

IN•TOUCH®

INFORMATION ON FLEXIBLE POLYURETHANE FOAM

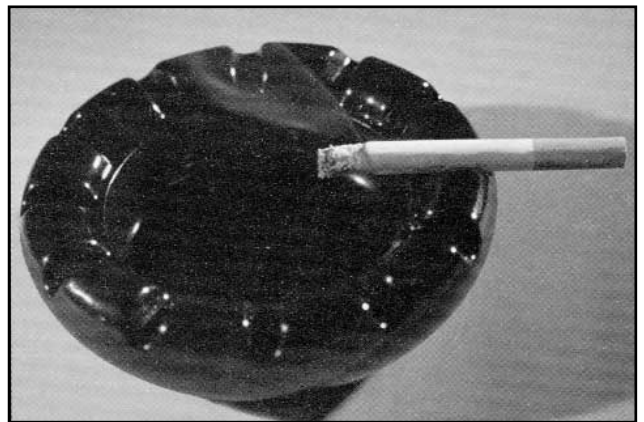
IN•TOUCH® is a regular publication of the Polyurethane Foam Association (PFA). It covers topics of interest to users of flexible polyurethane foam and is designed as a quick reference for background information on key issues. To get more detailed information about a particular topic, consult a PFA member.

InTouch Overview

Flammability Update: Flexible Polyurethane Foam Industry Strives to Further Reduce Fire Deaths and Injuries

Like any organic product, flexible polyurethane foam (FPF) will burn when subjected to sufficient heat under specific circumstances. And, although technologies exist to produce FPF that is more resistant to ignition and burns more slowly when ignited, like most other components FPF acts as a fuel source under many actual fire conditions. Emphasizing this fact to FPF producers, to the flexible foam industry's customers who manufacture household products, and to consumers is an ongoing industry priority. Because flexible polyurethane foam is the most widely used cushioning component in a variety of consumer end-use products, the FPF producing industry is deeply concerned with flammability issues.

According to the Consumer Product Safety Commission (CPSC), residential upholstered furniture and mattress fires resulted in 1,020 deaths and 3,450 injuries in 1996. The PFA continues to work with the upholstered furniture and mattress producers to reduce these numbers. The challenge to address this problem becomes more complex as new levels of fire resistance are considered for upholstered furniture and mattress construction. Until recently, the concern has focused on cigarette smoldering ignition; however, the CPSC has now turned its attention to small open flame ignition sources such as matches, cigarette lighters, and candles. Developing consensus on a reliable, reproducible test, which reflects behavior in a real fire situation, is a task in which the PFA is involved. PFA will continue its efforts to educate regulators, fire officials, furniture and mattress manufacturers, home furnishings retailers and consumers about the safe handling and use of FPF.



Two Decades of Progress

More than 20 years ago, the Consumer Product Safety Commission issued a call to the bedding and furniture industries to provide products that would resist ignition from the most common source of household fires-smoldering cigarettes. The bedding and upholstered furniture manufacturers took two different, but equally effective paths. The bedding industry worked with federal regulators to develop mandatory standards for mattress products, and the furniture industry chose to develop a voluntary program resulting in the creation of the Upholstered Furniture Action Council (UFAC) which established and maintains comprehensive, voluntary standards for the manufacturer of furniture that resist ignition from smoldering cigarettes. While both approaches were successful in reducing the number of fires caused by smoldering cigarettes, the mandatory mattress standard also served to help conventional FPF (without FR additives) grow in use. Tests showed that a layer of conventional FPF worked well to dissipate heat and serve as a heat wicking layer under the mattress ticking or cover fabric. UFAC work also showed that conventional FPF (without FR additives) was useful as a heat damping layer with Class I fabrics, while Class II fabrics required the addition of a protective layer or barrier under the fabric and over the FPF.

Over the years, PFA has cooperated with both the upholstered furniture and mattress producers to educate consumers and to protect households with composite items produced to resist smoldering ignition.

