



Facts About Fabric Flammability

What do you know about how clothes burn? Have news stories about cancer-causing chemicals in flame retardant clothes caused you to "turn off" whenever the subject is mentioned? If so, take a few minutes to read this publication and review the facts about fabric flammability. You may be able to prevent a severe and crippling burn injury.

FACT 1. Most clothing and household textiles will burn if set on fire. Clothing and textiles don't burn unless ignited or heated by an outside source. To start a fire, all you need is heat, not necessarily flames. Burning cigarettes, matches, candles, gas flames, fireplaces, stoves and space heaters are some of the things that can set clothing and household textiles on fire. Fires also have been started by cigarette lighters and flammable liquids, such as charcoal lighter fluid, gasoline and paint thinner that were exposed to a spark or flame. Remember that vapors from flammable liquids can travel across a room and be ignited by a pilot light or other flame source, adding to the risk of fire.

You can prevent fires from these sources by recognizing the danger and taking extra care. For example, be sure decorative candles are on a sturdy base and can't be tipped over. Store matches and flammable liquids out of the reach of young children. Don't reach across lighted gas flames or hot coils on kitchen ranges when wearing full garments or wide sleeves. Stay away from space heaters so your clothes can't ignite. Never reach into a wood burning stove or fireplace while wearing any long sleeved garment. Don't smoke in bed — bedding will burn too.

FACT 2. Clothing labels tell if fabric is flame resistant. You won't be able to tell just by looking at a fabric if it is flame resistant or flame retardant,

so you need to read the labels. If a fabric is flame resistant, the label will tell you. If the label doesn't say, assume the fabric will burn rapidly.

Be sure you understand terms used on clothing labels and other products. This chart may help:

If it says:	It means:
Flammable	Will burn readily
Inflammable	
Combustible	
Fire resistant	Will not burn readily,
Fire retardant	may burn slowly,
Flame resistant	usually will self-extinguish when source of
Flame retardant	heat is removed.
	Will not burn
Fireproof	
Flame proof	
Non-combustible	
Non-flammable	

Some of the most highly flammable fibers are cotton, acrylic, acetate, linen and rayon. Wool and silk have some natural flame resistance, but they also burn easily depending on how they have

been woven or knitted or finished (see Fact 5).

Synthetic fibers that are flame resistant include modacrylics, some nylons, some polyesters, vinyl/vinyon matrix and modified acetates. No flame proof fibers are used in ordinary wearing apparel. Table 1 ranks the burning behavior of the fibers from the most to least hazardous. Table 2 lists some of the flame resistant fibers by their trade names, and Table 3 gives trade names of flame resistant finishes applied to fibers that are not inherently flame resistant.

FACT 3. Flame resistant fabrics burn slowly. Flame resistant or retardant fabrics are those that ignite with difficulty, burn slowly when set on fire and go out or self-extinguish when the source of flame is removed. Because of this, flame resistant fabrics allow more time to remove the clothes or put out the fire. This little margin of safety can make a big difference in the degree and extent of burn injury.

Table 1. Burning characteristics of fibers.*

Cotton/Linen — Burns with hot, vigorous flame, light colored smoke and leaves red glowing ember after flaming stops. Does not melt or draw away from the flame.
Rayon — Burns similarly to cotton and linen except that it may shrink up and become tighter to the body.
Acetate — Burns with a rapid flame and melts when burning. May melt and pull away from small flames without igniting. Melted area may drip off the clothing carrying flames with it. When flames have died out, residue is a hot molten plastic and is difficult to remove from any surface.
Acrylic — Burns similarly to acetate except that it burns with a very heavy, dense black smoke. It drips excessively.
Nylon, Olefin and Polyester — Burns slowly and melts when burning. May melt and pull away from small flames without igniting. Melted area may drip off clothing carrying flames with it but not to the extent of acetate and acrylic. Residue is molten and hot and difficult to remove. May self-extinguish.
Wool and silk — Burns slowly and is difficult to ignite (especially in winter garments). May self-extinguish.
Modacrylic and Saran — Burns very slowly with melting. May melt and pull away from small flames without igniting. Self-extinguishes.
Aramid, Novoloid and Vinyon — Chars; does not burn.

* Listed from less safe to more safe.

