



Testing Mattresses and Mattress Systems for the U.S. Market





Testing Mattresses and Mattress Systems for the U.S. Market

Today's mattresses and mattress systems offer consumers a wide range of features and options that can help to provide a comfortable and restful sleeping experience. A visit to a typical mattress retail showroom will reveal a multitude of options for firmness or softness, with or without cushioned padding, and in a number of different sizes and thicknesses. But advanced mattress choices now extend to include models and sleeping systems that offer alternative materials and construction methods, as well as integrated controls that enable consumers to personalize their mattress to their own unique requirements.

In the U.S., all mattresses are required to meet federal flammability standards to reduce the risk of fire. For mattresses designed for infants and children, additional chemical testing may be required to prevent exposure to potentially hazardous chemicals. Advanced mattress systems that incorporate heating elements, massage rollers or elevation adjustments may be subject to electrical safety testing. As a result, achieving compliance with mattress requirements can be a complex process for manufacturers.

This UL white paper discusses the testing requirements for mattresses and mattress systems intended for sale in the U.S. The paper begins with an overview of the U.S. mattress market and the dynamics that are likely to impact future market growth. The white paper then summarizes the key flammability requirements and testing methods applicable to mattresses sold in the U.S., and addresses special considerations that apply to mattresses intended for use by infants and children. The paper also offers a summary of other mattress testing that may be required for mattress systems and special mattress configurations, and concludes with recommendations for mattress manufacturers and retailers.

An Overview of Mattresses and Mattress Systems

Under applicable U.S. requirements, mattresses are generally defined as “a resilient material or combination of materials enclosed by a ticking (used alone or in combination with other products) intended or promoted for sleeping upon.” In practice, this definition includes a wide range of traditional mattress products, such as innerspring and foam mattresses intended for use by adults, children and infants, either alone or in conjunction with a mattress foundation. Mattress products are available in



different sizes and configurations suitable for use in bedroom sets, bunk beds and cribs. Mattresses can also be integrated into furniture products such as convertible sofa beds and roll-a-way bed mattresses.

Today, mattresses also include products based on alternative support systems, such as memory foam mattresses that more readily conform to individual body shapes and sleeping patterns, and sophisticated air mattresses that enable users to adjust the degree of mattress firmness at the touch of a button. Some mattresses may also feature extra padding on the sleeping surface (so-called pillow-top or Euro-top mattresses) to provide further cushioning between the mattress and a sleeper. Many of these products as well as mattresses based on more traditional support methods are also available in bed systems that allow users to elevate specific sections of the mattress for reasons of health or convenience. And some manufacturers now offer mattress products incorporating latex and natural fibers with lower chemical emissions profiles.

