Table 21.1
Interconnecting conductors and cable types

Furnishing type	Energy source	
	15 watts or less (under any condition of loading)	Class 2 or LPS
Portable	A or B	B
Stationary or Fixed	A or B	B

A) The conductor or cable shall be rated for the intended temperature, power and voltage.

B) Cords or cables not evaluated as a part of the component product requirement and not contained within a metal or polymeric enclosure in accordance with Table 11.2 shall be a jacketed type CL3, CL3R, CL3P, Power-limited Circuit Cable or other jacketed type cord with a minimum 0.013 inch (0.33 mm) jacket thickness or the combined conductor and jacket thickness not less than 0.013 inch (0.33 mm). Individual conductors may not be utilized outside a fire enclosure or without an overall jacket covering.

22 Furnishings with Extendable Elements

22.1 A drawer or other pullout component shall incorporate a stop to reduce the likelihood of unintentional dislocation from the furnishing.

Exception: Drawers and pullouts with less than 15.4 lbs (7.0 kg) do not need a stop.

22.2 A furnishing that has multiple extendable elements shall be provided with a mechanism that only allows one pullout component at a time.

Exception: The furnishing does not need to be provided with a mechanism provided it complies with the following tests in any configuration permitted:

a) Loading tests:

1) Section 32, Structural Test Requirements for Furnishings – General Loading;

2) Section 34, Desks and Tables;

3) Section 35, Storage Furnishings; and

b) Stability tests:

1) Section 39, Stability Test for Portable Furnishings;

2) Section 41, Desks and Tables (Non-Motorized and Motorized With and Without Casters; and

3) Section 42, Storage Furnishings.

23 Operator Attended Commercial Products

23.1 Usage Area II

23.1.1 A commercial furnishing that requires the operator to be present to perform the intended function complies with the requirements in 11.4, Mechanical Enclosure and Guards – Mechanical Considerations, when all of the following conditions are met:

a) A furnishing that is accessible to the public when the trained operator is not present shall be provided with a security lockout device that disables operation of the furnishing to prevent nonqualified persons from operating the furnishing;

1) A trained operator is considered present when they are within sight of the furnishing and are within 20 feet (6.1 meter) of the furnishing.

2) The lockout device may be a passcode, proximity sensor that require a unique sensor to activate (such as RFID), a physical key, a two-step process (such as pressing 2 keys in the correct order, or other means that would prevent an untrained person to operate the furnishing.

3) Where multiple furnishings are located within the same space and a proximity activation device is used as the access to allow movement of the furnishing, each furnishing shall have a separate code or equivalent restriction to allow movement of only the intended furnishing within the specified proximity.

4) A lockout (electronic or mechanical) system shall automatically reset and lockout the movement of the furnishing after a maximum of 2 minutes of inactivity. Inactivity is when the operator is no longer present.

b) Any point or part of the furnishing that is considered to present an entrapment or personal injury hazard shall be visible to the operator such that they can determine the proximity of an individual to the entrapment area when positioned at the operator controls while performing the intended function;

c) A control for the operation of the exposed movable part shall be a momentary contact type that when released all moving parts of the device that constitute a hazard are stopped. The moving parts may move some distance after power is disconnected as long as no potential hazard occurs with consideration of the body part (s) that may be involved. For instance, if a finger could be involved, the entrapment area after the moving part has fully stopped shall not be less than 1 inch (2.5 cm). Non-momentary contact memory and remote controls shall not be used;

d) A switch that controls the direction of travel shall be capable of being stopped and the direction of travel reversed at any point in the operation of the furnishing;

e) A switch that is used to control a movable part that can result in personal injury shall be guarded or located to prevent unintentional movement of the part; and

f) Upon power failure the furnishing shall remain in the existing position. Upon reinstatement of power the furnishing shall not move until the operator activates the switch controlling movement. A product that complies with this section shall be provided with installation and operation instructions in accordance with Section 104, Operator Attended Commercial Products Instructions.

g) Shall have the marking specified in 90.4.

23.2 Usage Area III

23.2.1 Furnishings in Usage Area III shall comply with 23.1, Operator Attended Commercial Products – Usage Area II with the following differences:

a) A security lockout is not necessary;

b) If the speed is less than 1 inch / second (2.54 cm/second), the entrapment area does not have to be visible to the operator;

c) The switch referred to in 23.1.1 (c) may be a memory type switch that allows the furnishing to adjust to a preset position when the operator is present at the control on the furnishing;

d) If the speed is less than 1 inch / second (2.54 cm/second), the switch specified in 23.1.1 (e), would not need to be guarded. This requirement supersedes the requirement in 10.2.1.14; and

e) Shall have the marking specified in 90.5.

