

Fire Is The Third Leading Cause Of Death And Injury in the U.S.

In the United States, accidental death and injury from fire ranks third following automobile accidents and falls. Over the past twenty years, an average of 10,000 people have died and approximately 60,000 have been injured EVERY YEAR, many seriously disfigured, a result of fires. The combination of building interior furnishings and smoking materials alone contribute to more than thirty percent of these annual fatalities and injuries.

Smoking materials, specifically cigarettes, cigars, and pipes, are the primary hazards associated with fires where upholstered furniture or mattresses are ignited. Typically, the smoking material is dropped onto an item of furniture or bedding and remains unnoticed. The resulting smoldering or flaming combustion generates considerable quantities of smoke, toxic gases, and heat. The most likely cause of death is suffocation from breathing carbon monoxide and carbon dioxide.

Fires also occur when open flame ignition sources are present. Open flame sources include matches, lighters, and candles. A fire started by an open flame ignition source can spread rapidly, causing extensive damage and quite possibly injury or death to the individuals involved.

Flammability Testing

In 1954, the United States Congress passed the Flammable Fabrics Act that required fabrics to meet mandatory standards. The first test was CS 191-53, a simple test that identified hazardous, flammable fabrics from those formerly considered safe for sale into commerce. Standards were later developed for identifying hazardous, flammable mattress ticking. There are other tests that are quoted when the flammability of mattress ticking and interior furnishing fabrics is discussed. Some of

these tests are mandatory while others are voluntary. Some are component tests performed only on fabric or foam, while others are composite tests performed on the product as it would be purchased and used. The following is a brief description of these tests, how they are performed and how the test results should be interpreted.

Federal Flammability Standard Title 16CFR1632

(Formerly DOC FF 4-72) – The United States Government Standard For The Flammability Of Mattresses. May be referred to as CTB 106.

The 16CFR1632 test is sometimes referred to as the cigarette test. This is a component test that measures the horizontal flame spread of a lighted cigarette placed on top of the ticking fabric. The burned area on the ticking is measured after the cigarette has burned its entire length. If the burned area is over one inch, it does not pass. The Class A test is performed by placing the ticking over a thickness of cotton batting and the Class B test is performed with the ticking over urethane foam.

MVSS 302 - The Motor Vehicles Safety Standard Test Required For Fabrics Used In Automotive Vehicles

This is a component test that measures the horizontal rate of flame spread on a fourteen inch strip of fabric ignited by an open flame from a Bunsen burner. If the flame spread is greater than four inches per minute, the fabrics are not considered safe for automobile interior application. This is a component test and there are fabrics that will pass this test, but will fail composite tests when they are used in conjunction with flammable materials in cushions.



NFPA 101 Life Safety Code

The NFPA Life Safety Code® Handbook is a guide that lists safety requirements in public occupancy buildings. In regard to fire standards for mattresses it basically states if a facility is protected by an approved automatic sprinkler system, follow city, state and the federal regulation 16 CFR 1632. If there is not an approved automatic sprinkler system mattresses must pass California Technical Bulletin #129.

NFPA 701 Small And Large Scale

The National Fire Protection Association component tests that measure the vertical flame spread of fabrics intended for draperies, curtains, and other loosely hanging decorations. A strip of cloth is suspended over a gas flame and the resultant char (burn) length and/or after-flame of the sample determines if the sample passes or fails. The maximum allowable char lengths vary according to the weight of the fabrics. Since this is a component test much like the MVSS 302 test, it should be used only as a screening test for fabrics and not relied upon when these fabrics ultimately will be made into products containing additional materials. Draperies, for instance, when constructed with blackout linings, may fail this test even though the individual fabrics pass.

California Bureau of Home Furnishings Technical Bulletin #117

This is a component fire retardancy test that is applied to filling or covering materials such as fabric, polyurethane foam or cotton batting. The test varies for different items, but basically it is a vertical flame test which measures after-flame (time it burns after source of flame is removed) and char length. Other 117 test procedures involve using a cigarette on treated cotton batting with a sheeting cover over it, or a cigarette placed in a crevice of folded fabric on a mini chair mock-up.