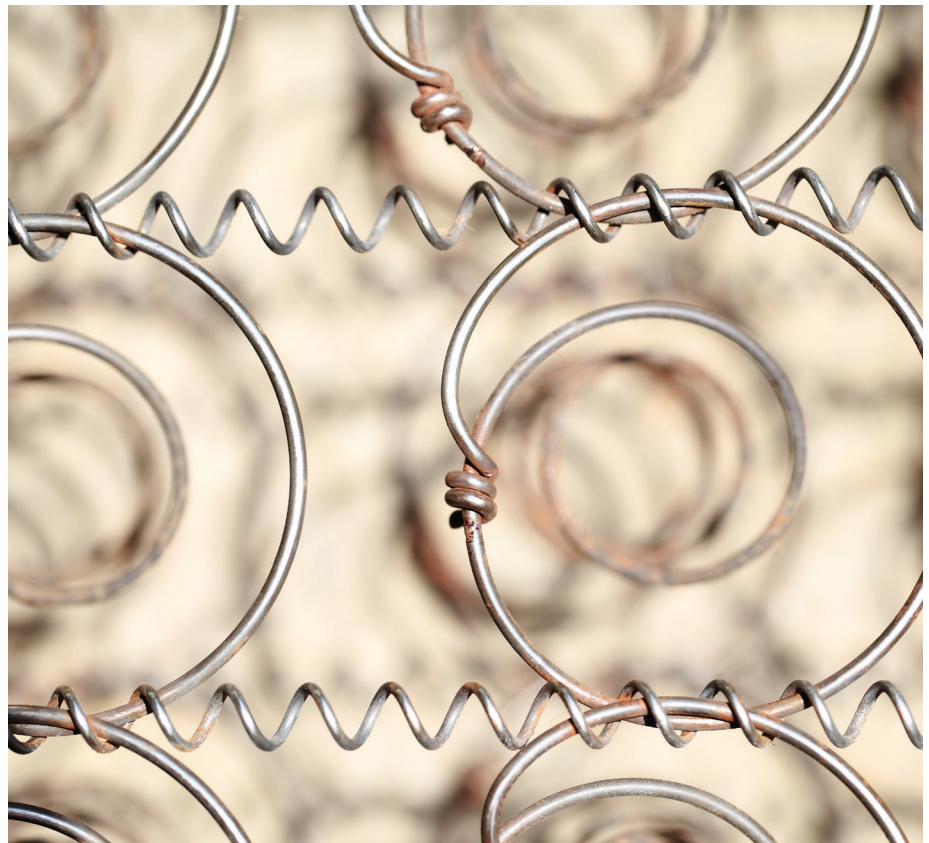
The sheer plethora of options available to consumers helps to explain the current size and potential of the market for mattresses in the U.S. According to one industry source, U.S. consumers spend about \$14 billion (USD) annually on mattresses and mattress systems. With an average unit price of under \$300, that's nearly 50 million mattresses sold in the U.S. each and every year. And the prospects for future increases in mattress sales appear strong, driven in large part by so-called Generation X consumers who are upgrading existing mattress

to take advantage of new and innovative products that manufacturers are bringing to market.⁴

Mattresses and the Link with Residential Fires

Residential fires and fire-related deaths have decreased dramatically over the past 35 years. According to statistics from the National Fire Protection Association (NFPA), home fires are down 50 percent from the number of fires reported in 1980, while deaths related to home fires have declined by 47 percent over the same period. These positive trends can be traced to a number of factors, including increased use of smoke detectors and reduced rates of smoking by adults.

However, the same NFPA statistics also indicate that fires related to mattresses are one of two leading causes of home fire deaths, despite the fact that only six percent of fires originate in the bedroom. During the period from 2009 to 2013, the NFPA estimates that 25 percent of all home fire deaths were caused by fires that started in the bedroom, with 14 percent of all home fire deaths (about 346 persons annually) directly attributable to fires in which a mattress or bedding was the first item ignited. Indeed, as a category, mattresses and bedding were surpassed only by upholstered furniture as the first item ignited in a fire, which was connected with 17 percent of all home fire deaths.



Earlier NFPA research has identified the principle causes of mattress fires. According to data compiled for the period from 2005 to 2009, smoking materials were identified as the leading cause of mattress and bedding-related fires and deaths (20 percent and 51 percent respectively), followed by a heat source being located too closely to a mattress or bedding (accounting for 27 percent of mattress fires and 34 percent of related deaths).

These and other statistics illustrate the importance of flammability standards and testing requirements for mattresses and mattress systems in reducing the risk of fire and protecting consumers from fire-related death or injury. Yet, even with rigorous standards in place, recalls of mattresses and mattress products that fail to meet applicable flammability standards are still far too common.

For example, during the six-month period from April through September 2015, mattress manufacturers or retailers initiated five separate voluntary recalls, involving more than 60,000 individual adult and crib mattresses that failed to meet U.S. mattress flammability requirements. While no consumer deaths or injuries have been directly connected with these mattress recalls, they almost certainly imposed a significant financial cost on the manufacturers involved. Such recalls also have the potential to damage a company's brand reputation in the market

The frequency and extent of mattress recalls due to non-compliance with flammability requirements illustrate the importance of efforts to educate manufacturers, distributors and retailers regarding these requirements.

Mattress Flammability Regulations in the U.S.