23.3 Usage Area III – Alternate for motorized tables

23.3.1 These requirements are for furnishings that are provided with safety features that prevent personal injury and may be used as an alternate evaluate means to the requirements in 23.2, Operator Attended Commercial Products – Usage Area III.

23.3.2 The viability of these safety features shall be determined by performing the Collision Mitigation Evaluation, Section 54.

23.3.3 The controls shall be evaluated for reliability by performing a FMEA in accordance with UL 991, Standard for Tests for Safety-Related Controls Employing Solid-State Devices, Sections 7 and 23, 24 or 25 and the 14 day Composite Operational and Thermal Cycling Test, Section 16.

23.3.4 The computational investigation shall be used as part of the FMEA Analysis. The computational investigation shall comply with 3.5.4.6(f).

23.3.5 For the Composite Operational and Thermal Cycling Test, the temperature range shall be 16 – 30°C (60 – 85°F) unless the manufacturer specifies temperatures outside that range. In that case, the temperatures shall be based on the manufacturer's specifications. During the test if the control stops working, because of a temperature limiting safety feature of the control, the temperatures shall be adjusted so that the product will operate throughout the 14 day test.

23.3.6 The control shall be subjected to the Follow-Up program specified in UL 991, Supplement SA.

24 Parts Subject to Pressure

24.1 Factory sealed systems

24.1.1 A component or system that is pressurized with fluids or gasses from the factory shall be subjected to the normal and abnormal test series for that furnishing without rupture of the system or resulting in a risk of fire, shock or injury to persons.

24.1.2 A component or system with a polymeric containment part such as a hose, tubing, enclosure and the like, relied upon to contain the pressure, shall be subjected to the requirements in 30.1, Conditioning of Polymeric Components, before subjecting the component or system to the normal and abnormal test series for the furnishing.

24.2 Open systems and systems with pumps

24.2.1 A system other than specified in 24.1, Factory Sealed Systems, or one that is intended to move the fluid or gas with a pump shall withstand, without rupture, a hydrostatic pressure equivalent to five times the maximum working pressure in accordance with Section 52, Hydrostatic Pressure Test.

25 Abnormal Conditions – General

25.1 When the conditions of intended operation are not representative of all conditions possible in service, a product shall not present a risk of fire, electric shock, or injury to persons when operated under such abnormal conditions and foreseeable misuse (likely using the furnishing in a manner not intended by the manufacturer).

25.2 Continuous operation, malfunction of components, shorting of output circuits, failure of cooling fans, and likely misuses of the product are conditions to be simulated.

25.3 Abnormal conditions (See Section 75, Abnormal Tests) shall be considered when evaluating furnishings.

25.4 The failure of a component in a furnishing circuit shall not result in a risk of fire, electric shock, or injury to persons.

25.5 A controller designed to manage power or signaling to single or multiple loads shall operate so that upon any single component failure the system does not result in a risk of fire, electric shock, or injury to persons.

25.6 A product that requires operations in a specific sequence shall operate so that upon any single component failure the product does not result in a risk of fire, electric shock, or injury to persons.

25.7 A product that requires limited operation time shall operate so that upon any single component failure the product does not result in a risk of fire, electric shock, or injury to persons.

26 Safety Circuits

26.1 A safety circuit shall be suitable for the application. Components that have been determined to be reliable through previous investigation are not subject to further evaluation unless review of the use, or specific use within a circuit, requires additional evaluation to determine the device or circuit will perform reliably. An electro/mechanical device intended to control the safety functionality of the furnishing such as but not limited to a relay, contactor, position switch, reed switch and similar devices shall be capable of functioning properly through 100,000 cycles of operation at rated load.

26.2 When the investigation in accordance with Section 75, Abnormal Tests, determines that a component or circuit fault results in a risk of fire, electric shock, or injury to persons or the furnishing has a safety function, then the component(s) or circuit(s) in question shall be investigated to determine that they possess the necessary reliability for the anticipated product service life. The circuit(s) shall comply with the requirements for Protective Controls, 3.5.4.

