



Standard Specification for Mattress and Box Springs for Use in Berths in Marine Vessels¹

This standard is issued under the fixed designation F1085; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification provides the requirements for mattresses and box springs that are for use in berths for officers, crew, and passengers in marine vessels. This shall be considered a minimum standard.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses, in inch-pound units, are for information only.

1.3 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire-hazard or fire-risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- D123 Terminology Relating to Textiles
- D1424 Test Method for Tearing Strength of Fabrics by Falling-Pendulum (Elmendorf-Type) Apparatus
- D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
- D3951 Practice for Commercial Packaging
- D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- D6193 Practice for Stitches and Seams
- D6413 Test Method for Flame Resistance of Textiles (Vertical Test)

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.03 on Outfitting and Deck Machinery.

Current edition approved Nov. 1, 2014. Published November 2014. Originally approved in 1988. Last previous edition approved in 2010 as F1085 – 10. DOI: 10.1520/F1085-14.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
 - E176 Terminology of Fire Standards
 - E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - E1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
 - E1590 Test Method for Fire Testing of Mattresses
 - F1566 Test Methods for Evaluation of Innersprings, Boxsprings, Mattresses or Mattress Sets
- 2.2 ANSI Standards:³

- ANSI Z357.1-1981 American National Standard for Bedding Products and Components
 - ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes
- 2.3 California Bureau of Home Furnishings and Thermal Insulation Standard:

- CA Technical Bulletin 129, (CA TB 129) Flammability Test Procedure for Mattresses for Use in Public Buildings—October 1992⁴

2.4 Federal Standards:

- Code of Federal Regulations Title 16, Vol 2, Part 1632⁵ Purchase Description—Mattress—Innerspring, Flame-Resistant, Shipboard—NAVSEA 05L PD 4-02 (May 2002)⁶

2.5 NFPA Standard:

- NFPA 301 Code for Safety to Life from Fire on Merchant Vessels⁷

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification associated with textiles, see Terminology D123. For

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from California Bureau of Home Furnishings and Thermal Insulation, 3483 Orange Grove Ave., North Highlands, CA 95660.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

⁶ Available from Naval Sea Systems Command (NAVSEA), 1333 Isaac Hull Ave., SE, Washington, DC 20376, <http://www.navsea.navy.mil>.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

definitions of terms used in this specification associated with fire issues, see Terminology E176.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *border, n*—a material that forms the side panel that surrounds the perimeter of the mattress and defines its depth.

3.2.2 *box spring, n*—a foundation for a mattress, consisting of wire spring elements mounted on a frame, generally upholstered and covered on the top and sides with ticking, and on the bottom with a dust cover.

3.2.3 *box spring assembly, n*—an interconnection of coil springs, border wire, and top wire assembly contained within a box spring.

3.2.4 *flaming droplets, n*—flaming molten or flaming liquefied droplets which fall from the test specimen during the fire test and continue to burn.

3.2.5 *flange, n*—strip of material secured to the perimeter of an upholstery panel to secure to the innerspring core.

3.2.6 *innerspring unit, n*—an interconnection of wire spring elements other than mounting on a frame that forms a single unit that can be incorporated into a mattress.

3.2.7 *insulator pad, n*—one or more layers of a cushioning system between the upholstery and mattress core, which consist of foam or other cushioning or filling materials.

3.2.8 *mattress, n*—ticking filled with a resilient material used alone or in combination with other products intended or promoted for sleeping upon.

3.2.9 *mattress core, n*—the main support system that may be present in a mattress, such as springs, foam, or resilient filling.

3.2.10 *mattress, innerspring, n*—any mattress containing an innerspring unit.

3.2.11 *mattress, solid core, n*—any mattress containing padding, but not an innerspring unit.

3.2.12 *quilted, adj*—stitched with any thread or by fusion through the ticking and one or more layers of upholstery material.

3.2.13 *tape edge, n*—seam or border edge of a mattress.

3.2.14 *ticking, n*—the outermost layer of fabric or related material that encloses the core and upholstery materials of a mattress or mattress pad.

4. Ordering Information

4.1 Orders for items purchased under this specification shall define the following:

4.1.1 *Mattresses*—Quantity, dimensional requirements, type (solid core or innerspring), and weight per each size.

4.1.2 *Box Springs*—Quantity, dimensional requirements, and weight per each size.

4.1.3 Upholstery material selections are to be offered as choices by the manufacturer or distributor to the purchaser. The selection shall be of good quality suitable for commercial use and for use aboard U.S. Navy vessels.

4.1.4 When first article of inspection is required, it shall be spelled out in the paperwork.

5. Materials and Manufacture

5.1 *Innerspring Mattress*—The essential components of an innerspring mattress are: an innerspring core, cushioning, upholstery ticking (either quilted or with a smooth top, and potentially including a flange), and a border. Optional components include various insulating layers or pads, flanges, and tapes. All materials used shall meet the mechanical property and fire performance requirements of Table 1. All materials used shall comply with appropriate commercial bedding industry standards of manufacture and durability. Any construction of an innerspring mattress that is suitable for its intended use and that complies with the performance requirements shown herein shall be permitted to be used.