Regardless of where they are manufactured, all mattresses and mattress systems sold in the U.S. must comply with mandatory flammability requirements. These requirements are set forth in Chapter 16 of the U.S. Code of Federal Regulations (CFR) in two separate standards, Part 1632, Standard for the Flammability of Mattresses and Mattress Pads, and Part 1633, Standard for the Flammability (Open Flame) of Mattress Sets. Both standards are implementing regulations under the U.S. Federal Flammable Fabrics Act (FFA), which regulates the manufacture of highly flammable clothing and interior furnishings. Flammability regulations under the FFA are administered by the U.S. Consumer Product Safety Commission (CPSC).

While there are similarities between the standards, Part 1632 and Part 1633 utilize significantly different methods to assess mattress flammability resistance. Part 1632 involves the testing of mattress flammability through the application of a lit cigarette, to the mattress surface. Part 1633, on the other hand, involves the application of an open flame to the top and side of mattress samples. The intent of the more rigorous testing requirements in Part 1633 is to better simulate a broader range of likely fire scenarios involving mattresses, such as the prior ignition of bed sheets and blankets.

The following sections detail the specific flammability testing requirements under Parts 1632 and 1633.





Part 1632

Prototype testing—Part 1632 requires testing of all prototype mattresses or mattress pads before being placed on the market. Testing is also required for any previously tested mattress or mattress pad that has undergone a change in prototype materials that could affect the product’s cigarette ignition resistance.

Sample requirements—Testing generally requires two mattress surfaces (crib, twin, full, queen or king) that have complied with the open flame Standard of 16 CFR Part 1633 (three mattresses tested for each new prototype) or six mattress pad surfaces.

Testing conditions—Each surface sample being tested is exposed to a minimum of 18 burning cigarettes, with a least nine cigarettes on the bare mattress side and at least nine cigarettes on the sheet side. In addition to the above distribution, a minimum number of burning cigarettes must be applied to smooth, quilted and tufted surfaces, and to any tape or seam edge.

Passing criteria—In order to meet the requirements of Part 1632, the char length for each individual cigarette location on each mattress surface cannot exceed 2 inches (5.1cm) in any direction from the nearest point of the cigarette, including down into the mattress filling.

Tape edge substitution testing—In cases where a manufacturer wishes to substitute tape edge materials of different colors or sizes that do not reduce ignition existence, two mattress surfaces are subject to a total of 36 burning cigarettes. Passing criteria is the same as that for prototype mattresses and mattress pads.

Recordkeeping—The manufacturer or importer must retain all records of prototype testing, including prototype manufacturing specifications, certified test results, photographs of each tested surface, test results of all ticking classifications. Records of certified test results and photographs of any tape edge substitution tests must also be retained.

Labeling requirements—Each mattress or mattress pad must be permanently labeled with the location, e.g., city and state, month and year of manufacture. Mattress pads that have been treated with chemical retardants must be prominently labeled with the letter “T” and include instructions for protecting the pads from chemicals, such as laundry detergents, that may reduce the pads’ flame resistant properties.



Part 1633

Prototype testing—Part 1633 requires testing of a “qualified” prototype mattress or mattress system design that uses the same materials, components and methods of assembly as planned production units. As an alternative, manufacturers may submit for testing “confirmed” prototypes that are the equivalent of qualified prototypes with respect to materials, components and methods of assembly.

Sample requirements—When a prototype mattress or mattress system is intended to be manufactured in multiple locations, samples from each manufacturing site must be submitted for testing.

Testing conditions—Each tested sample is exposed to a 19 kilowatt (kW) flame on the top surface of the mattress for 70 seconds and, simultaneously, a 10kW flame on the mattress border for 50 seconds. The total heat release from the mattress during the first 10 minutes of the test cannot exceed 15 megajoules (MJ), and the peak rate of heat release cannot exceed 200 kW at any time during the 30-minute duration of the test.

Passing criteria—At least three samples from each batch of qualified prototype samples cannot exceed the maximum values for total heat release or peak rate of heat release as noted above. A confirmed prototype is deemed to have met the standard’s requirements based on one passing sample.

