air velometers. Ventilation specialists may be needed to fix or redesign more complicated ventilation problems.

If an existing IVS appears to be functioning improperly, the following checks can be made without extensive measurements or expert help:

Observation	Yes	No
Is the fan belt broken or slipping?		
Is the fan wired backwards (reversed polarity)?		
Is duct clogged with dust?		
Are there holes, cracks or openings in the ducts?		
Is the air cleaner clogged?		
Are any dampers in the duct closed?		
Is there insufficient makeup air?		
Have ducts been changed to include more length, more or sharper bends, or abrupt diameter changes?		
Have additional hoods and ducts been added? (Without proper airflow balancing, some hoods in a multiple system may have inadequate flow or the fan may be too small to handle the additional resistance.)		
Has the contaminant source been moved further away from the hood opening?		
Is the canopy hood located as close to the source as possible without letting the employees work over the source?		
Is an access to enclosing hoods provided?		
Is more contaminant being generated at the source?		
Are cooling fans causing cross drafts?		
Have employees modified the hood because it interferes with their job tasks?		

What are the reasons of IVS failure?

The reasons of IVS failure include:

Inadequate maintenance

When ventilation systems are not maintained routinely, they eventually stop delivering the required exhaust airflow due to either natural system degradation over time or from unauthorized changes.

Inadequate airflow speed

Systems transporting gases and mists may experience gas pocketing and mist pooling inside the ductwork if the transport velocity (see the Glossary) is too low.

If the minimum transport velocities in the branches or elbows of the duct network are less than the acceptable ranges, some of the branches or elbows will get blocked by settled particles. This build-up slows down air velocity and results in more dust dropout and adds to the problem. Without maintenance to clear the dropout, the elbow will eventually get blocked.

Malfunctioning air cleaner

If the air cleaner develops operating problems, it can cause general reduction of system airflow and loss of protection for the workers; in addition, unacceptable levels of environmental emissions might also occur. Air cleaning devices, especially baghouse filter fabrics, can get blocked by dust build-up.

Reduced performance of the exhaust fan

Exhaust fan capability can change either due:

- material build-up (i.e., dust or paint) on the fan impellor that reduce its air moving performance, or
- mechanical failures of the fan's ball bearings or pulley belts.

Insufficient make-up air supply

The supply air system (make-up air) is the other important component of the industrial ventilation system. The air exhausted by the industrial ventilation system must be replaced by the make-up air system to avoid negative air pressure in the building. A negative pressure inside the building can reduce industrial ventilation system airflow.

Modifications in the ventilation system

Unauthorized changes can alter the system design parameters. Only qualified resources should be used to make system changes correctly the first time.

What are some common causes of the ineffectiveness of an IVS?

Examples of IVS problems include:

- dust escaping from the hoods,
- contaminants blowing out the exhaust stack, or
- contaminants in air samples exceed recommended exposure limits.
- A prompt investigation is needed to determine the cause of above problems.

Often, by the time the problems are noticeable, the system has already degraded. Probable causes of such problems include:

- plugged ducts,
- plugged air collector, or
- any other condition that can reduce system airflow.

It takes a lot of hard work cleaning ducts or shovelling out the baghouse filter hopper to get the system back on line. A periodic monitoring program for the industrial ventilation system or the local exhaust ventilation (LEV) can help predict the potential problems so that the remedial actions are not a difficult job.

What steps are required for monitoring of the IVS?

Periodic monitoring to check the effectiveness of IVS or LEV should involve the following steps (Note: The following measurements must be carried out by qualified persons such as certified occupational hygienists or ventilation specialists).

1. Gather original airflow data taken at the system start-up time. This data includes air velocities and static pressures throughout the system at the chosen test points. This is referred to as "Baseline measurements".
2. Measure system static pressure and airflow velocity at test points. This is referred to as "Monitoring Data".
3. Compare the monitoring data to the baseline measurements to make sure that the air velocities or static pressures for which the system was designed are actually achieved. This is referred to as "Restoring the System to Baseline".
4. A difference of greater than 20% between the measured static pressure and the baseline static pressure is an early warning of system failure or degradation.
5. Take area and personal air samples while the IVS is on. The exposure levels should be below the exposure limits if the IVS is working as designed. According to some government regulations, this is the only way to check the effectiveness of an IVS.