27 Furniture Flammability

27.1 Mattresses

27.1.1 All Mattresses, Mattress Sets and Mattress Foundations shall comply with the Federal Register 16 CFR Part 1633 – Standard for the Flammability (Open Flame) of Mattress Sets. The mattress shall be marked as required in 16 CFR Part 1633 and any other markings required by this standard.

27.1.2 All mattresses, mattress sets and mattress foundations shall comply with the Federal Register 16 CFR Part 1632, Standard for the Flammability of Mattresses and Mattress Pads. The mattress shall be marked as required in 16 CFR Part 1632 and any other markings required by this standard.

27.1.3 Mattresses, mattress sets and mattress foundations intended for use in public occupancies shall comply with 27.1.1, 27.1.2, and the State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation, Technical Bulletin 129, Flammability Test Procedure for a Mattress for Use in Public Buildings (October 1992). The mattress shall be marked in accordance with Technical Bulletin 129 and 87.2.25.

27.2 Upholstered seating

27.2.1 Upholstered seating furnishings shall comply with the State of California Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation, Technical Bulletin 117-2013, Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture (March 2013). The furnishing shall be marked in accordance with 87.2.27.

27.3 Other commercial furnishing types

27.3.1 A furnishing or combination of furnishings that are intended to be used together, such as a row of bookcases or tables ganged (mechanically connected) together within one foot (30.5 cm), with a combustible surface area greater than 10 square feet (0.93 m^2) shall comply with the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723 (ASTM E84, Characteristics of Building Materials). The product literature shall be reviewed to determine the intended use. Surface area calculation shall be determined as follows:

a) Surface areas are calculated based on only one side of the surface;

b) All surfaces between vertical and 45 degrees including 45 degrees from vertical are considered vertical surfaces. All surfaces between horizontal and up to 45 degrees from horizontal are considered horizontal surfaces. The areas of the vertical and horizontal surfaces shall be added together;

c) Edges (Examples – Front edge of a shelf, vertical stile or horizontal rail of a unit) of surfaces 2 inches or less in dimension are not added into the area calculation unless they can be positioned directly adjacent to each other;

d) Removable and optional portions of the furnishing are to be included in the area determination; and

e) Merchandise or electrical equipment on the furniture or separately investigated portions of the furnishing such as a conductor, cable, luminaire, power supply, amplifier, speaker, TV, monitor etc. are not to be included in the surface calculation or test.

27.3.2 A decorative molding, cover, shelf, top cap, or a similar component that is formed of combustible material and runs at least the full width of one unit, such as the length of a table, shall have a flammability rating of HB in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception: Materials that are tested in combination with a sample evaluated to 27.3.1 do not need to comply with UL 94 unless used for other purposes specified in this standard.

27.3.3 A combustible material used to form a small [less than 1 sq. inch or less than 4 oz (113.4 g)] decorative part or mechanical connector is not required to have a flammability rating of HB or better in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. This requirement also applies to fabric and adhesive systems employed as a decorative covering on interpanel poles and posts.

27.3.4 Products tested to UL 723 shall have a maximum flame-spread rating of 200 and if the smoke developed rating is over 450 the product shall be marked as specified in 87.2.17.

28 Heating Pads – For Use in Upholstered Furnishings

28.1 A heating pad employed in a furnishing shall comply with the applicable requirements in the Standard for Electric Heating Pads, UL 130 or Medical Electrical Equipment, Part 1: General Requirements for Safety, UL 60601-1.

Exception: A heating pad that is not accessible and that complies with the requirements in the Resistance to Moisture Test, 79.1; the Thermostat Test, 79.2, and the Flexing and Twisting Test, 79.3, is acceptable.

28.2 Fabric, batting, padding, foam, and synthetic or natural leather shall not be relied upon to serve as electrical insulation.

28.3 Current-carrying metal parts within a heating pad shall be electrically insulated with a material that complies with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. The thickness (not including the envelope or padding material) of insulation applied directly to the current-carrying metal parts shall not be less than 0.028 inch (0.71 mm) unless the parts are secured in position (to prevent their motion relative to one another, the envelope, or both). If the parts are secured, 0.013 inch (0.33 mm) shall be the minimum insulation thickness.

Exception: Appliance wiring material with insulation thickness as specified above.