Table 2. Flame resistant fiber trade names

Generic class of fibers	Trade names
Acetate	FR acetate
Aramid	Nomex, Kevlar (primarily for safety apparel)
Biconstituent (vinal/vinyon matrix)	Cordelan
Glass	Fiberglas, Beta
Modacrylic	SEF, Verel, Kanekalon, Lufnen
Novoloid	Kynol
Nylon	FR nylon
Polyester	Tetoron Extra, Trevira 271, Toyobo GH
Rayon	PFR rayon
Saran	Saran, Rovana
Vinyon	Treviron, Leavil, Clevyl T

Table 3. Flame resistant finish trade names.

Generic class of fibers	Trade names
Acetate, Cotton, Rayon	Fyrol, Pyroset
Nylon	Nyloset, Nylo-Gard, Celluset
Polyester	Antiblaze 19, Pyron
Wool	Zipro

Some people think flame resistant fabrics are safer than they really are. Flame resistant fabrics are not designed to protect you from burn injury if you are caught in a burning building or reach into a wood burning stove or an oven. Firefighters do have specially designed clothing to withstand very high heat for limited amounts of time, but the flame resistant clothes usually found in stores are not designed for that kind of protection.

FACT 4. Most flame resistant fabrics today do not have chemical finishes. At first, fabrics were made flame resistant by adding extra chemical finishes to the surface in the same way you might add frosting to a cake. Now the fibers have changed to be inherently flame resistant so that no extra chemical finish is needed. You could say they changed the recipe for the cake because the inherently flame resistant fibers have

different chemical formulations than regular fibers of the same generic class. Two polyesters that look and feel the same might have different burning characteristics because of this. To know if a fabric is inherently flame resistant, one must read the label.

Children's sleepwear with a tris finish applied has been taken off the market because tris was linked to cancer in laboratory animals. Flame resistant fabrics and clothing with a tris finish are no longer available in reputable stores, but it pays to avoid buying bargain priced children's sleepwear that have the labels cut out. Some of these banned garments were sold illegally in retail outlets as late as 1981.

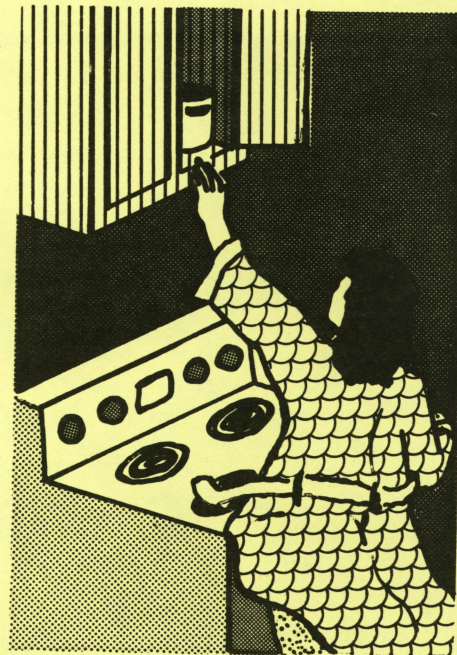
Some work clothes may have flame resistant finishes, but tris is not used on these either. Since adult clothing does not have to meet the test that children's sleepwear does, the flame resistance of these items may be gained by finishes and may not be quite as permanent. If members of your family work around possible ignition sources, it may be a good idea for them to wear flame resistant coveralls or work clothes. Laboratory or uniform supply companies usually sell flame resistant work clothing.

FACT 5. The way a fabric is made affects how it burns. In addition to fiber content, the way a fabric is made — whether knitted or woven — affects the way it burns. Heavy, tightly constructed fabrics ignite with difficulty and burn more slowly than light, thin or loosely constructed fabrics. Thus, in general terms, summer weight fabrics are more flammable than winter weight fabrics. However, heavy weight fabrics will burn **longer** when ignited because there is more flammable material present.

Fabrics that are thin or open have more surface area exposed to the air, so they tend to ignite and burn quickly and freely. Fabrics that are pile, napped or have a brushed surface of fine fibers also are quite flammable because of greater surface area exposed to air, supplying generous amounts of oxygen to each fiber.

Fake fur fabrics are often made of modacrylic fibers that are inherently flame resistant. If the backing of the fur is cotton, the whole fabric can burn if ignited. Napped fabrics that contain wool may be somewhat flame resistant, but

napped acrylic fabrics are very flammable — and the two may look and feel very much alike.