5.1.1 *Innerspring Core*—The innerspring core shall be constructed from an all-wire carbon steel. The coils shall extend the full length and width of the mattress. The coils shall be permanently secured to provide long-term structural stability. Various core designs shall be permitted. The support properties of the innerspring core, in terms of firmness rating, durability, resistance to impact, firmness retention, and surface deformation, shall be assessed by Test Methods F1566. The coils, or the complete spring unit assembly, shall be given suitable thermal treatment to relieve residual stresses caused by coiling.

5.1.2 *Cushioning and Insulator Layers*—An insulator pad shall be placed over each sleeping surface of the innerspring core to insulate the upholstery from the core. The various cushioning layers shall be constructed of materials that meet the performance requirements of Table 1.

5.1.3 *Ticking and Cover Assembly*—The cover construction shall be suitable for the type of mattress construction used. Upholstery ticking materials shall be durable, in accordance with common bedding industry practices. The ticking for each sleeping surface shall be cut in one piece without fabric splices. The ticking for the mattress border shall be made of not more than two pieces of ticking, with the ends spliced and sewn together in a continuous manner leaving no gaps or voids in uniformity and finish. The border assembly shall be secured to the top and bottom sleeping surfaces of the mattress, by automatic sewing, in accordance with common bedding industry practices.

5.1.4 *Border*—The ticking for the mattress border shall be made of not more than two pieces of ticking, with the ends spliced and sewn together in a continuous manner leaving no gaps or voids in uniformity and finish. The border assembly shall be secured to the top and bottom sleeping surfaces of the mattress, by automatic sewing, in accordance with common bedding industry practices.

5.1.5 *Tape*—A tape shall be permitted to be used to conceal the seams formed between the border, if present, and an upholstery panel. The tape shall be continuously stitched along the total length of each seam, with no gaps or voids between the upholstery panel and border surfaces.

5.1.6 *Seam and Stitching*—The seam and stitch types shall be in accordance with Practice D6193. All seams shall be securely stitched. Seams shall not slip or pull out.

5.1.7 *Mattress*—All mattress components shall meet the requirements of Table 1, as appropriate. The overall mattress

TABLE 1 Mattress Component Requirements

Component	Characteristic	Requirement	Test Method
Upholstery Ticking (and Flange, Tape, and Pocketing Materials, if used) (Notes 1 and 2)	Initial Flammability		
	Char Length	≤127 mm (5.0 in.)	Test Method D6413
	After Flame	≤2.0 s	Test Method D6413
	No Flaming Droplets		Test Method D6413
	Flammability after 15 Launderings		
	Char Length	≤127 mm (5.0 in.)	Test Method D6413
	After Flame	≤2.0 s	Test Method D6413
	No Flaming Droplets		Test Method D6413
	Other Properties		
	Tear Strength (Note 3)	Warp: 1.6 kg (3.5 lb) min; Filling: 1.6 kg (3.5 lb) min	Test Method D1424
Breaking Strength (Note 3)	Warp: 42.6 kg (94 lb) min; Filling: 26.3 kg (58 lb) min	Test Method D5034	
Border Ticking	Flammability		
	Char Length	≤38 mm (1.5 in.)	Test Method D6413
	After Flame	≤2.0 s	Test Method D6413
	No Flaming Droplets		Test Method D6413
	D _{MAX}	50	Test Method E662
	D _{MAX}	No Flaming Droplets	Test Method E662
	Other Properties		
	Tear Strength	Warp: 1.8 kg (4 lb) min; Filling: 1.8 kg (4 lb) min	Test Method D1424
Breaking Strength	Warp: 42.6 kg (94 lb) min; Filling: 22.7 kg (50 lb) min	Test Method D5034	
Cushioning and Insulator Layers	Flammability		
	Char Length	≤127 mm (5.0 in.)	Test Method D6413
	After Flame	≤2.0 s	Test Method D6413
	No Flaming Droplets		Test Method D6413
	Flame Spread (I _s) (Note 4)	10	Test Method E162
	D _{MAX} (Note 4)	200	Test Method E662
	D _{MAX} (Note 4)	No Flaming Droplets	Test Method E662
	Other Properties		
	Dry Heat Aging / Compression Force Deflection	No more than 20 % change in compression force deflection	Test Method D3574 , Methods C and K

NOTE 1—Only Molten or Flaming Droplets requirement, or both, applies to Tape.

NOTE 2—Only Initial Flammability requirements apply to Pocketing Material.

NOTE 3—Tear Strength and Breaking Strength apply only to Upholstery Ticking.

NOTE 4—When materials are not identical on both sides, each side shall be tested as a different specimen.

