What is Local Ventilation?

Olander L
Building Services Engineering, KTH (Royal Institute of Technology), Stockholm, Sweden

Ventilation systems can be divided in many ways, by size, flow rate, velocity, material, placing, aim, etc. One common way is to divide between General Ventilation (GV) and Local Ventilation (LV). However, these terms do not have general accepted meanings. In the Design Guide Book for Industrial Ventilation (DGB), chapter 10 Local Ventilation, we (members of COST G3 Working Group 4) have tried to define and describe Local Ventilation systems.

We have also made a division of LV into different specific systems. In combination with the description of General Ventilation in DGB chapter 2 we think this division is usable for all kinds of more or less well defined ventilation systems used for contaminant control.

Definition

A LV system uses as small air flow rate as possible to minimise the amount of airborne contaminants entering a specified volume or passing specified point(s). This (these) are usually intended to be inside the breathing zone. The minimisation can be achieved either by extracting the airborne contaminant into an exhaust hood before it enters the volume or by blowing non-contaminated air from a supply inlet through the volume to prevent the contaminant from entering or a combination of those.

Purpose and Function

The main purpose of LV is to diminish or prevent exposure to contaminants (including heat sometimes). This includes protection of persons or products or animals from hazardous and/or nuisance contaminants. This task is not specific for LV so there are other definitions. By using LV less air is needed to reach a specific contaminant level than is usually possible with General Ventilation. It can also be said that the purpose of LV is to achieve a more efficient (defined in some way) ventilation in a part of a room or in the whole room. There are also processes which are nearly impossible to run properly without LV.

To achieve the purpose, the flow rate(s) of a LV system must be designed while taking into account the contaminant generation process and rate and the generated flow rate of contaminated air. To control the contaminants is mostly the same as to control the contaminated air. LV is often a very important part of the ventilation system (specially in industrial buildings), both in function and in construction, which makes a specific definition difficult. LV can be ventilation of a separate volume inside a large room as opposed to GV, which is for the complete room or building. One problem with this specification is that LV systems could function as localised ventilation in one

surrounding and as GV in another surrounding. E.g. an inlet ceiling combined with floor exhaust is a LV system in a large hall and a GV system in a small room without any other ventilation. Though in this latter case its main purpose could be different from a common general ventilation system.

Modes

All LV systems can, in principle, be (and many are in practice) manufactured for use in three different modes: Fixed, Flexible and Movable.

Fixed systems. These are not possible to move or change by the user, except perhaps by opening and closing of lids and doors. One example is the hood surrounding a drilling machine where there is a sliding door in the hood, another is the laboratory fume cupboard and another is the canopy hood above or the enclosure around a paper machine.

Flexible systems. For these the suction opening (or the supply device) is possible to place at different locations inside a limited area or volume. This is achieved by connecting the exhaust (or supply) opening and duct (or tube) to the fan by flexible connections (ducts with moveable elbows or flexible tubes). One example is a wall mounted hood for welding exhaust, another is the exhaust connected to a portable grinding machine.

Movable systems. For these the exhaust (supply) opening is possible to place nearly anywhere inside a workroom (sometimes also in different rooms). This is achieved by placing the whole system (exhaust/supply opening, duct, fan) on wheels or a portable frame. It can also be accomplished by having a separate exhaust part (opening and short tube) which connects to the central duct system at many places (in walls, in the floor or from the ceiling). One example of the former is a welding exhaust (with filter) on a small carriage and an example of the latter is a centralised exhaust system for connection to car exhaust pipes. For this case it is also possible to have a sliding connection between exhaust and duct, which makes it possible to let the exhaust follow the car (or any contaminant generator) around the room.

Descriptions

For all LV systems the air flow field decides the performance. And the performance is how efficient the contaminant is transported, away from the place where it should not be, to a place where it can be accepted (usually outside). Thus the disturbance of the intended flow field diminishes the efficiency of the LV system. And all LV systems can be disturbed by tools or machines or persons or by anything else that moves air (passing trucks, wind through doors, high temperature gradients, pressure gradients, etc). Naturally the maintenance is as important for LV systems as for GV systems.

The necessary containment of a LV system depends on which type of contaminant that is present and its health risks. This means that there could be different demands for gases and particles, for contaminants which have immediate health risks and which have long-term effects, for contaminants which have effects on the breathing system and which have effects on the skin and eyes, for contaminants which are infectious and

which are not transmitted by air, for contaminants which follow the air streamlines closely and which fall out on floor and workplaces, etc.

There are many possible ways to sort and describe LV systems. When LV is meant to include only exhaust hoods, one practice is to separate between hoods that totally surrounds the contaminant source (enclosing hoods), hoods that partially surrounds the contaminant source (partially enclosing hoods) and hoods where the contaminant source is outside the hood's physical boundaries (exterior hoods). Since LV in the DGB chapter 10 includes more than exhaust hoods, the following three main categories are used: Exhaust hoods, Supply inlets and Combined exhaust hoods and supply inlets.

For each system a detailed description is included in the DGB and the main contents of these descriptions are presented.

I think it is interesting to see how many different forms of LV systems that exist. The preliminary contents list is presented. This is not a complete list of all kinds of LV systems, but I think we have included most of the systems used today.

Shortage of writers and time has made it necessary to limit the number of systems described in DGB chapter 10 and in this chapter the number of systems will be fewer than presented here.