FACT 6. Clothes that fit closely to the body are less likely to catch fire than those with a loose fit. Since clothing has to come into contact with an ignition source to catch fire, keeping it a safe distance from ignition sources helps prevent fires. Clothes that trail or float away from the body as a person moves are more likely to ignite than close fitting styles. Sleeves can be ignited as you reach across a gas flame or electric coil on a kitchen range. Loose fitting or maternity tops can catch fire at the hem as a person reaches above a kitchen range to get something from a cupboard. Lace ruffles, full sleeves and puffy designs that tend to extend from the body are more apt to catch fire than clothing without these features. Close fitting clothes are safer than others because they are less likely to be ignited accidentally and have less air surrounding them to support burning; therefore, they burn more slowly.

Clothes that are easily removed also can help prevent serious burns. If a garment can be quickly stripped off when it catches fire, injury may be less severe or avoided altogether.

Look for quick release features such as snaps and hook and loop fasteners such as Velcro® on wrap-style adult clothing items when you shop — especially when the clothes are highly flammable. Flame

resistant fibers are a help, but quick release features do make a garment safer.

FACT 7. Some groups are more likely to be burned than others. Clothing burn injury records indicate that men aged 18 to 44 are more likely to be injured in clothing related fires than women in the same age group. For men, generally daytime clothing is involved, and the fire usually starts because of some job-related hazard. When women are burned, generally the clothes are ignited in the kitchen, but night clothes are also involved.

Although the number of victims in this middle aged group is high, injuries are often less severe than they might be. Researchers think this is because middle aged people usually have some knowledge of fire safety and can act quickly to put the fire out.

In contrast, children and the elderly are more likely to die from clothing related burn injuries than middle aged persons when their clothing catches fire. Children may not know what to do to put the fire out, and they act in a way to make it burn more quickly. Early data on burn injuries of children led to the Children's Sleepwear Flammability Standard (see Fact 10).

The elderly of both sexes frequently suffer burn injury. They may not respond as quickly to put out a clothing fire because they are often less able than younger persons to detect changes in temperature and may not feel the heat. Any delay in action to extinguish a fire means it is more difficult to put out and can cause a more serious injury.

FACT 8. Burn injuries from clothing fires are more severe than burn injuries from other fires. About 40 percent of the people treated in emergency rooms for clothing fires are admitted to the hospital. People who suffer clothing burn injuries generally have deeper burn injuries that affect a larger area of the skin surface than non-clothing related burn victims. Clothing burn victims are more likely to die as a result of their injuries than persons burned another way. They spend more time in the hospital, and their treatment is more expensive than non-clothing burn victims. Doctors and nurses consider burn injuries as the most painful of all injuries. Burn injuries can cause extremely severe pain and disfigurement.

It is encouraging to see that deaths from clothing fires are decreasing most rapidly among children, which may be partly a result of the requirement that children's sleepwear be flame resistant and partly because of increased consumer awareness.

FACT 9. Governmental flammability standards do not guarantee personal safety or mean textile products are flame proof. The federal government has regulated fabric flammability since 1953 under the Flammable Fabrics Act. In 1967, this law was amended to authorize more research on fabric flammability so that more stringent safety standards could be set. In the early 1970s, standards were established for carpets and rugs, children's sleepwear sizes 0 to 14, mattresses and mattress pads.

The Consumer Product Safety Commission (CPSC) now administers this law and the various regulations that have been enacted. Carpets and rugs, children's sleepwear, mattresses and mattress pads must pass specific flammability tests to be sold in the United States. The test methods are not perfect, and scientists often disagree about whether the tests chosen are the most appropriate ones.

The standards do not regulate garment design or ease of removal. Some scientists argue that if garments were easier to remove, burn injury would be reduced in the event of a clothing fire. Others point out that changing garment design could reduce the possibility that the clothes would ignite in the first place.

None of these standards considers the heat on the skin that causes the burn injury or attempts to measure toxic smoke emitted during burning. Toxic smoke can cause death. No standard gives any consideration to changes that may result if fabrics are soiled or set on fire in other ways. For example, mattresses made of polyurethane foam or cellulosic padding materials that have passed the cigarette char test (described in Fact 10), may catch fire if exposed to a burning cigarette lighter or to a book of burning matches.