TABLE 2 Full Mattress Requirements

Characteristics	Requirement	Test Method
Fire Performance Characteristics		
Minimum	a. Maximum Rate of Heat Release ≤100 kW	Test Method E1590
	b. Maximum Total Heat Release in first 10 min of test ≤25 MJ	Test Method E1590
	c. Maximum Mass Loss in the first 10 min of test ≤1.4 kg (3 lb)	Test Method E1590
	d. Class A Pass	16 CFR 1632
Optional (US Navy Requirement)	a. Maximum Rate of Heat Release ≤150 kW	Annex A1
	b. Maximum Average Specific Extinction Area <300 m ² /kg	Annex A1
	c. No Flaming Droplets	Annex A1
Optional Screening Test	Mass loss ≤15 % (based on initial mass)	Annex A3
Physical Characteristics		
Durability (Rollator Test)	a. Firmness Rating of 330 N (75 lbf) ± 10 %, after 100 000 cycles	Test Method F1566 , Section 7
	b. Permanent Deformation ≤20 % of depth	Test Method F1566 , Section 7
	c. No Damage	Test Method F1566 , Section 7
Firmness Retention and Surface Deformation (Cornell Test)	a. Accumulated Dimple ≤44.5 mm (1.75 in.)	Test Method F1566 , Section 9
	b. Support Firmness Change ≤(+ 40 %) - (-15 %)	Test Method F1566 , Section 9
Dimensions	See Section 6	
Weight	See Section 6	
Visual Characteristics		
Visual Defects	See 6.5	ANSI/ASQC Z1.4

shall meet the performance requirements of [Table 2](#), as discussed in Section [6](#). For dimensional requirements, see [6.6](#).

5.1.7.1 Upholstery ticking, as well as any flange, tape, and pocketing materials used, shall exhibit a char length not

TABLE 3 Defects

Material	Any hole, cut, tear, thick or thin place, mend, smash causing the mattress not to meet its intended performance use shall be scored as a major defect. Otherwise shall be scored as a minor defect.
Construction	Major defects: Design and construction of the mattress not as specified in Section 3. Springs not completely filled in the mattress. Mattress ends have loose, sagging appearance; filling not evenly distributed; clearly noticeable lumps; thin hollow spaces; and corner(s) not firm. Mattress not in accordance with the requirements in this specification. Stitch type, seam type, and stitches per inch not as specified; needle chew or needle cutting, or both; end of stitching when not caught in another seam; broken stitch not repaired as specified; open seam, skipped or runoff stitches, raw edges. Seam allowances not as specified; loose or tight tension; badly pleated, caught or twisted in any unrelated row of stitching. Thread breaks and ends of stitching not caught in another line of stitching, backstitched less than 13 mm (0.5 in.). Thread type not as specified shall be scored as a major defect.
Labels	Major defect: Label omitted, incorrect, illegible, misplaced, not attached as specified, or stitched through printing; bar code causes damage to the item.
Cleanliness	Any spot, dirt, stain (grease, oil, ink, and so forth) or odor; five or more thread ends or more than 10 mm (3/8 in.); loose threads not removed shall be scored as a minor defect unless defect causes mattress not to meet its intended performance, then it shall be scored as a major defect.

exceeding 127 mm (5.0 in.), an after flame period not exceeding 2.0 s, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **D6413**. The char length and after flame requirements shall not apply to tape.

5.1.7.2 Upholstery ticking, as well as any flange, tape, and pocketing materials used, shall exhibit a char length not exceeding 127 mm (5.0 in.), an after flame period not exceeding 2.0 s, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **D6413**, after having been subjected to 15 launderings. The char length and after flame requirements shall not apply to tape.

5.1.7.3 Border ticking materials shall exhibit a char length not exceeding 38 mm (1.5 in.), an after flame period not exceeding 2.0 s, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **D6413**. Border ticking materials shall also exhibit a maximum specific optical density (D_{MAX}) not exceeding 50, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **E662**.

5.1.7.4 Cushioning and insulator layer materials shall exhibit a char length not exceeding 127 mm (5.0 in.), an after flame period not exceeding 2.0 s, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **D6413**. Cushioning and insulator layer materials shall also exhibit a radiant panel index (I_s) not exceeding 10 when tested in accordance with Test Method **E162**. Cushioning and insulator layer materials shall also exhibit a maximum specific optical density (D_{MAX}) not exceeding 200, and shall not exhibit any molten or flaming droplets, or both, when tested in accordance with Test Method **E662**. When materials are not identical on both sides, each side shall be tested as a different specimen, with Test Method **E162** and with Test Method **E662**. An optional additional fire test, applicable if the mattress is intended for use aboard U.S. Navy vessels, is shown in **Annex A2**.

5.1.7.5 *Physical Properties:*

(1) Upholstery ticking materials shall exhibit a tear strength of no less than 1.6 kg (3.5 lb) in either the warp or the filling direction when tested in accordance with Test Method

D1424. Upholstery ticking materials shall also exhibit a breaking strength of no less than 42.6 kg (94 lb) in the warp direction and of no less than 26.3 kg (58 lb) in the filling direction when tested in accordance with Test Method **D5034**.

