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Shop Safety



PVC Pipe Dangers Debunked

4-in.-dia. plastic duct is unlikely to cause a static-induced blast in a home shop

BY ROD COLE

Home-shop dust-collection systems have become increasingly popular, but their safety has been hotly debated. The primary issue is whether PVC pipe is safe for use as ductwork. Many claim that sparks in PVC pipe due to static electricity may ignite the dust cloud in the pipe. The specter of a giant fireball consuming a shop and home is repeatedly raised. Others claim you can ground PVC, thus ensuring its safety.

Two years ago I had to decide for myself: PVC or metal ducts for my basement shop. Being both an avid woodworker and a scientist, I made a concerted effort to understand the issues. Fortunately, I have the resources of the library at the Massachusetts Institute of Technology (MIT) and a professor just down the hall who's an expert in the physics of lightning.

I studied static discharge from insulators, as well as the more general topic of dust ignition. I found that it's extremely unlikely for a home-shop-sized system to have a dustcloud explosion. Commercial-sized systems have had dust-cloud explosions, but different phenomena come into play in larger systems, and 4-in.-dia. PVC is too small for use in such systems, where the airflow is much greater than in a home shop.

Sparks are unlikely in 4-in.-dia. PVC pipe

In my research I turned to the Journal of Electrostatics, a publication that covers the effects and interactions of static electricity, particularly in commercial applications. This journal has published a number of studies on the combustibility of dust clouds by electrostatic sparks. The researchers were able to determine some of the conditions necessary to create sparks and ignite a dust cloud.

Sparks can be caused by a variety of conditions—one of which is static electricity. However, sparks are unlikely inside a standard 4-in.-dia. PVC pipe that would be used in a home shop, and more importantly, any such sparks are extremely unlikely to be strong enough to cause an ignition. I can't say it is truly impossible, but it is very close to impossible, and I do not know of a single instance. The difference

between metal and PVC is that one is a conductor (metal) and the other is an insulator (PVC). A conductor allows electrical charges to flow freely. If any excess charge is not given a path to ground, it can arc, creating a spark that in certain conditions can ignite a flammable substance such as dust. Grounding provides a path for this excess charge to flow harmlessly to the earth, which is why dust-collection systems in all commercial shops are required by code to be grounded. However, an insulator is a very poor conductor of electricity. While it's possible to get a static shock from the outside of a PVC pipe, it is highly unlikely for sparks to occur inside.

Dust collectors with 3 hp or less pose little danger

I published my findings on my web site. Rob Witter, a representative at Oneida Air Systems Inc., which makes dust-collection systems, said he largely agreed with my research. "We as a company have been trying to trim away at these misunderstandings for years," he said. He added that plastic pipe will "probably never cause a problem" in a home shop. Finally, he pointed out that the National Fire Protection Association (NFPA) puts no regulations on dust-collection systems of 1,500 cu. ft. per minute (cfm) or less.

All of this discussion applies to home-shop-scale systems. Larger systems, complete with ducts and filters that move more than 1,500 cfm, require at least 3 hp and are not found in most home shops. Larger systems need larger ducts, and with that you have to begin to worry about more complicated forms of static sparks.

The real hazards

In a home shop, the dust-collection fire hazards you need to worry about are not in the ductwork but in the collection bag or bin itself. A fire may be caused by a spark, which can occur when a piece of metal is sucked into the ductwork and strikes another piece of metal, or by embers from a pinched blade. The spark or ember settles into the dust pile to smolder, erupting into a full-blown fire hours later, often after the shop has been shut down and no one is there to respond. For this reason, my most important recommendation is to empty the collected dust every day or at least keep it in a closed metal container. As you can see from the photo of my shop, I ended up plumbing it using 4-in.-dia. PVC pipes and did not ground them. I feel perfectly safe using them this way.



- 1. Buildup of dust in machines.** Hot metal that finds its way to the dust that collects at the base of a saw could start a fire there or be sucked up into the dustcollection system.
- 2. Cutting a nail.** Not only does this damage a blade, but it can also send a very hot piece of metal into your saw cabinet.
- 3. Metal in the dust pile.** When cleaning shop, it's easy to sweep up screws, washers and nails. Dust from the floor should be sifted by hand, before it's introduced into a dust-collection system.
- 4. Sparks in the bag.** Metal sucked into the dust collector's fan blade may cause a spark and ignite sawdust in the filter bag.

Rod Cole is a woodworker and mathematician who lives in Lexington, Mass.

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