California Technical Bulletin #121

A full scale composite test that subjects mattresses to open flame ignition from ten double sheets of newspaper burning in a metal wastepaper basket. This ignition source is placed under the bed in a test chamber equipped to monitor weight loss, ceiling temperature, concentration of carbon monoxide, and smoke opacity. If any one of the first three test criteria is not met, the product does not pass. This test is mandatory for products used in the State of California in high risk occupancy buildings such as prisons nursing homes and health care facilities. As a composite test, it addresses the flammability of the end product. If there is 10% of weight loss, the mattress fails.

California Technical Bulletin #133

A full scale composite test that subjects seating furniture to an open flame ignition from five crumpled sheets of newspaper placed in a small metal and wire container. The test is conducted in a chamber by placing the container on the seat and igniting the newspaper. Air temperature, smoke, carbon monoxide, and weight loss are monitored. As a composite test, it addresses the flammability of the end product. This test is required for Seating Furniture to be used in public occupancies.

Underwriters Laboratories Proposed Standard 1895

A full scale composite test of mattresses and box springs similar to California Technical Bulletin 121 with the exception of the ignition source and its placement. The UL 1895 open flame ignition source is a five-pound crib of kiln dried hardwood placed beside the bed and ignited. The UL test monitors the rate of heat release, the concentration of carbon dioxide, and smoke density. This test was designed by fire engineers and represents the latest in available fire technology, relating sophisticated lab calorimeter results to full scale burn testing. As a composite test, it addresses the flammability of the end product.

California Technical Bulletin #129

A mattress is fully made up:

- Mattress Pad
- Bottom Sheet
- Draw Sheet
- Top Sheet
- Blanket
- Pillow with pillow cover

The bed clothes must be 50% synthetic fiber (poly) and 50% cotton. (cotton burns slowly and poly burns fast.) The bedclothes are tucked under the mattress except for the top sheet and blanket which is left hanging. A burner (like a blowtorch) is ignited at the side of the mattress. A mattress passes based on a combination of factors that includes weight loss, toxic fumes, rate and heat release, ceiling temperature, etc. Many Fire Marshals and Safety Officers require mattresses to pass this test if there is not an approved automatic sprinkler system in each room where mattresses will be used.

Boston Fire Code IX-11

A mattress is fully made up with:

- Mattress Pad
- Bottom Sheet
- Draw Sheet
- Top Sheet
- Blanket
- Pillow with Pillow Cover

A container is placed under the mattress, filled with newspapers, and ignited. A combination of factors including weight loss, toxic gases, rate of heat release, ceiling temperature, etc. is considered to determine pass or fail.

Federal Flammability Standard Title 16 CFR Part 1633

Effective July 1, 2007, all mattresses manufactured, imported or renovated for sale or introduction into commerce must meet new federal regulations regarding flammability. This new standard, 16 CFR 1633 (referred to as 1633), is similar to California Technical Bulletin (TB) 603 but is not the same. The new federal regulation has energy release levels that are more stringent than TB 603, and requires that mattresses have a label exclusively dedicated to showing they are 1633 compliant.

The new Federal Standard sets two criteria to limit the growth of the fire in a mattress or mattress set as follows:

- Must not exceed a 200 kW peak heat release rate within 30 minutes of the test.
- The total energy released must be no more than 15 MJ for the first 10 minutes of the test.

Fabric Flammability

The primary flammability hazard associated with textile products such as drapes, furniture, upholstery, and mattress ticking is accidental exposure to an ignition source. Fabrics composed of cellulosic fibers such as cotton, rayon, and linen or thermoplastic fibers such as polyester, acrylic, nylon, and polypropylene will ignite source and as a result, expose a composite product's inner components as potential fuel for a fire. In a room the resultant fire can then reach flashover in a few short minutes. Flashover is a phenomenon that occurs when an individual room fire approaching 1,000 degrees Fahrenheit actually explodes the room. When this happens, every organic thing in the room is consumed and the now intense fire proceeds to hallways and

adjacent rooms repeating the flashover. This domino effect of flashover has been known to consume entire buildings with catastrophic results. The burning of urethane foams such as those used in mattresses and upholstered furniture has proven to be a vehicle that can carry a room fire to flashover.