Recordkeeping—Manufacturers and importers must maintain the following records and documents for mattresses and mattress systems sold in the U.S.:

- Testing and manufacturing records, including test results and details of each test performed, as well a video or photos of the testing of each mattress;
- Complete records of each prototype tested, including a detailed description of materials, components and methods of assembly used for each prototype;
- Quality assurance records, including a copy of the manufacturer’s written quality assurance procedures, and records of any production tests performed.

The above records must be maintained as long as mattresses under an approved prototype continue to be manufactured, and must be retained for a period of three years after production of a given prototype has ended. In addition, records must be maintained at the manufacturing location if located in the U.S., or at designated location in the U.S. for mattress and mattress systems manufactured outside of the U.S.



Part 1633, continued

Labeling requirements—Mattresses and mattress system models whose prototypes meet Part 1633 flammability testing requirements must include a permanent, conspicuous and legible label that includes the following information in English:

- The name of the manufacturer or, in cases of imported mattresses and mattress systems, the name of the foreign manufacturer and importer;
- For imported mattresses, the complete address of the foreign manufacturer and the complete address of the importer or the location in the U.S. where required records are maintained;
- The month and year of manufacture of the mattress or mattress system;
- The mattress model identification;
- The mattress prototype identification;
- A certification that the mattress complies with the requirements of Part 1633;
- A statement identifying whether the mattress is intended to be sold alone or with a foundation.

Enforcement of Parts 1632 and 1633

Under the authority of the FFA, inspectors from the CPSC's Division of Regulatory Enforcement are empowered to conduct unannounced inspections of manufacturing facilities, to obtain information regarding the manufacturing and production of mattresses and mattress systems, and to inspect records required under Parts 1632 and 1633. The CPSC can also require manufacturers to recall mattresses already on the market that fail to meet federal flammability requirements. Finally, under the provisions of the FFA, manufacturers may be held legally liable for selling non-compliant mattresses, exposing the company to monetary forfeitures and company executives to imprisonment.

Additional U.S. Requirements for Mattresses for Children and Infants

Aside from compliance with federal flammability requirements, mattresses and mattress systems sold in the U.S. that are primarily intended for use by children and infants must meet additional requirements. Enacted in 2008, the U.S. Consumer Product Safety Improvement Act (CPSIA) sets specific limits for lead content in products (including mattresses and mattress systems) intended for use by children 12 years of age and younger. The CPSIA also establishes requirements limiting the use of certain phthalates in “child care articles” intended for use by children three years of age and younger.

In both cases, the CPSIA requires that mattress manufacturers use CPSC-accredited third parties to test and certify that concentrations of these potentially harmful materials in accessible mattress components are below the maximum concentrations identified in CPSC regulations.

Under the CPSIA, manufacturers are also required to place a permanent, distinguishing mark or label on any product intended for use by children. The information that must be made available on this tracking label is similar to that required for adult mattresses and mattress systems, but must also include specific production batch or run to facilitate the prompt and efficient recall of unsafe products. Manufacturers and importers must make available to importers and retailers a Children’s Product Certificate, attesting to their product’s compliance with all applicable

product safety rules and regulations.

Finally, the CPSC stipulates size requirements for mattresses used in full-size baby cribs. The intent of these requirements is to minimize the risk of entrapment between a mattress and the sides of a crib. These mattresses must measure at least 27.25 inches in width by 51.25 inches in length, with a thickness not exceeding six inches. In addition, cribs and their accompanying assembly instructions must include a specific warning statement noting these mattress dimensions.

Other Testing Considerations for Mattresses and Mattress Systems

Mattresses and mattress systems sold in the U.S. may be subject to further evaluation and testing. For example, some mattress systems available today incorporate electrical or electronic components to facilitate the operation or control of specific product features.

These mattress products must be tested for electrical safety to identify potential electrical hazards and to evaluate how a given product’s design or construction eliminates or minimizes the risk of fire or shock.

In certain jurisdictions, chemical restrictions may require testing for concentrations of restricted substances. Enacted into law in 1986, California’s Safe Drinking Water and Toxic Enforcement Act (more widely known as California Proposition 65) restricts the use of more than 900 different listed chemicals, and requires any product sold within the state to carry a warning regarding the presence of any restricted chemicals.

