

What goes on in your printer when you're not looking?

Did you ever wonder how clicking Print turns what you see on the screen into words and images on a page? Or why the paper is always warm fresh from the copier?

It all starts with static electricity—the same energy that zaps you getting out of a car, or that makes your hair stand on end when you take off a wool hat. Static electricity is the buildup of electrical charge on an object.

The charge can be negative or positive. Since oppositely charged atoms are attracted to each other, objects with opposite static charges attract each other.

What does static electricity have to do with printing and copying? Laser printers and copiers use static electricity to position toner on paper.

Toner is a very fine, positively- or negatively-charged powder, made up of pigment (the dye that determines what color appears on the paper) and plastic. Toner is stored in a revolving drum inside a toner cartridge. When it's time to print or copy a page, the drum's surface drum is given a positive electrical charge.

To print a page, laser printers shine a tiny laser across the surface of the drum. Each point that the laser touches loses its charge. When the pattern is complete, positively-charged toner is released over the surface of the drum. Because positive charges repel each other, toner gathers on the points touched by the laser.

How does the laser know where to shine? When you print a document, your computer breaks each page down into tiny dots, creating a pattern for the laser. There may be between about 300 and 1600 of these dots per inch of page.

Copying uses the same principles, but applies them a little differently. The copier shines a bright light on the original page. As light reflects off the white portions of the page, it shines on the print drum. Where the light hits, the drum loses its charge, drawing negatively-charged toner to the dark areas.

As paper is pulled into the printer or copier, it is given a strong, temporary charge that causes the patterned toner to leave the drum and cling to the paper. So that the paper won't stick to the drum, a wire is used to get rid of the charge as soon as the toner is on the page.

The Anatomy of a Toner Cartridge



So what keeps the toner on the paper if the charge is gone? Not much! At this point, the toner is just resting on the paper. If you were to brush your finger against the unfinished page, the toner would smear.

To permanently stick the toner to the paper, the page moves through a pair of heated rollers called the fuser. The fuser melts the plastic in the toner powder, binding the pigment to the paper. The heat from the fuser is what makes freshly printed pages warm to the touch.

Once the toner has been fused to the paper, the toner drum surface is "erased" by a bright light, given a fresh, positive charge, and prepared for the next page.

And all of this happens in one to three seconds!