Educating consumers about the hazards of smoldering cigarettes is a major thrust of both the upholstered furniture and mattress producers. Furniture that meets UFAC requirements is identified with a definitive hang tag. Most mattresses have hang tags from the SPSC (Sleep Products Safety Council). Both of these tags warn about smoldering cigarettes and encourage consumers to use smoke detectors.

PFA, is actively involved with the upholstered furniture and mattress educational programs and additionally provides public service materials on fire safety to the media in major markets. These fire safety messages have been widely used throughout the country especially during National Fire Prevention Week.

Greatly improved statistics on fires and deaths from fires cannot be credited wholly to smolder-resistant furniture and mattress construction. Other major factors are the smaller number of people who smoke, wider use of smoke detectors, and aggressive industry consumer and fire safety organization efforts to educate consumers to eliminate situations that can result in fire hazards.

ESTIMATED RESIDENTIAL STRUCTURE FIRE DEATHS

	1980	1995	1996
Upholstered Furniture			
Smoking Material Ignition	1,150	500	470
Open Flame Ignition	200	90	90
Mattresses			
Smoking Material Ignition	570	270	330
Open Flame Ignition	260	160	130

Source: US Consumer Products Safety Commission, Oct. 1998

ESTIMATED RESIDENTIAL STRUCTURE FIRE INJURIES

	1980	1995	1996
Upholstered Furniture			
Smoking Material Ignition	1,260	880	940
Open Flame Ignition	530	490	410
Mattresses			
Smoking Material Ignition	1,200	780	830
Open Flame Ignition	1,270	1,370	1,270

Source: US Consumer Products Safety Commission, Oct. 1998

A Proven Way to Significantly Reduce Fire Deaths and Injuries

Operation Life Safety (OLS) is dedicated to the principles of detection, alarm and suppression of residential fires. PFA is an active participant and supporter of the OLS partnership with national fire safety and fire fighting organizations. OLS is a staunch advocate of the use of smoke detectors and sprinkler systems in residences which significantly reduces the threat of death, injury and property loss in fires from any cause.

The OLS educational effort informs consumers, local governments and home builders of the enormous safety benefits associated with the installation of residential sprinkler systems.

According to OLS a residential sprinkler system working off a domestic water supply is probably the ultimate answer to residential fire protection.

The Challenges Ahead

Now, in addition to calling for upholstered furniture and mattresses that resist ignition from smoldering cigarettes, the CPSC is exploring mandates for upholstered furniture and mattresses that pass small open-flame tests. CPSC's upholstered furniture flammability project director has stated that the new small open-flame requirements would replace and surpass those for cigarette ignition, making the fire resistance of the furniture even more effective.

The assumption that resistance to an open flame will enhance resistance to cigarette ignition may hold true for some components in upholstered furniture and mattresses, but not necessarily for FPF. A highly desirable property of FPF is its ability to "retreat" under heat from smoldering cigarettes or to dissipate the heat and, therefore, resist ignition. The intensity of open flame testing would mandate the heavy use of fire retardants, significantly increasing the density of the foam component and compromising its ability to withdraw from a smoldering heat source or to dissipate the heat.

Another key consideration in the small open flame challenge for all those involved in the upholstered furniture and mattress industry is the inability of tests to accurately simulate actual fire conditions. Because actual fires are a combination of many factors including fuel source, available oxygen and radiant heat, it is imperative to test the upholstered furniture or mattress composite form under simulated fire conditions rather than just test individual components. This would include frame components, fabrics, bed linens, and all cushioning materials as a fully assembled product just as you'd find in your home. But even with composite product testing, performance of a home furnishings item in a real fire has been shown to differ from performance observed in small-scale tests. Laboratory results have also proven to vary widely from one test incidence to another conducted under the same protocols.

Complexities of small open flame testing constitute a formidable challenge. There appear to be no easy solutions, but FPF manufacturers and their colleagues involved in the furniture and mattress industries are working for a resolution. PFA welcomes the opportunity to participate in consumer protection practices that reduce fire hazards and prevent deaths.