In most instances, chemical assessment and testing is required to determine the extent of potential exposure to restricted substances posed by a given product.

Beyond chemical content requirements applicable to mattresses for children and infants or mattresses and mattress systems sold in certain jurisdictions,



manufacturers and importers may choose to conduct chemical content and emissions testing to support claims of environmental health or sustainability. Mattresses that have been tested and certified to third-party chemical emissions standards may be more attractive to health-conscious consumers, thereby providing a marketing advantage in a competitive market.

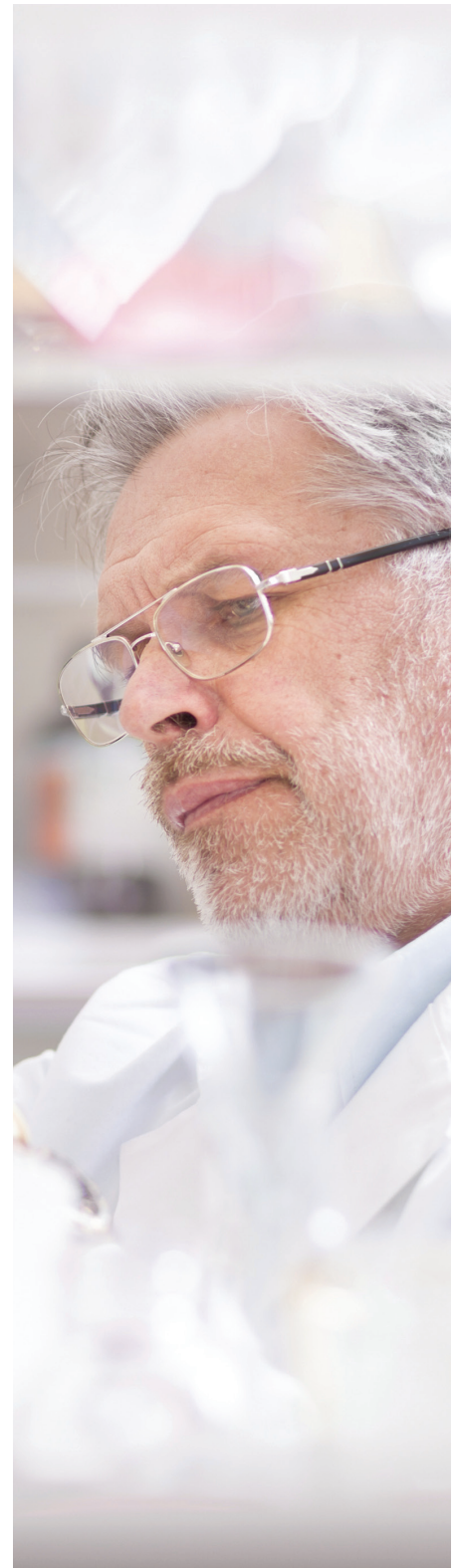
Finally, some manufacturers and importers may also elect to conduct additional tests related to product safety or performance as a method of reducing potential product liability. Mechanical testing can be used to evaluate those aspects of a mattress or mattress system that could lead to mechanical failure. Specific mechanical tests can include structural testing to assess strength and durability, component testing to evaluate frames, drawer guides and hinges, and mechanical safety testing to identify potential risks associated with sharp points and edges, or potential areas for unintended squeezing, shearing or entrapment of fingers and other appendages.

Recommendations for Achieving and Maintaining Compliance

Given the breadth and complexity of required and recommended testing for mattress and mattress systems sold in the U.S., manufacturers and importers may benefit from adopting some or all of the following recommended practices:

- Determine the applicable testing requirements: Flammability testing is required for all mattress and mattress systems, but additional testing requirements depend on the specific product configuration and its intended use. Initially identifying the specific testing required for a given mattress product can result in product design and material selections that contribute to better test outcomes and reduce the need for product redesign.
- Conduct advanced prototype testing: In addition, prototype mattress and mattress systems should be subjected to testing as early as possible in the product development process. Advanced testing can help identify potential compliance challenges that could delay product approval and market access.
- Stipulate component requirements: Although mattresses are tested as a final product, individual materials and components can enhance or detract from a product's overall compliance. Develop clear specifications and requirements for mattress components and make them a formal element of the procurement process.
- Conduct periodic supplier audits: Efforts to maintain ongoing compliance with flammability standards and other requirements can be strengthened by conducting periodic audits of materials and components from third-party suppliers for conformity with established product specifications.