(2) Border ticking materials shall exhibit a tear strength of no less than 1.8 kg (4 lb) in either the warp or the filling direction when tested in accordance with Test Method **D1424**. Border ticking materials shall exhibit a breaking strength of no less than 42.6 kg (94 lb) in the warp direction and of no less than 22.7 kg (50 lb) in the filling direction when tested in accordance with Test Method **D5034**.

(3) Cushioning and insulator layer materials shall exhibit a dry heat aging/compression force deflection of no more than 20 % change in compression force deflection when tested in accordance with Sections C and K of Test Method **D3574**.

5.1.8 *Label*—The label shall state that the mattress meets one of the following sets of fire test requirements: (1) this specification (in accordance with **Table 1** and **Table 2**), (2) California Technical Bulletin 129, or (3), Purchase Description—Mattress—Innerspring, Flame-Resistant, Shipboard—NAVSEA 05L PD 4-02 (May 2002).

5.2 *Solid Core Mattress*—The required components of a solid core mattress are cushioning and upholstery ticking.

5.2.1 All materials used shall meet the mechanical property and fire performance requirements of **Table 1**, as indicated in **5.1**, for innerspring mattresses, as applicable. All materials used shall comply with appropriate commercial bedding industry standards of manufacture and durability.

5.2.2 *Mattress*—All mattress components shall meet the requirements of **Table 1**, as appropriate. The overall mattress shall meet the performance requirements of **Table 2**.

5.2.3 *Label*—The label shall state that the mattress meets one of the following sets of fire test requirements: (1) this specification (in accordance with **Table 1** and **Table 2**), (2) California Technical Bulletin 129, or (3), Purchase Description—Mattress—Innerspring, Flame-Resistant, Shipboard—NAVSEA 05L PD 4-02 (May 2002).

5.3 *Box Spring*—The tolerances of the overall length, width and thickness dimensions of the box spring shall be consistent

with the mattress dimensions. Fig. 1 shows an example of a typical design of box spring. The top wire assembly shall be attached securely to the border wire.

5.3.1 The individual coils shall be securely attached to the top wire assembly. The coils, or the complete spring assembly, shall be given thermal treatment to relieve residual stresses caused by coiling. The wood frame assembly shall be suitable for commercial use or for use aboard U.S. Navy vessels. All four corners shall be suitably fastened at each point of attachment, in accordance with standard commercial bedding practices. All bottom edges shall be eased (sharp corners blunted by sanding). The wood base frame shall be constructed of industry standard box spring frame lumber, typically Eastern Canadian spruce or Southern yellow pine. The spring assembly shall be attached to the wood base frame.

5.3.2 *Cushioning, Insulation Layers, Ticking and Construction*—The requirements for materials and manufacture of all other components shall be as those for innerspring mattresses, in 5.1, as applicable. The insulation layer shall be attached to the top surface to prevent slippage. Each corner shall be filled with cushioning material, to provide proper tailoring. The box spring border ticking shall be of the same material as that of the mattress. The top panel shall be of a material that retards slipping. The cover assembly shall be placed over the top of the steel and wood assembly and properly attached, in accordance with standard commercial bedding practices.

5.3.3 The box spring shall display trade labels regarding material content and manufacturer as required by law.

5.3.4 *Label*—The label shall state that the box spring meets one of the following sets of fire test requirements: (1) this specification (in accordance with Table 1 and Table 2), (2) California Technical Bulletin 129, or (3), Purchase

Description—Mattress—Innerspring, Flame-Resistant, Shipboard—NAVSEA 05L PD 4-02 (May 2002).

5.4 *Mattress/Box Spring:*

5.4.1 Packaging shall protect the products from physical damage and be acceptable to a common carrier.

5.4.2 Each item shall be clearly marked in accordance with the purchase order requirements.

6. Performance Requirements for the Complete Mattress

6.1 The complete mattress shall meet the performance requirements shown in Table 2.

6.2 *Fire Performance Requirements*—At a minimum, the mattress shall comply with the requirements of 6.2.1 – 6.2.4 (consistent with those contained in NFPA 301).

6.2.1 The mattress ticking shall pass the requirements for Class A performance in accordance with 16 CFR 1632.

6.2.2 The mattress shall exhibit a maximum rate of heat release not exceeding 100 kW when tested in accordance with Test Method E1590.

6.2.3 The mattress shall exhibit a total heat released in the first 10 min of test not exceeding 25 MJ when tested in accordance with Test Method E1590.

6.2.4 The mattress shall exhibit a mass loss in the first 10 min of test not exceeding 1.4 kg (3 lb) when tested in accordance with Test Method E1590.