Mattress Industry Addresses Open-flame Ignitions

The unmatched comfort, support and durability characteristics and manufacturing economies of flexible polyurethane foam all contribute to its dominant role as a comfort and support component in most mattresses sold today. FPF has long been used as a quilting cushion, upholstering pad, mattress topper, and cushioning wrap in conjunction with innerspring units and as a core in all foam mattresses. FPF also is used as the retaining border wall in hybrid water mattress construction.

This widespread use makes recent efforts between the mattress industry and the CPSC to explore the possibility of developing a small open flame ignition standard of keen interest to FPF producers who share the determination to further increase product safety for consumers.

In 1996, the CPSC estimates that there were 130 deaths involving open flame ignition where mattresses or bedclothes were reported to be the first items ignited. Unlike the upholstered furniture industry, mattress producers currently operate under mandatory federal flammability standards. The standards, established in 1972 by the CPSC for mattresses used in residential settings, are intended to reduce fires from ignition from cigarettes, often related to smoking in bed.

Currently, all mattresses manufactured in the United States must conform to Consumer Product Safety Commission Standard DOC FF4-72 "Flammability Standard for Mattresses." The test protocol requires the placement of burning cigarettes on defined locations on the mattress. Bedclothes are not included in the test procedure. FPF plays a key role in helping mattress



manufacturers achieve compliance. Conventional FPF (without FR additives) has been shown to be an effective heat dissipation layer to help reduce the chance for smoldering ignition.

A recent study funded by the International Sleep Products Association (ISPA) and the National Association of State Fire Marshals and a separate study conducted by the CPSC show that the number of deaths and injuries resulting from cigarette ignitions of mattresses has decreased since the cigarette ignition standard was established. The studies also show that mattress fires associated with small open flames, such as matches, cigarettes and candles have not been significantly reduced. Of particular concern is the number of fires caused by children playing with such ignition sources in the bedroom.

ISPA has initiated an effort to address the risks of open-flame ignitions and to improve product safety. Early in 1998, ISPA's Board of Trustees made the decision to study, in conjunction with the CPSC, the feasibility of modifying existing mattress flammability standards to encompass small open-flame ignition.

The Sleep Product Safety Council (SPSC) was established in 1986 by ISPA, to manage science and safety education issues. In a major step to improve consumer safety, the Combustibility Committee of SPSC has reviewed and approved a proposal for open flame ignition testing on mattress and bed clothing combinations. Objectives of the project are: to characterize the heat flux imposed on mattress and foundation by various combinations of bed clothes; to develop simple gas burners that simulate the local heat flux imposed by certain bedding combinations; and to use these burners to assess the level of fire safety improvements that might be achieved with current, marketable flammability modifications in mattresses. A desirable outgrowth of the project could be the establishment of a standard procedure for testing mattress-foundation sets for improved fire safety and a standard method for testing reduced scale component or composite samples that would serve as an accurate screen for a full-scale test. SPSC reinforces its technical efforts with an aggressive consumer educational campaign. One recent SPSC educational campaign focused on three themes: fire and children don't mix; keep matches and lighters away from children; take fire safety precautions in the bedroom.

A mainstay of SPSC's continuing education program is a safety hang tag displayed on mattress products. The SPSC safety tag is widely used throughout the mattress industry.

Flammability Requirements for Carpet Cushion and Backing

As with mattresses, flexible polyurethane foam is an important component in floor covering systems that add comfort and ease of maintenance to the home and business environment. FPF serves as either carpet cushion or as an attached resilient backing. In both cases, it is considered an integral part of the floor covering system.

Federal law requires that all carpet (including attached cushion) installed on floor surfaces must pass the Methenamine Pill Test 16CFR1630FF1-70. Additionally, carpet systems in areas such as access/exit corridors and enclosed exits of public buildings also may be required to pass the Flooring Radiant Panel Test which has been approved by the National Fire Protection Association, the American Society for Testing Materials, several federal agencies and some building code groups.

Automotive Industry Standards

Advanced FPF technology addresses safety factors as well as the automotive industry's requirements for seating systems that are durable and comfortable.

The Federal Department of Transportation is responsible for safety standards in private automobiles. Motor Vehicle Safety Standard-302 deals specifically with flammability of furnishings in the passenger compartments of private automobiles. The flexible polyurethane foam industry cooperated with the DOT in development of the standard, which evaluates the interior system.