Mattress retailers can also play an important role in overall mattress safety by requiring manufacturers to supply evidence of compliance with applicable regulations and standards as a condition of procurement. Here too, periodic audits of mattress suppliers can support efforts to identify noncompliant products before they reach consumers.





Summary and Conclusion

Mattresses and mattress systems must be tested for compliance with federally-mandated standards prior to being made available for sale in the U.S. 16 CFR Parts 1632 and 1633 detail the specific flammability testing requirements and protocols applicable to mattresses and mattress systems, and CPSIA regulations mandate chemical testing for mattress products intended for use by children and infants. Additional testing may be required for certain mattress systems, or for mattress products sold in certain jurisdictions within the U.S., while other testing may be recommended to improve marketability or reduce potential product liability.

In addition to the recommendations noted above, mattress manufacturers and importers should consider working with an independent testing organization with in-depth experience in mattress flammability requirements and testing protocols applicable in the U.S. and elsewhere in the world. Such an arrangement can help make the testing process more efficient and economical, facilitate the introduction of new and innovative mattresses and mattress systems to the market, and gain the trust of retailers and consumers alike.

UL is a global independent safety science company offering a comprehensive suite of testing and certification services for manufacturers of mattresses and mattress systems, as well as all types of commercial and residential furniture products. UL experts are knowledgeable about every aspect of mattress flammability and chemical testing, as well as electrical and mechanical safety and environmental considerations. And UL's GREENGUARD Certification can provide specifiers, purchasers and consumers with objective information regarding mattress chemical emissions. This broad capability makes UL a single source for mattress testing and certification, and a trusted resource for mattress manufacturers around the world.

For additional information about UL's mattress testing and certification services, visit www.ul.com/furniture, or contact +1 (844) 221-5689.

1. 16 CFR 1633 - Standard for the Flammability (Open Flame) of Mattress Sets, U.S. Consumer Product Safety Commission, March 15, 2006. Web, 20 November 2015. <http://www.gpo.gov/fdsys/pkg/CFR-2012-title16-vol2/pdf/CFR-2012-title16-vol2-part1633.pdf>.
2. Statistic cited in "New Startups Aren't Keeping Big Mattress Up at Night," BloombergBusiness, March 12, 2015. Web, 20 November 2015. <http://www.bloomberg.com/news/articles/2015-03-12/new-startups-aren-t-keeping-big-mattress-up-at-night>.
3. "2013 Mattress Industry Report of Sales and Trends," International Sleep Products Association, 2014, as quoted in "Proof Your New Mattress Doesn't Have to Cost an Arm and a Leg," The Huffington Post, May 30, 2014. Web, 20 November 2015. http://www.huffingtonpost.com/2014/05/30/mattress-price-cost_n_5412778.html.
4. "Consumer Bedding Buying Trends," posting on FurnitureToday website, November 4, 2015. Web, 20 November 2015. <http://www.furnituretoday.com/article/525520-consumer-bedding-buying-trends>.
5. "Home Structure Fires," a report by the National Fire Protection Association, September 2015. Web, 20 November 2015. <http://www.nfpa.org/research/reports-and-statistics/fires-by-property-type/residential/home-structure-fires>.
6. "Home Fires That Begin With Mattresses and Bedding," Executive Summary, National Fire Protection Association, October, 2011. Web, 20 November 2015. <http://www.nfpa.org/research/reports-and-statistics/fire-causes/household-products/mattresses-and-bedding>.

©2016 UL LLC. All rights reserved. This white paper may not be copied or distributed without permission. It is provided for general information purposes only and is not intended to convey legal or other professional advice.