Some people feel government regulation costs too much. Since recent data show less frequency of clothing-related burn injury than before, it seems to be less of a problem. Meanwhile, the costs of testing programs and new fibers are passed on to consumers in the form of

higher priced merchandise. Some consumers feel the costs exceed the benefits gained in terms of decreased risk of injury. Others feel it is a small price to pay for increased safety. Government involvement in this area will continue to be controversial.



FACT 10. Carpet and rug, sleepwear and mattress flammability standards offer a margin of safety. Each standard does offer a margin of safety that consumers did not have before the standards were initiated. Each is based on tests scientifically designed to take into consideration the specific situations found to be associated with fires in a particular product category.

With carpets, a major concern was the way flames spread along the surface of the carpet and set furniture and drapes on fire. The test uses a burning methanamine pill. The carpet passes the test if the flame does not spread more than 3 inches in any direction — an area that is marked off with a steel ring.

With mattresses, smoldering fires often started from cigarettes that were dropped as people smoked in bed. The mattress test requires that nine burning cigarettes be placed on the bare mattress and another nine between two sheets used to cover the mattress. The mattress passes the test if the charred (burned) area does not exceed 2 inches in any direction from the cigarettes. The same test is used on mattress pads.

With children's sleepwear, early evidence showed that children under 5 were more likely to be burned in clothing related fires than the general population. Sleepwear garments were most often involved. Since young children are often unable to understand the danger or protect themselves, scientists devised a stringent, vertical flame test for their sleepwear. Small fabric samples are cut, slipped in a steel frame, dried to remove moisture, hung in a special cabinet and exposed along the bottom edge to a gas flame for 3 seconds. The average char length (burned area) cannot exceed 7 inches, and no specimen can burn the entire length. The fabric must be able to "pass" the test after it has been laundered 50 times.

FACT 11. Flame resistant clothing needs special care to maintain its flame resistance. While many people may not consider choice of detergent important, it is necessary to use phosphate-based detergents rather than true soaps to care for flame resistant clothing. (If you don't know the phosphate content of your detergent, check the label.)

In hard water areas, soaps coat fibers with a film that is flammable and causes fabrics, even inherently flame resistant ones, to burn. If you live in an area where

there is a ban on the sale of phosphate-built detergents, the CPSC recommends the use of a non-phosphate, heavy duty liquid detergent rather than soap or a carbonate-built detergent.

Inherently flame resistant garments are not adversely affected by bleaches and fabric softeners, but use of these on flame resistant finished fabrics is not recommended. Some workers' protective clothing may be made of chemically finished cotton fabrics. Generally, wearers of flame resistant protective clothes can maintain flame resistance by following advice on garment labels.

On Feb. 24, 1985, the Children's Sleepwear Standard was amended to include precautionary care instructions. These must be placed on the reverse side of care labels. This must be a permanent label. Placement must be readily visible. The side of the label facing you must indicate "Care Instructions on Reverse."

Lettering must be conspicuous, permanent and legible. When displaying the item for sale, the label should be easily manipulated so that the entire text of the care instructions can be seen and read. In the event the label cannot be manipulated, the package or hang tag must also give the care instructions.

FACT 12. You can sew your own flame resistant clothing. Inherently

flame resistant, polyester knit-type flannelettes are available as piece goods in some fabric stores. Some are designed to appeal to young boys and girls, but some of the floral or geometric prints and plain colors would be fine for adults, too.

When you shop for fabric, pay attention to labels on the end of fabric bolts. Flammable cotton/polyester flannelettes are often sold side-by-side with flame-resistant polyester fabrics. You'll have to read the labels because you won't be able to feel the difference.

Some flame resistant sleepwear is generally not available in adult sizes, and it may be a good idea to sew some for the elderly persons in your family. Use as few seams as possible. Don't bother with fancy seam finishes. Plain seams are best because they require less thread. Home sewn garments tend to burn longer along seam lines when more thread is used.

Pay attention to garment fit. Make your home sewn garment with long or full length front opening so they are quick to pull off or step out of. Sleeves that are three-quarter length or end with stretch cuffs that fit closely and are easy to remove may be less of a hazard. Keep garment length easy to manage, and avoid excess fullness.

Adapted by Ernestine Porter, University of Idaho Extension Textiles and Clothing Specialist. Permission to reprint North Central Regional Extension publication 174 granted by Janis Stone, Textiles and Clothing Specialist, Iowa Cooperative Extension Service.

No endorsement of companies or their products mentioned is intended, nor is criticism implied of similar companies or their products not mentioned.