To understand dust collection systems, it helps to know how particulates interact with filter media—that is, the filtration mechanisms.

The most commonly understood is SIEVING, where filter fibers block particulate from passing through because openings in the filter media are smaller than the particles. But this is not the only mechanism that filters particles from an airstream. In fact, sieving plays a relatively small role in capturing the very fine particles generated in laser and plasma cutting.

When dust particles make physical contact with a fiber's surface in the filters structure, they stick, and it is this principle that allows filters to capture much of the particulate produced by thermal cutting.

INERTIAL IMPACTION is the filtration mechanism commonly at work when large, heavy particles begin to follow the airstream around a fiber, but because they have too much mass to make the turn, impact the fiber. For illustration purposes, consider air passing over a car windshield in a snowstorm. Smaller, lighter snowflakes follow the airstream and pass over the car windshield without making contact. Heavier, wet snowflakes fail to make the changes in direction and impact the windshield.

INTERCEPTION is the mechanism at work when the outer diameter of a particle is just large enough that it will graze the fiber surface as it attempts to pass. That brief touch represents enough contact with the fiber surface to cause the particle to adhere.
The final filtration mechanism is **DIFFUSION.** This is the primary filtration mechanism effecting sub-micron particles. These particles are so small that individual air molecules around them influence how they move within the general airflow. The particles are bounced around within the airstream, moving every which way. Consider trying to get to your seat at a sports stadium during a break in the action. You may be moving with the general flow, but if you are really small, you get bumped and jostled as you move toward your seat. Your path is not very straight, and, if you happen to be near the edge of the crowd, you bump into rails or a wall at some point. Those patrons are like air molecules jostling you, a small particle until it strikes a surface.

Different filtration mechanisms have different levels of filtration efficiency, depending on the particle size being filtered.