6.3 *Optional Fire Performance Requirements*—As an option, the mattress shall be permitted to exhibit fire performance in accordance with the fire test method described in Annex A1. This will involve, at a minimum, that the mattress comply with the requirements of 6.3.1 – 6.3.3. If a mattress is intended for use aboard U.S. Navy vessels, it shall be required

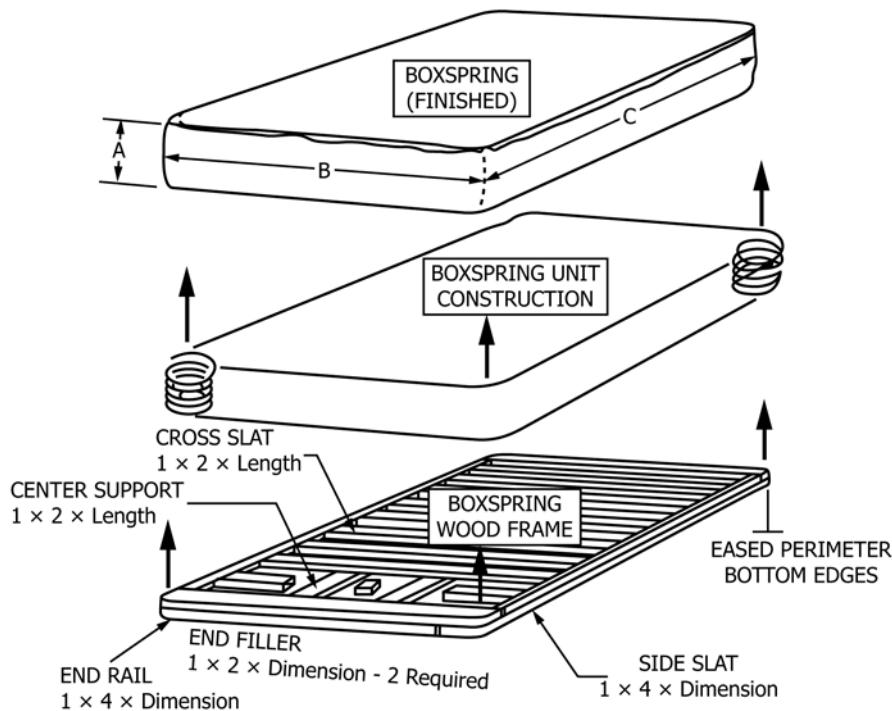


FIG. 1 Example Design of Box Springs

to comply with the criteria shown in 6.3.1 – 6.3.3, when tested in accordance with the fire test method described in Annex A1.

6.3.1 The mattress shall exhibit a maximum rate of heat release, during the test, not exceeding 150 kW.

6.3.2 The mattress shall exhibit a maximum average specific extinction area, during the test, not exceeding 300 m²/kg.

6.3.3 The mattress shall not exhibit flaming droplets during the test.

6.4 *Physical Characteristics:*

6.4.1 The mattress shall exhibit a firmness rating of 330 N (75 lbf) ± 10 %, and shall not exhibit any signs of wear, tear, damage, or degradation, when tested for 100 000 cycles in accordance with Section 7 of Test Method F1566. The test report shall include the initial firmness rating, the firmness rating after 25 000,

50 000, and 75 000 cycles, as well as the final firmness rating after 100 000 cycles. The test report shall also include any signs of wear, tear, damage, or degradation on any part of the mattress when inspected after each set of 25 000 cycles.

6.4.2 The mattress shall exhibit a permanent deformation not exceeding 20 % of depth, when tested in accordance with the Rollator Test section of Test Method F1566.

6.4.3 The mattress shall exhibit an accumulated dimple not to exceed 44.5 mm (1.75 in.), when tested in accordance with the Cornell Test section of Test Method F1566.

6.4.4 The mattress shall exhibit a support firmness change not exceeding (+40 %) or (–15 %), when tested in accordance with the Cornell Test section of Test Method F1566.

6.5 *Visual Inspection*—Visual inspection shall be conducted to check for any defects in the finished mattress, as shown in Table 3. The finished mattresses shall be clean and free from defects and other conditions affecting form, fit, function, and appearance. The lot size shall be expressed in units of

mattresses. The sample unit shall be one mattress. The inspection shall be performed in accordance with ANSI/ASQC Z1.4.

6.6 Dimensional requirements for mattresses are contained in ANSI A.357.1-1981. Dimensional requirements for inner-spring mattresses intended for use aboard U.S. Navy vessels are contained in Purchase Description—Mattress—Innerspring, Flame-Resistant, Shipboard—NAVSEA 05L PD 4-02 (May 2002).

NOTE 1—Dimensional requirements in NAVSEA 05L PD 4-02 are contained in inch-pound units.

7. Workmanship, Finish, and Appearance

7.1 All workmanship and material shall be of specified quality in keeping with the best commercial marine practice so as to produce each item suitable for its intended use.

7.2 Where first article inspection is required, it shall be spelled out in the purchase order.

8. Inspection and Certification

8.1 The manufacturer or distributor shall issue a certificate of conformance for each shipment of mattresses and of box springs to this specification. In addition, the manufacturer or distributor shall have available (upon request) independent test data to depict compliance with the stated fire test criteria, either for Test Method E1590 or for the test method described in Annex A1 of this specification. The independent test data shall always reflect a test date not to exceed a time period of three years from the date of product shipment.

