
Soiling Around Supply Air Diffusers

Do you have dark soiling on ceiling surfaces around ventilation system supply air diffusers? The presence of this soiling commonly leads people to believe that the ductwork needs to be cleaned and gives the perception of poor indoor air quality in the space. Lets reveal the mechanism that causes this unsightly staining and see what can be done to minimize or prevent it.

First, building ventilation systems with air conditioning typically supply cool 55 °F air, and in order to avoid causing draft to the occupants, this cool air is supplied through air diffusers that are designed to discharge tangentially across the ceiling. As this supply discharge radiates from the ceiling diffuser, room air is entrained and mixed into the supply jet warming the air and reducing draft to occupants.



Second, the Coanda effect, which is the tendency for a fluid stream to stay attached to a convex surface, is exploited to increase the throw of air. The supply air discharged from the diffuser is caused to “stick” to the ceiling for some distance before detaching.

Third, the speed of the supply air across the ceiling thins the laminar boundary layer of air between the ceiling surface and the supply air. In areas 1-12 inches from the diffuser, the boundary layer thins enough to allow the mixture of particles from the room air and supply air to deposit at higher rates than at other surface areas in the room.

This type of soiling does NOT necessarily mean that the ductwork needs to be cleaned. What this type of soiling does mean is that the concentration of fine dark particles (i.e. combustion particles from motor vehicles, stationary sources, copier or printer toner, etc.) in the air are high. The solution is to reduce the concentration of fine dark particles in the room air and the ventilation system supply air by controlling outdoor sources by upgrading the ventilation system air filters and/or controlling indoor sources by ensuring that office copy equipment is operating correctly or installing special filters or exhausts. In addition to controlling the sources of these particles, janitorial activities should include cleaning of stained areas around diffusers to remove particle buildup.