MVSS-302 relies on an open-flame ignition test. It is significant that FPF that meets the requirements of MVSS-302 can be produced in many cases without the addition of fire retardants.

The standard recognizes that the systems will burn under severe conditions. The test is generally concerned with measuring a sufficiently slow ignition rate to allow time for occupants to vacate the vehicle.

In Public Venues

The highly desirable safety, comfort, support, environmental and weight properties of FPF that make it so popular for use in homes and private automobiles make it equally attractive for appointments in commercial buildings and mass transportation.

Added risk factors dictate different standards for public buildings and public transportation. For example, in hospitals and nursing homes, the mobility of the residents is very important. In public buildings, such as theaters and clubs, density of occupancy in relation to availability of exits is a factor. The same holds true of seating in busses and trains. Aircraft pose still another consideration.

Flammability is the first priority in specifications for aircraft seating spelled out in Federation Aviation Regulation 25.853. The FAR test takes into consideration initial ignition, burn rate and smoke evolution using multiple ignition sources. Special construction requirements and the addition of fire retardants produce FPF that meets FAR 25.853 guidelines.

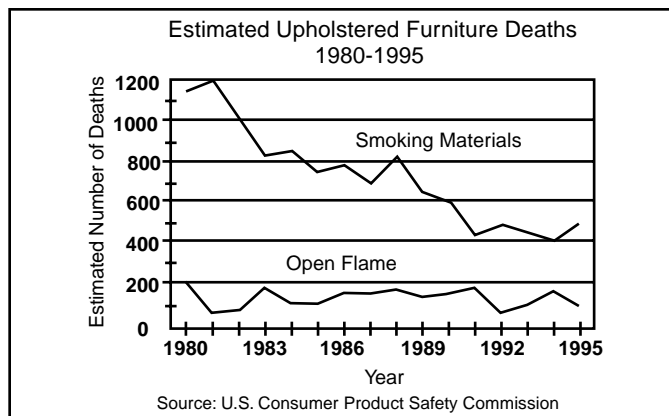
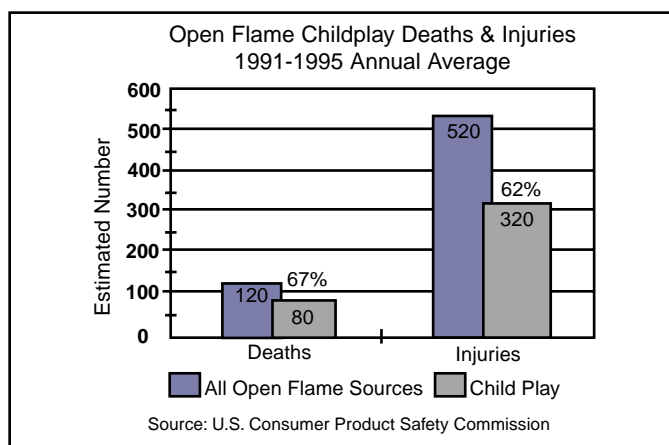
Other Agencies and Flammability Tests

A wide variety of test methods are used to evaluate the flammability performance of composites and components, ranging from laboratory scale to full-scale tests involving whole rooms or buildings. Laboratory tests generally compare the ignition rate and burn rate of small specimens. The results of these laboratory tests can vary widely depending on the size and source of the flame, room conditions and the orientation to the burn test specimen.

The U.S. Consumer Product Safety Commission is the highly visible regulatory agency responsible for establishing national flammability standards and testing requirements for consumer products. The CPSC, however, is specifically excluded from jurisdiction over cigarettes, the culprit in a majority of fatal home and automobile fires.

There are, however, other agencies that set standards industry must meet in producing products that reduce fire hazards for consumers. States also have jurisdiction over the issue and their requirements can exceed those of federal regulations, where these exist. Notable among the state regulations are those from the California Bureau of Home Furnishings which has mandated TB-117, which spells out requirements for residential furniture sold in California, and TB-133 which sets the flammability standards for furnishings in areas of high risk and public occupancy. California's TB-133 requirements have been adopted for furnishings used in high-risk occupancies by some other states.