9. Keywords

9.1 berths; box springs; fire; fire test; heat release; inner-spring mattress; marine; marine berth mattress; naval vessel; solid core mattress

ANNEXES

(Mandatory Information)

A1. FIRE TEST METHOD FOR MATTRESSES FOR USE IN MARINE VESSEL OCCUPANCIES

A1.1 This fire test method is a modification of the one in Test Method E1590, as developed by the U.S. Navy for determining the acceptability of mattresses for use aboard marine vessels. It assesses the burning behavior of mattresses by determining heat release, smoke release, mass loss, and combustion product release when a mattress is subjected to a specified flaming ignition source under well-ventilated conditions.

A1.2 Apparatus and Procedure

A1.2.1 The apparatus shall be as described in Section 6 of Test Method E1590, except as indicated in A1.3.

A1.2.2 The test specimen shall be as described in Section 7 of Test Method E1590, except as indicated in A1.3.

A1.2.3 The calibration of instrumentation shall be as described in Section 8 of Test Method E1590.

A1.2.4 The test specimen conditioning shall be as described in Section 9 of Test Method E1590.

A1.2.5 The test procedure shall be as described in Section 10 of Test Method E1590, except as indicated in A1.3.

A1.2.6 The calculations shall be as described in Section 11 of Test Method E1590, except as indicated in A1.3.

A1.2.7 The test report shall be as described in Section 12 of Test Method **E1590**, except for the additional information required in **A1.3.5**.

A1.3 Test Method Modifications for This Standard

A1.3.1 The test specimen shall be a full sized mattress, mounted on an open flame bunk or support system that will allow direct flame impingement to the bottom surface and sides of the mattress by the ignition source.

A1.3.2 Replace the “T” burner described in 6.2 of Test Method **E1590** with a burner having a nominal 0.3 by 0.3 m (1 by 1 ft) top surface. The burner shall have a minimum 102 mm (4 in.) layer of Ottawa silica sand, to provide the horizontal surface through which the gas is supplied. The sand layer shall be flush with the top of the burner. The burner shall be positioned such that the top edge of the burner is 380 ± 13 mm (15 ± 0.5 in.) below the bottom edge of the test specimen and centered with respect to the long side of the test specimen, with one-half of the width of the burner under the mattress.

A1.3.3 Support the mattress on a metal bed frame, constructed of heavy angle section iron, with all joints welded. The bed frame shall be nominally 1.94 by 0.76 m (76 by 30 in.) and

shall contain a wire grid, constructed of nominally 2 mm (0.08 in., 12.5 gage) welded steel wire mesh, with nominally 51 by 102 mm (2 by 4 in.) openings, secured to the perimeter of the bed frame with steel tie wires.

A1.3.4 The test specimen shall be exposed to a fire producing a total heat output of 50 ± 3 kW (47.6 ± 2.86 Btu/s) for the first 5 min of the test followed by an increase to 100 ± 5 kW (95.2 ± 4.76 Btu/s) for an additional 10 min. The total fire exposure shall be 15 min.

A1.3.5 Report the average specific extinction area from the test (m^2/kg), which is assessed as the total smoke released (m^2) divided by the total mass loss (kg).

A1.4 *Critical Test Results*—The following three test results shall be presented in a summary table: (a) the maximum rate of heat release obtained during the test minus the burner heat input at the time the maximum heat release rate occurs, (b) the average specific extinction area from the test, and (c) a visual report as to whether or not burning droplets were formed and dropped to the floor or the top of the mattress platform. These critical test results are used for the pass-fail criteria described in **6.3**, if the mattress is required to pass this test.

A2. OPTIONAL COMPONENT FIRE TEST METHOD FOR CUSHIONING MATERIALS FOR MATTRESSES FOR USE IN MARINE VESSEL OCCUPANCIES

A2.1 If required, use Test Method **E1354** for assessing the heat release rate of cushioning materials to be included in mattresses for use aboard U.S. Navy vessels, under the conditions of **A2.2** and with the pass/fail criteria of **A2.3**.

A2.2 The cushioning material shall be tested at an incident heat flux of 50 kW/m^2 , in the horizontal orientation and at a thickness of 50 mm (approximately 2 in.). Testing shall be conducted in triplicate.

A2.3 Pass/Fail Criteria:

A2.3.1 The maximum rate of heat release of the cushioning material (average of the three replicate tests) shall not exceed 120 kW/m^2 .

A2.3.2 The average rate of heat release of the cushioning material during the three minutes following ignition (average of the three replicate tests) shall not exceed 50 kW/m^2 .

A3. OPTIONAL SCREENING TEST METHOD FOR FIRE PERFORMANCE OF MATTRESSES FOR USE IN BUNKS OR BERTHS

A3.1 Background

A3.1.1 This optional test method provides a means for evaluating mattresses, and mattress inserts, for the weight loss, and fire behavior they exhibit under specified exposure conditions.

A3.1.2 Results of this test method are likely to be reasonably predictive of the results of the test method in **Annex A1**,

in terms of being able to differentiate between mattresses (or mattress inserts) of various degrees of fire performance.

