

# FIRE FINDINGS

Information for Broadening Your Knowledge of Fire Origin and Cause

## Cigarette fires in fabrics: After 500 tests, these results, too, may be difficult to fathom

*Nearly a decade ago, we published an article in Fire Findings, Vol. 6, No. 1, about the likelihood of cigarettes igniting various forms of paper trash. For those tests, we placed lit cigarettes in trash and observed what happened.*

*Five times out of 300, flame ignition resulted, but the cigarettes simply burned out during the other tests. The results, to put it mildly, have generated a lot of comments over the years, as some readers think (incorrectly) that we implied ignition couldn't occur.*

*Our point, however, was that it is far from a given that flaming combustion will occur. In fact, our tests showed it was the exception and not the rule, at least under the test scenario we devised.*

*This issue, we revisit the topic, but with a twist: Instead of using paper trash, we placed lit cigarettes on various articles of clothing to judge the likelihood of the cigarettes igniting a certain type of fabric.*

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by Jack L. Sanderson, Editor

To the general public, it would seem a natural: Someone drops a cigarette into a pile of clothing on the floor and the clothing catches fire. They have probably seen it happen many times in movies or on television. Problem is, what makes good entertainment isn't necessarily what happens in real life.

So, we set out to learn what would really happen when lit cigarettes come in contact with certain fabrics. To start our experiment, we went on a buying frenzy for shirts, blouses, sweaters, skirts, pants, shorts, T-shirts, suit

jackets and the like. We purchased used items since most clothing in someone's home has been typically laundered many times.

Considering the possibility that different fabrics would be easier or more difficult to ignite, we chose fabrics that most people have on hand: cotton, 50/50 cotton-polyester blend, denim, nylon, polyester, silk and wool. This enabled us to test both natural and synthetic fabrics. We also purchased a variety of popular brands of cigarettes

(Continued on page 2.)

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## FAST FACTS

### Ignitable liquid traces in child's room may be from toys

While most parents wouldn't ever store an ignitable liquid in their child's bedroom, after a fire, you may find evidence they did exactly that.

The U.S. Consumer Product Safety Commission (CPSC) recently issued a recall alert for plastic toy eyeballs containing kerosene. If you find traces of kerosene or other ignitable liquid in a child's bedroom or playroom, but no other signs of an accelerant, try to find out what sort of toys were present before the fire.

Seems strange, but people have even left oil-filled lamps in children's rooms, so, it's always good to stay observant.

### Use Ohm's law to figure load

With just a few devices, a homeowner can quickly overload a circuit, but do you know how much is too much?

A 15-ampere receptacle can carry 1,800 watts of power. Ohm's law —  $P \text{ (watts)} = E \text{ (volts)} \times I \text{ (amps)}$  — tells us a 1,400-watt hair dryer is rated at 11.7 amps, a 1,300-watt vacuum cleaner at 10.8 and a 1,200-watt space heater at 10 amps. Assume  $E$  (voltage) is 120, which is typical for U.S. residences.

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Page	Subject
1	Cigarette fires in fabrics
4	NFPA 921: Wildfire chapter
5	Something for Nothing
6	Review: Kirk's 6th edition
7	Special Report: Arc mapping follow up
12	How it Works: Air conditioning systems
14	In-court tips and Tools
15	Techniques
16	Recalls and problems

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(Continued from page 1.)

## Cigarette fires in fabric ...

Figure 1. To test what burning cigarettes would do to a variety of fabrics, we bought many brands of popular cigarettes, lit them and placed them atop and in the folds of articles of clothing. In all, we burned 500 cigarettes.



and built an igniter to light the cigarettes (Figure 1).

Our test procedure was simple: We laid out clothing so it was "folded

in" from one to several layers, lit the cigarettes and placed them on top of or enfolded into the clothing.

We quickly learned that dropping a

lit cigarette onto any sort of clothing wasn't a good thing for the garment. Regardless of the fabric, the cigarette left a burn mark. In wool the burning cigarettes left blackened areas the lengths of the cigarettes, but damage didn't often extend beyond the areas in contact with the cigarettes.

Fires often smoldered in the cotton items a short way beyond the cigarettes and sometimes through layers below the clothing. With the nylon and polyester items, the cigarettes seldom burned beyond the "footprint" of the cigarette and often left the cigarette butt fused to melted fabric (Figure 2).

The silk articles often burned beyond the cigarettes, made a lot of smoke and the material was fragile after the event. In the denims, the smoldering often continued beneath the cigarettes,

## Feds not enacting 'fire-safe' cigarette legislation, so states beginning to step up to the task

Fire-safety advocates have long fought for cigarettes that self-extinguish. Careless smoking, after all, has been the leading cause of fire deaths for many years. If only the cigarette industry could come up with a cigarette that would go out if someone stopped puffing it.

Some sort of legislation at the federal level could mandate manufacturers to incorporate such a "feature," but gridlock in the U.S. Congress and competing interests of congressional members have prevented such a law from being enacted to date. Several states have gotten tired of waiting on the feds: New York legislators, for instance, passed the first fire-safe cigarette law in 2003. Since then, laws have also taken effect in California and Vermont. Another 11 states have passed legislation, with the laws still to go into effect. Several other states have followed suit and are in the process of introducing legislation.

### States requiring the tobacco companies to use ASTM test method

Aiding states' efforts is the development of the American Society of Testing and Materials (ASTM) International

E2187, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*, which predicts a cigarette's capacity to ignite bedding and upholstered furniture. (See related Editor's Note in *Fire Findings*, Vol. 11, No. 4.) For example, Massachusetts, one of the states that has passed the law but is waiting for it to take effect, says in Chapter 64C, Section 2B of the Massachusetts General Laws: (a) No cigarettes may be sold or offered for sale in the commonwealth or offered for sale or sold to persons located in the commonwealth unless the cigarettes have been tested in accordance with the test method prescribed in this section [ASTM E2187-04] and meet the performance standard specified in this section and unless a written certification has been filed by the manufacturer with the secretary in accordance with section 2C.