28.4 A furnishing heating pad shall be provided with a supplemental envelope (enclosure) that complies with the following:

a) The envelope shall be of materials acceptable for the application and shall enclose all electrical parts of the pad without any ventilation or other openings;

b) An envelope of unsupported vinyl sheeting on a furnishing pad shall not be thinner than an average thickness of 0.020 inch (0.5 mm):

1) The average thickness of a rectangular specimen measuring approximately 1 by 4 inches (25 by 102 mm) is to be determined from measurements made by means of a dead-weight dial micrometer having a flat anvil and a flat-faced cylindrical presser foot that is 0.25 ±0.01 inch (6.35 ±0.25 mm) in diameter and exerts 85 ±3 gf (0.83 ±0.03 N) on the specimen. The calibration of the dial on the micrometer is to facilitate estimation of each measurement to 0.0001 inch (0.0025 mm); and

2) The thickness of a specimen is to be measured midway across the width of the specimen at the center of its length and at points 1/2 inch (13 mm) from each end. Each measurement is to be estimated at the nearest 0.0001 inch (0.0025 mm) and recorded. The smallest of the three recorded thicknesses is to be rounded off to the nearest 0.001 inch (0.025 mm).

28.5 Foam padding in direct contact with or provided as a component of a heating pad shall comply with the requirements for HBF or better material as specified in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

PERFORMANCE

MECHANICAL TESTS

29 General Conditions

29.1 General

29.1.1 Where an angle is specified, the tolerance shall be ±2.0 degrees.

29.2 Trial installation

29.2.1 A furnishing shipped disassembled or an accessory shall be trial-installed to determine that the installation is applicable, that the instructions are detailed and accurate, and that the use of the furnishing or accessory does not introduce a risk of fire, electric shock, or injury to persons.

30 Conditioning of Products

30.1 Conditioning of polymeric components

30.1.1 A polymeric material used to support or carry a weight load shall be conditioned in accordance with 30.1.2 prior to conducting loading or mounting tests.

30.1.2 An unloaded representative furnishing support system employing polymeric parts and its accessories are to be placed in a full-draft circulating-air oven. The air temperature within the oven is to be maintained at a minimum of 70°C (158°F) or 10°C higher than the temperature obtained on the polymeric parts during the temperature test, whichever is higher, for a minimum of 7 hours. The support system and its accessories are to be allowed to cool to room temperature before conducting the Stability Test, Loading Test, Cycling Test or Mounting Securement Test.

30.2 Conditioning of components secured by adhesives

30.2.1 An adhesively secured component used to support or carry a weight load shall be conditioned as specified in 30.2.2 prior to conducting the stability, loading tests or the Adhesive Securement Test, Section 31.

30.2.2 Two representative furniture support systems employing adhesives as the sole support shall be conditioned as follows:

a) One furniture support system shall be placed in an air-circulating oven for: Seven days at 100 ±1.0°C (212 ±1.8°F); and

b) One furniture support system shall be conditioned for a minimum of seven days in an environment of 85 ±5 percent relative humidity at 32.0 ±2.0°C (89.6 ±3.6°F).

The support system and its accessories are to be allowed to cool to room temperature before conducting the required test.

31 Adhesive Securement Test

31.1 A component of a furnishing secured by an adhesive that would create a risk of fire, electrical shock or injury to persons upon adhesive failure shall comply with the test specified in 31.2. The adhesive is considered satisfactory when the adhered surfaces do not separate.

31.2 The joined components shall be subjected to the conditioning specified in 30.2, Conditioning of Components Secured by Adhesives.

31.3 The furnishing shall be installed in accordance with the installation instructions. A weight equal to 4 times the weight of the adhered component is to be attached to any point on the adhered component that subjects the adhesive to the weight load. The component shall remain affixed to the furnishing for a minimum of 1 minute.

32 Structural Test Requirements for Furnishings – General Loading

32.1 A furnishing shall be subjected to the structural loading tests, Section 33, Seating, Section 34, Desks and Tables, Section 35, Storage Furnishings, and Section 36, Bests and shall not collapse or deform to a degree that presents a risk of fire, electric shock, or injury to persons.

a) A risk of injury to persons is determined to exist when the furnishing or part of a furnishing collapses, partially collapses or is damaged to the extent that there are sharp edges or corners exposed which do not comply with the Standard for Tests for Sharpness of Edges on Equipment, UL 1439; and

b) Electrical components within the furnishing shall comply with the requirements of Accessibility of Uninsulated Live Parts and Film-Coated Wire, Section 13, and Dielectric Voltage-Withstand Test, Section 71.

32.2 For height adjustable tables, the tables shall be able to maintain the functional load at its highest height and for proof load shall not collapse or deform to a degree that presents a risk of fire, electric shock, or injury to persons.