Some local public bodies also have flammability standards including the Port Authority of New York and New Jersey, which publishes requirements for public buildings and maritime facilities, and the Boston Fire Department.



The Department of Transportation, of course, has jurisdiction over vehicle safety in private automobiles, commercial vehicles and mass transportation, and the Federal Aviation Administration is responsible for safety factors in commercial and private aircraft.

These and several other domestic agencies and organizations are concerned with consumer protection from fire hazards. Those who specify FPF to be used in upholstered furniture shipped overseas should be aware of British Standard 5852. Developed under the direction of the British Furniture Standards Committee, the standard assesses the flammability of upholstered furniture systems from both smoldering cigarettes, lighted matches and larger ignition sources. It is unknown at this time whether the European Community will adopt the British standards. Additionally, mattresses are regulated by British Standard 7177.

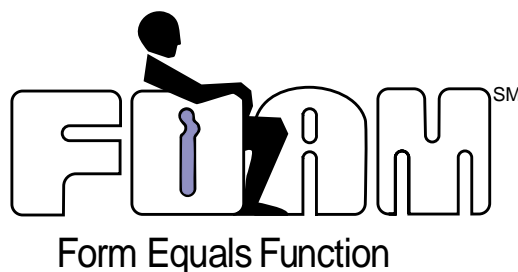
The California Standards

Tests for compliance with California TB-117 and TB-133 are examples of test methods to assess the flammability of upholstered furniture or the components used to produce it.

Combustibility behavior of upholstered furniture is largely influenced by the combined effect of the components in the composite system including the fabric covering, the frame and the filling materials, such as FPF, and the design and configuration of the piece as well as available oxygen and radiant heat. For this reason, flammability performance should be evaluated only by testing the composite system rather than individual components. California TB-133, a standard for furniture in areas of high-risk public occupancy, is an example of a full-scale composite system test. The test uses either a finished piece of upholstered furniture or a full size mock up and a large size test chamber

Along with the International Association of Fire Fighters and the American Furniture Manufacturers Association, PFA has supported TB-133 as the basis for uniform requirements for upholstered furniture used in places of public occupancy.

California TB-117 is a test that evaluates components used in the manufacture of residential upholstered furniture sold in the state of California. This small scale open flame ignition test for furniture components has limited applicability in defining fire performance of upholstered furniture..



UFAC Tests

Six composite tests are used by the Upholstered Furniture Action Council to evaluate components used in upholstered furniture manufacture. Members of the organization are provided with regular lab tests to confirm that all materials being used conform to program requirements.

The UFAC Fabric Test Method uses a burning cigarette to test each fabric over a standard foam substrate. A burning cigarette placed on the fabric produces a length of char, which determines the fabric class. Class I fabrics may be used directly over conventional FPF anywhere in the furniture construction. Class II fabrics require a complying barrier between the fabric cover and conventional FPF in horizontal seating surfaces.

British Standard 5852

The Furniture and Furnishings (Fire) (Safety) Regulations 1988 commonly known as BS 5852 used in Great Britain consists of two parts to test both smoldering and open flame ignition.

The "cribs" section of the regulations refers to a testing protocol to assess the combustibility of FPF used as cushioning in upholstered furniture exposed to open flame, such as might be generated from a small liquid fuel space heater. The standard mandates the use of combustible modified foam in the assembly.

BS 5852 uses a composite mockup in which a stand with right-angled horizontal and vertical surfaces is used. In the test a standard fabric covers the FPF samples. A wooden crib is placed directly on top of the fabric cover and ignited. Performance criteria include flaming drips, charring and smoldering after flame.