The ASTM test method is relatively straightforward. It involves the ignition of 40 sample cigarettes, with the lit cigarettes placed on a substrate of 10 layers of filter paper and allowed to burn. To pass the test, no more than 25 percent of the cigarettes in the sample are allowed to burn the length of the cigarette.

(Continued on page 3.)

sometimes burning holes through multiple layers of material (*Figure 3*).

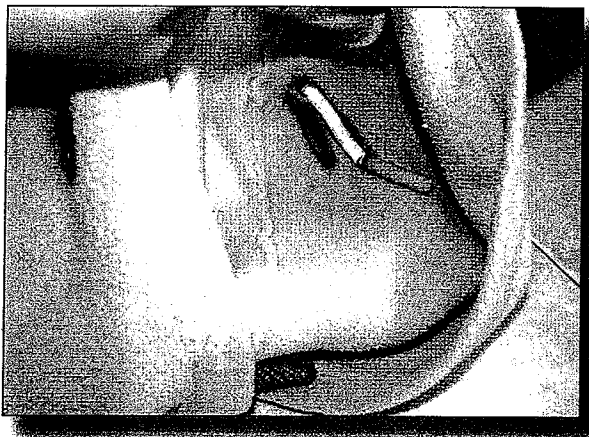
### No ignition after 500 tests

Of the tests conducted in our laboratory with no appreciable air movement, there were three constants: Of the 500 cigarettes we lit and placed in or atop the articles of clothing, every item self-extinguished, fire damage was always limited to the immediate area around a cigarette and not one test resulted in flaming combustion.

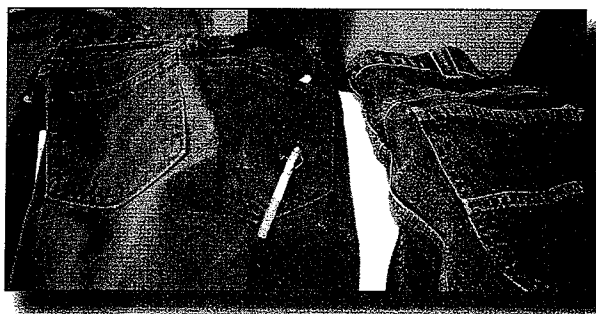
While 500 represent a fairly significant number of burn tests, our results do not prove flaming combustion could never occur. They do show, however, it is very difficult to make the transition from limited smoldering combustion to flaming combustion in still air.

We found, however, that when we changed conditions slightly, ignitions would occur fairly dependably. All we had to do was add a bit of air movement. For instance, we turned on a ceiling fan, which was 8½ feet above our test station, and set it to the lowest setting, then placed the smoldering cigarettes and clothing items under the fan.

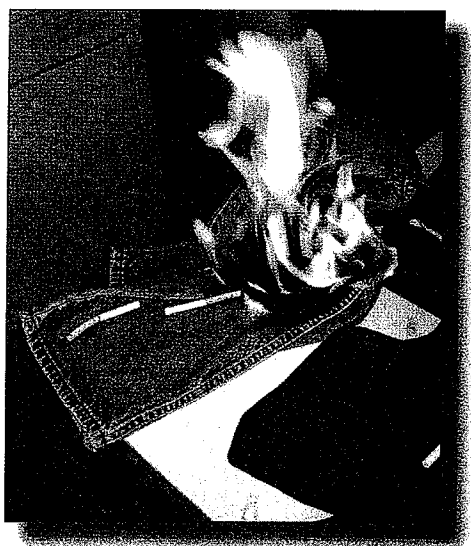
We checked the wind velocity at the clothing and found the highest reading was slightly more than 2.1 miles per hour, certainly not a roaring gale. Yet, the cigarettes ignited the fabrics fairly dependably in those conditions, with rather good-sized fires resulting (*Figure 4*). **FF**



*Figure 2. Even when we folded over "fuzzy" polyester materials, the cigarettes only burned small holes through the fabric in contact with them.*



*Figure 3. The cigarettes that we laid on top, stuck in pockets and placed in folds of denim failed to burn far beyond the cigarette itself.*



*Figure 4. Just a slight breeze was all it took to fan tiny glowing fibers around a burn pattern beneath the cigarette and ignite a fire that rapidly grew in size.*

*(Continued from page 2.)*

### Fire-safe cigarettes ...

Manufacturers have reportedly employed several approaches to pass the test, but the most common is to incorporate two or three bands of less-porous paper (less porous than the remainder of the cigarette wrapping paper) along the length of the cigarette. The bands apparently reduce the amount of air available for combustion when the "burn front" reaches a band. When the smoldering reaches any one of the bands, chances are good the fire will self-extinguish for lack of oxygen. If it doesn't go out at the first band, it has two (or three) more chances to do so.

R.J. Reynolds Tobacco Company has argued that while reducing fires due to careless smoking is an admirable goal, even cigarettes that pass the new fire-safe test have the potential for igniting material in the real world. Even so, adherence to ASTM E2187 will likely lessen the *number* of fires associated with carelessly discarded or abandoned cigarettes.

R.J. Reynolds has also expressed concern with the name "fire-safe," saying it will cause people to become less vigilant about cigarettes. Since a sizable number of cigarette-related fire deaths occur after smokers fall asleep, it seems unlikely they will be very concerned whether the cigarette is rated "fire-safe" or not. So far, news sources say New York's statistics seem to indicate fire-safe cigarettes are less fire prone. **FF**