32.3 Optionally, for tables, desks, and storage units, the company can specify the functional load. In those cases, the normal (functional) load will be the load specified by the company and the abnormal (proof) load will be 1.5 the normal load.

33 Seating

33.1 Chairs shall be subjected to the tests as outlined in Table 33.1, Table 33.2, or Table 33.3, as applicable.

Table 33.1
Office seating ANSI/BIFMA 5.1-2017

Section	Test Name
5	Backrest Strength – Static Type I & II
6	Backrest Strength – Static Type III
7	Drop – Dynamic
8	Swivel – Cyclic
9	Tilt Mechanism – Cyclic
10	Seating Durability – Cyclic
12	Arm Strength – Vertical – Static
13	Arm Strength – Horizontal – Static
14	Backrest Durability – Cyclic – Type I
15	Backrest Durability – Cyclic – Type II & III
17	Leg Strength – Front & Side Application
18	Footrest Static Load – Vertical

Table 33.1 Continued on Next Page

Table 33.1 Continued

Section	Test Name
19	Footrest Static Load – Vertical – Cyclic
20	Arm Durability – Cyclic
22	Tablet Arm Chair Static Load
23	Tablet Arm Chair Load Ease – Cyclic
24	Durability

Table 33.2
Large occupant seating ANSI/BIFMA 5.11-2015

Section	Test Name
6	Backrest Strength – Static Type I
7	Backrest Strength – Static Type II & III
8	Drop – Dynamic
9	Swivel – Cyclic
10	Tilt Mechanism – Cyclic
11	Seating Durability – Cyclic
13	Arm Strength – Vertical – Static
14	Arm Strength – Horizontal – Static
15	Backrest Durability – Cyclic – Type I
16	Backrest Durability – Cyclic – Type II & III
18	Leg Strength – Front & Side Application
19	Arm Durability – Cyclic
21	Tablet Arm Chair Static Load
22	Tablet Arm Chair Load Ease – Cyclic
23	Structural Durability – Cyclic

Table 33.3
Lounge and Public Seating – Tests ANSI/BIFMA 5.4-2012

Section	Test Name
5	Backrest Strength Test – Horizontal – Static
6	Backrest Strength Test – Vertical – Static
7	Backrest Durability Test – Horizontal – Cyclic
8	Backrest Durability Test – Vertical – Cyclic
9	Arm Strength Test – Horizontal – Static
10	Arm Strength Test – Vertical – Static
11	Arm Durability Test – Horizontal – Cyclic
12	Arm Durability Test for Multiple Seating Units – Vertical – Cyclic
13	Arm Durability Test for Single Seat Units – Angular – Cyclic
14	Seating Durability Tests – Cyclic
15	Drop Test – Dynamic

Table 33.3 Continued on Next Page

Table 33.3 Continued

Section	Test Name
16	Leg Strength Test – Front and Side Application
17	Unit Drop Test – Dynamic
19	Swivel Test – Cyclic
20	Tilt Mechanism Test – Cyclic
22	Tablet Arm Load Ease Test – Cyclic
23	Tablet Arm Load Test – Static

34 Desks and Tables

34.1 Desks and tables shall be subjected to the tests as outlined in Table 34.1.

Table 34.1
Desk / Table products ANSI/BIFMA X5.5-2014

Section	Test Name
5.2	Concentrated Functional Load
5.3	Distributed Functional Load
5.4	Concentrated Proof Load
5.5	Distributed Proof Load
5.6	Transactional Surface Torsion Load
5.7	Extendible Element Static Load
5.8	Benching Systems – Distributed Functional Load and Stability
5.9	Benching Systems – Distributed Proof Load
6	Top Load Ease Cycle
7	Desk/Table Unit Drop
8	Leg Strength
9	Separation Tests for Tall Desk/Table Products
13	Interlock Strength
15	Work Surface Vertical Adjustment
16	Keyboard Support and Input Device Support Adjustment
17.2 & 17.3	Vertical Hinged & Vertical Receding Doors, BiFold, and Multi-Fold Strength
5.3 & 5.4	Bottom Horizontal Hinged Strength
17.4	Vertical Receding Strength
17.5	Horizontal Receding Strength
20	Tilting Top Table – Cycle
21	Tilting Top Table – Latch Strength
22	Monitor Arm Strength
23	Monitor Arm Cycle

35 Storage Furnishings

35.1 Storage furnishings shall be subjected to the tests as outlined in Table 35.1, as applicable.