AIR CLEANING EQUIPMENT

As discussed in detail in Chapter 33, air cleaning equipment should be considered in all systems where it can prevent property damage, neighborhood pollution or re-entry of polluted air to the working space, or where it can salvage usable material, reduce fire and explosion hazards or make possible some recirculation of air to the working spaces. The present growing emphasis on air pollution control makes it desirable to remove all contaminants to the greatest practical degree based on reasonable cost and maintenance.

MAKE-UP AIR REQUIREMENTS

A correctly designed exhaust system may be ineffective during periods when windows and doors are closed. This condition should be anticipated and prevented by making provision for an adequate air supply. Poor performance of exhaust hoods is caused by: absence of air supply systems; cold drafts due to high indraft velocities through cracks and openings in building construction especially at windows and doors; reverse air flow through low pressure systems of roof ventilators or general ventilation systems; downflow through heater vent stacks preventing exhaust of flue gases to the outside. Systems for conditioning make-up air do not necessarily increase heating requirements for the space, as cold air due to infiltration from the outside must be heated somehow to maintain comfortable temperatures in the area. The cost will depend on the ratio of exhaust air to that required for ventilation of the space occupied.

MAINTENANCE OF PERFORMANCE

Periodic inspection and checking of exhaust systems are necessary if control is to be maintained at the effective level of the original installation. Continued effectiveness depends on maintained design air volume flowing through the exhaust hoods. A checking procedure, therefore, must include some data to indicate at least relative air flow through the hoods. The static pressure or hood suction measurement will prove useful for such checking if data are available on air volumes and pressures at the time the system was installed. Testing and recording of such data for each new installation are of the utmost importance.

While hood suction readings have rightfully been discarded as a means of measuring air flow, they do offer a quick and accurate method of measuring relative air flow. If the hood suction is known while an exhaust system is functioning properly, its continued effectiveness can be assured so long as the hood suction is not reduced from its original value.

Difficulty from plugging may be encountered where heavy dust loads or moist air are encountered. Unless the hood design is altered or there are accumulations in the hood or branch pipe between hood and point of hood suction reading, the air volume exhausted from a hood cannot change without a change in hood suction reading.

The Pitot tube can be used for routine check purposes instead of the static pressure method but requires care in reading velocity pressures in an exact position with the tube paralleling the flow of air. The hood suction method of checking can however be more readily delegated to an assistant having no technical training. U-gages have been standard plant equipment long enough to eliminate any feeling of uncertainty in their use.

Since pressure readings vary as the square of the velocity or volume of flow, a slight change in flow is magnified by a comparison of gage readings. Normally, a reduction of volume or velocity of 10 to 15 percent will not be sufficient to reduce the effectiveness of the exhaust system. This range is equivalent to a reduction in static pressure readings of 19 to 30 percent.

A marked reduction in hood suction can often be traced to one or more of the following items:

1. Reduced performance by the exhaust fan caused by reduced speed due to belt slippage, wear on rotor or casing, or an accumulation of material in the rotor or casing obstructing the air flow.
2. Incorrect direction of exhauster rotation.
3. Reduced performance caused by defects in the exhaust piping, such as accumulations of material in branch or main ducts due to insufficient conveying velocities, condensation of oil or water vapors on duct walls, adhesive characteristics of material exhausted.
4. Leakage losses caused by loose clean-out doors, broken joints, holes worn in duct (most frequently in elbows), or poor connection to the exhauster inlet.
5. Losses in suction due to exhaust openings added to the system or due to a change of setting of blast gates in branch lines.
6. Increased pressure loss through the dust collector due to lack of maintenance, improper operation, wear, etc.

MATERIALS REQUIRED FOR CORROSION RESISTANCE

In many cases, exhaust systems including hoods, ducts, air flow producing equipment, and air cleaning equipment will require protective coatings if carbon steel is used, or other materials of construction will be required. Need for such materials will be determined by (a) the corrosion rates on interior or exterior duct surfaces, (b) protection against product contamination, and (c) explosion hazards.

Construction for corrosion protection is the most difficult due to the complex factors that influence rate of corrosion. It is seldom possible to predict the concentration, composition, and dry-bulb and dew-point temperatures that will exist in actual operations. A guide for selecting corrosive resistant materials based on a survey of actual experiences has been reproduced in Tables 9 and 10.[46]

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