The National Institute of Standards and Testing (NIST) has created a highly sophisticated computer model that is able to accurately predict a room flashover situation by entering room furnishings, room dimensions, and laboratory fire test data into the program. This model predicts that by protecting the flammable fuel sources (i.e., foams and stuffing) in a typical room through the use of barrier textiles, it is possible to contain the fire within the room thereby averting a flashover situation and protect the building from catastrophic destruction. NIST computer model results have been confirmed with full room burn testing. With flammable materials involved in a room fire, flashover can occur in as few as seven minutes. With state of the art barrier fabrics in room furnishings, the probability of flashover is dramatically reduced.

Innovative fibers, such as Kevlar®, and fiberglass, add a high level of inherent flame retardancy to fabrics to the point that these high tech products have become the current state of the art for fire protection all over the world.

Flame Retardant – What Does it Mean?

You should be aware that there are many fabrics that will pass component flammability tests when burned in single strips as per that particular test's protocol. Some of these same fabrics, particularly thermoplastic products such as polyester, nylon, and polypropylene can burn, melt, or shrink away when subjected to an ignition source. This action can expose flammable contents underneath to the fire creating a dangerous and potentially deadly fire situation.

By testing the end use (composite) product, such as a mattress or an upholstered chair, flammability test results are much more meaningful. This is why you should place more confidence in composite testing than in component testing. Composite tests such as California Technical Bulletins 121 and 133, Boston Regulatory Notes (2-7-83), and Underwriters laboratories Proposed Standard 1895 recognize that real life fire situations involve the entire finished product and these tests have been engineered to set parameters and gauge the results. Composite testing must be considered when one realizes the potential for death, property damage, and the resultant liability associated with building fires.

Additional Fire Codes

ASTM E 1590: This test method provides a means of determining the burning behavior of mattresses used in public occupancies by measuring specific fire test responses when the test specimen (mattress or mattress with foundation) is subjected to a specified flaming ignition source under well ventilated conditions. To pass this test the peak rate of heat release for the mattress shall not exceed 250 k W.

ASTM E 176: This terminology covers terms, related definitions, and descriptions of terms used or likely to be used in fire-test-response standards, fire-hazard-assessment standards, and fire-risk-assessment standards. Definitions of terms are special-purpose definitions that are consistent with the standard definitions but are written to ensure that a specific fire-test-response standard, fire-hazard-assessment standard, or fire-risk-assessment standard is properly understood and precisely interpreted.

NFPA 267: Standard Method of Test for Fire Characteristics of Mattresses and Bedding Assemblies Exposed to Flaming Ignition Source. NFPA 267 presents a test method using an open calorimeter environment to determine heat release, smoke density, weight loss, and generation of carbon monoxide of mattresses and bedding assemblies when exposed to a flaming ignition source, 1998 Edition.

NFPA: 260: Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture, 2003 Edition.

NFPA: 261: Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes, 2003 Edition.

NFPA 267: Standard Method of Test for Fire Characteristics of Mattresses and Bedding Assemblies Exposed to Flaming Ignition Source, 1998 Edition.

FF4-72: State of California Department of Consumer Affairs Bureau of Home Furnishings, Technical Bulletin #106, Federal Standard 16 CFR 1632 (FF 4-72): See Federal Flammability standard on page 1 of this Primer.

For Additional Information

- 16 CFR 1633: New Federal regulations
<http://www.cpsc.gov/businfo/frnotices/fr05/openflame.pdf>
- California Bureau of Home Furnishings and Thermal Insulation:
www.bhfti.ca.gov
- TB 603: State of California regulations
<http://www.bhfti.ca.gov/laws/ab603.htm>