A3.1.3 This test method is capable of subdividing mattresses (or mattress inserts) into several categories depending on their response to the ignition source applied: some mattresses (or mattress inserts) will burn up completely, while

some others will lose small fractions of the initial weight, with a series of intermediate fire-test responses also likely.

A3.2 Test Specimen

A3.2.1 Use as the test specimen an actual manufactured mattress, mattress insert, or prototype thereof, in the configuration of its intended use.

A3.2.2 If an actual manufactured mattress, or mattress insert, is not supplied, the size of the default mattress to be tested has the following dimensions: 0.76 by 1.90 m by at least 76 mm thick (30.0 by 75 in. by at least 3 in. thick). Whenever possible an actual mattress shall be used.

A3.2.3 The test specimen used shall be the size representative of the intended use of the product to be tested. Report the actual dimensions of the test specimen used.

A3.2.4 The test specimen, shall, in all respects, reflect the construction of the actual mattress, or mattress insert, that it is intended to represent.

A3.3 Conditioning

A3.3.1 Prior to testing, condition the mattress, or mattress insert, for at least 48 hours in an atmosphere at a temperature of $21 \pm 4^\circ\text{C}$ ($70 \pm 7^\circ\text{F}$) and a relative humidity of less than 60 %. Test the mattress, or mattress insert, as soon as possible after removal from such conditions if test room conditions differ from the above. Report time between removal from conditioning room and start of testing.

A3.4 Operator Safety

A3.4.1 The test procedure involves high temperatures, and combustion processes. Therefore, it is possible for eye injuries, burns, ignition of extraneous objects or clothing, and inhalation of smoke or combustion products to occur, unless proper precautions are taken. To avoid accidental leakage of toxic combustion products into the surrounding atmosphere, it is advisable to evacuate the chamber, at the end of a test, into an exhaust system with adequate capacity. The operator shall use heavy gloves, safety tongs or other suitable protection for removal of the specimen holder. The venting shall be checked periodically for proper operation. The exhaust system shall be checked for proper operation before testing and have adequate capacity. The possibility of the violent ejection of molten hot material or sharp fragments from some kinds of specimens when exposed to the ignition source shall be taken into account to ensure operator safety.

A3.5 Procedure

A3.5.1 Conduct the tests in a room equipped with appropriate exhausts to ensure that the resulting smoke can be vented. The so-called “ASTM room” (2.4 by 3.7 by 2.4 m high; 8 by 12 by 8 ft high) described in Test Method [E1590](#) is an example of a room deemed satisfactory for this test. Rooms of other dimensions are also suitable.

A3.5.2 Weigh 8 double sheets of black print newspaper (not tabloid size) and record the weight, to an accuracy of no less than 1.0 g.

NOTE A3.1—Newspaper sizes are approximately 0.6 by 0.7 m (approximately 23 by 28 in.) per sheet. Each double sheet of newspaper is likely to weigh approximately 18-22 g, giving a total weight of between 145 and 175 g (5.1–6.3 oz.).

A3.5.3 Weigh the conditioned mattress, or mattress insert, and record the weight, to an accuracy of no less than 50 g. This shall be considered the initial mattress or mattress insert weight. Test within 30 min of weighing the mattress.

A3.5.3.1 The test specimen shall not be placed on a balance or load cell during the test.

A3.5.3.2 There shall be no continuous measurement of test specimen weight during the test. The test specimen weight loss shall be assessed by the difference between the mattress or mattress insert weight before the test and its weight after the test.

NOTE A3.2—The use of a load cell will lead to incorrect assessment of weight loss since burnt and molten material will be retained on the load cell.

A3.5.4 Use a pipe approximately 0.6-1.0 m (24-39 in.) long and 230-250 mm (9-10 in.) in internal diameter for rolling the mattress, or mattress insert.

NOTE A3.3—Traditionally mattresses, or mattress inserts, have been rolled around a non combustible material (for example a steel stove pipe), but any material capable of having a mattress, or mattress insert, rolled around it, to achieve a similar inside diameter, is suitable, since the pipe is removed prior to ignition.

A3.5.5 Roll the long dimension of the test specimen (mattress, mattress prototype, mattress insert or mattress cushioning material), completely around the pipe. Retain the test specimen in place by using steel poultry netting or a minimum of three steel wire ties. This configuration creates a “chimney effect.” Remove the pipe after the roll containing the test specimen has been secured and has formed a test specimen roll.

A3.5.5.1 If the mattress, or mattress insert, is asymmetrical, inasmuch as the top and bottom surfaces are different, tests shall be conducted on both sides. If results differ depending on the side exposed to the ignition source, the appropriate results are those from the test that is shown to be more severe.

A3.5.6 Position the test specimen roll such that it is both: (1) secure from falling and (2) tilted to one side at an angle of 75-80 degrees to the floor. This is achievable: (a) by propping up the test specimen roll on one side, with two 70-80 mm (3 in.) steel angle irons or two bricks, with 70-100 mm separation between them, and securing the test specimen roll from tipping over during testing by attaching 3 wires to the steel netting, with the wires suspended from up high (for example from the ceiling) or (b) by leaning the mattress against a non combustible support at the required angle. The angled configuration is needed to allow air to enter at the bottom of the chimney formed by the test specimen roll.