British Standard 7177

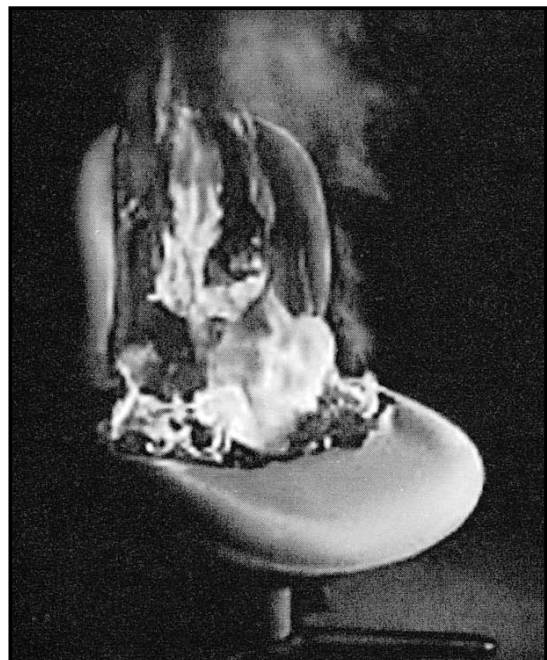
BS 7177 is the specification for Resistance to Ignition of Mattresses, Divans and Bed Bases for items manufactured and sold in the United Kingdom. Items sold for residential use are identified as low hazard use and must meet both a smoldering cigarette ignition test as well as a match flame equivalent ignition test.

The foregoing are only a few of the representative tests for assessing the flammability of upholstered products for the home and commercial uses. Copies of standards and the tests to support them can be obtained from the various sponsoring agencies, organizations or trade associations.

What Lies Ahead in Upholstered Furniture and Mattress Flammability Regulations

The initial flammability concerns about consumer home furnishings products, under the purview of the CPSC, which were identified in the early 1970's, have been dealt with in a reasonable manner. As mentioned previously, the bedding industry chose to follow the mandated regulation route, while the upholstered furniture industry chose the voluntary action path to deal with smoldering cigarette ignition problems. The positive results in both industries are commendable.

The CPSC has now shifted from concerns about smoldering cigarettes to concerns about small open flame ignitions of residential upholstered furniture and mattresses. The final course of action will most likely involve the FPF industry. The requirements of the upholstered furniture and mattress industries will be met based upon the historical and technical expertise of the FPF producers to supply what their customers need.



Summary

- ▶ 1. Smoldering ignition remains the primary cause of household fires involving upholstered furniture or mattress products. FPF that is capable of passing small-scale flame tests may not perform well in smoldering ignition situations.
- ▶ 2. Laboratory tests cannot simulate actual fire conditions. Results vary widely and replication is a frequent problem. Testing of composite assemblies rather than individual components is the preferred method because this approach is much more likely to replicate real life fire situations and to result in acceptable standards of flammability performance.
- ▶ 3. In view of on-going concerns about deaths and injuries due to the open flame ignition of upholstered home furnishings and mattresses, the flexible polyurethane foam industry reaffirms its commitment to safety for the workers who staff plants and to the consumers who buy products containing FPF.
- ▶ 4. FPF is one of the most commonly used components in the manufacture of mattresses and upholstered furniture. The mattress industry is exploring the feasibility of developing a small open flame ignition requirement for mattresses to augment the mandatory cigarette smoldering regulations. Upholstered furniture manufacturers address cigarette smolder resistance through voluntary UFAC construction standards. The small open flame ignition of upholstered furniture is under review by the CPSC. PFA will work closely with both the mattress and upholstered furniture industries to supply products needed to comply with their approaches to fire safety requirements.
- ▶ 5. The combined industries, including FPF suppliers and manufacturers of upholstered furniture and mattresses, have the expertise and experience to develop products to meet any requirements that are deemed reasonable to protect public safety.
- ▶ 6. Smoke alarms and sprinkler systems remain the number one practical solution to the challenge of dramatically reducing deaths caused by household fires.
- ▶ 7. PFA pledges to continue its educational efforts and to continue cooperation with industry groups, fire safety officials and regulatory agencies in a concerted effort to reduce fires involving products containing flexible polyurethane foam.

This information is provided as a service of the Polyurethane Foam Association to improve the understanding of key issues that affect flexible polyurethane foam cushioning. To learn more about specific foams, contact your foam supplier.

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