A3.5.6.1 The test results are invalid if the test specimen roll falls over during the test.

A3.5.7 Crumple up the sheets of newspaper, loosely, into individual balls approximately 150 mm (6 in.) in diameter and place them in the inside of the chimney.

NOTE A3.4—Make sure that crumpled paper does not end up any further than 200 mm (8 in.) from the top of the cushioning core.

A3.5.8 Ignite the crumpled newspaper, from the top, with a single match, ensuring that the newspaper is well lit.

NOTE A3.5—A rather intense fire lasting 90-100 s is likely to result.

NOTE A3.6—It is possible to ignite the newspaper from the top and from the bottom, but bottom ignition is more laborious and likely to lead to lower precision. It has been shown that the likely results are virtually the same with top ignition and bottom ignition, and the precision is also probably likely to be similar.

A3.5.9 Allow free burning of the test specimen roll until the first of the following conditions is reached: (a) All burning has ceased. (b) Flashover in the test room appears inevitable. In this case, extinguish the test specimen fire manually and report the result as a flashover. Weighing of the test specimen remains is not necessary in this case.

A3.5.10 Conclude the test after visible flames have ceased, unless the mattress, or mattress insert, is still smoldering. At the test conclusion, let the mattress, or mattress insert, cool to room temperature and check to ensure that there is no visible smoke and that the mattress, or mattress insert, is not smoldering.

A3.5.11 If the mattress, or mattress insert, is smoldering when visible flames have ceased, do not conclude the test but continue the test until 60 minutes have elapsed and then terminate the test. Report the time at which visible flames have ceased and the time at which smoldering has ceased, unless smoldering has continued until the test has been externally terminated. Report the method of test termination and check to ensure that there is no more smoldering, no visible smoke and that the mattress is dry (if water was used).

A3.5.12 Any molten mattress material or molten material that has solidified after cooling shall be excluded from the final test specimen weight. If molten material is all that remains of the test specimen the weight loss shall be reported as 100 %.

A3.5.13 Upon completion of the test, the mattress, or mattress insert, remains, if any, shall be weighed, after placing them in a pre-weighed non combustible container. The mattress, or mattress insert, remains shall include any portion of the test specimen that has fallen off, during or after the test.

A3.5.14 Clean the test room so that no charred residues remain. Then, safely discard all mattress residues, preferably in sealed containers.

A3.5.15 Conduct the test in duplicate. Conduct each burn on an untested specimen.

A3.6 Test Report

A3.6.1 The test report shall be as comprehensive as possible and shall include any observations made during the test and comments on any difficulties experienced during testing. The units for all measurements shall be clearly stated in the report.

A3.6.2 Include the following descriptive information in the test report:

A3.6.2.1 Name and address of the testing laboratory.

A3.6.2.2 Date and identification number of the report.

A3.6.2.3 Name and address of the test requester, when applicable.

A3.6.2.4 Name of manufacturer or supplier of material, product, or assembly tested, if known.

A3.6.2.5 Commercial name or other identification marks and description of the sample.

A3.6.2.6 Full description of the sample. This shall include essential dimensions of the mattress (length, width and thickness, in mm, of the mattress), overall density, or weight per unit surface area, total weight (in kg), and weight of combustible portion of test specimen, if known. It shall also include description of: mattress ticking or covering (if included in the test), mattress insert and any barriers (if present), if known.

(1) If the mattress is asymmetrical, this information shall be included here.

A3.6.2.7 Full description of specimen preparation.

A3.6.2.8 If known, the nominal thickness, weight and density of each of the mattress components.

A3.6.2.9 Conditioning of the test specimens.

A3.6.2.10 Date of the test.

A3.6.2.11 Test number and any special remarks.

A3.6.3 Include the following test results in the test report, for each burn.

A3.6.3.1 Initial weight of the mattress, or mattress insert (kg).

A3.6.3.2 Total newspaper weight (g).

A3.6.3.3 Whether melting or dripping occurred, and the time at which it started, and whether smoldering occurred, and the time at which it started.

A3.6.3.4 Whether flaming droplets were formed.

A3.6.3.5 Duration of total test specimen roll burn(s). Report flaming times and smoldering times separately.

A3.6.3.6 Duration of visible flames(s).

A3.6.3.7 Final weight of the mattress, or mattress insert (kg) (A3.5.12).

A3.6.3.8 Weight loss of the mattress, or mattress insert (kg) (A3.5.12).

A3.6.3.9 Weight loss of the mattress, or mattress insert (%) (A3.5.12).

A3.6.3.10 Results of optional temperature and gas measurements (if conducted).

A3.6.4 Average weight loss of the mattress, or mattress insert, from both burns (%).

A3.6.4.1 If the mattress is asymmetrical and four tests were conducted, the average mattress weight loss shall be the average of the tests resulting in the more severe exposure.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>