

Scientific Equipment & Furniture Association
Recommended Practices

SEFA 8M-2016

Laboratory Grade Metal Casework

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Foreword

SEFA Profile

The Scientific Equipment and Furniture Association (SEFA) is an international trade association comprised of manufacturers of laboratory furniture, casework, fume hoods and members of the design and installation professions. The Association was founded to promote this rapidly expanding industry and improve the quality, safety and timely completion of laboratory facilities in accordance with customer requirements.

SEFA Recommended Practices

SEFA and its committees are active in the development and promotion of Recommended Practices having domestic and international applications. Recommended Practices are developed by the association taking into account the work of other standard writing organizations. Liaison is also maintained with government agencies in the development of their specifications.

SEFA's Recommended Practices are developed in and for the public interest. These practices are designed to promote a better understanding between designers, architects, manufacturers, purchasers, and end-users and to assist the purchaser in selecting and specifying the proper product to meet the user's particular needs. SEFA's Recommended Practices are periodically updated. The Recommended Practices are numbered to include an annual suffix which reflects the year that they were updated. SEFA encourages architects to specify these Recommended Practices as follows: "SEFA 8M-2016".

SEFA Glossary of Terms

SEFA has developed a Glossary of Terms (SEFA 4-2010) for the purpose of promoting a greater understanding between designers, architects, manufacturers, purchasers and end users. The terms defined by SEFA are frequently used in contracts and other documents, which attempt to define the products to be furnished or the work involved. The Association has approved this Glossary in an effort to provide uniformity among those who use these terms. Where a specific Recommended Practice contains definitions which differ from those in the Glossary of Terms, then the definitions in the specific Recommended Practice should be used.

SEFA encourages all interested parties to submit additional terms or to suggest any changes to those terms already defined by the Association. The definitions should be used to help resolve any disputes that may arise or to incorporate the applicable terms in any contract or related documents.

SEFA Disclaimer

SEFA uses its best effort to promulgate Recommended Practices for the benefit of the public in light of available information and accepted industry practices. SEFA does not guarantee, certify or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with SEFA Recommended Practices or that any tests conducted under its Recommended Practices will be non-hazardous or free from risk. SEFA encourages the use of third party independent testing where appropriate.

Note : *Testing as described in this document must be performed and documented by a SEFA-approved third party testing facility. See Page 34 of the SEFA Desk Reference 5th Edition Version 2.0, or visit us at SEFALABS.COM for the most current list of SEFA-approved test labs.*

1.0 Scope

The scope of this document is intended to provide manufactures, specifiers, and users tools for evaluating the safety, durability, and structural integrity of metal laboratory grade furniture and complimentary items. This document is inclusive of casework (base units, wall mounted units, counter mounted units, tall units, tables and, shelving systems). Casework and shelving manufactured for laboratory use should be subjected to the tests and procedures outlined below.

Metal laboratory grade casework shall consist of base cabinets, wall cabinets, counter mounted cabinets, tall cabinets, and shelving.

Aggregate test results may vary by manufacturer. Procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products. However there may be certain door/drawer configurations and/or sizes outside the test unit configuration identified that may not meet certain parts of this test. A test unit has been identified in this document with the sole purpose of obtaining continuity of procedures and results in a scientific format.

Great care should be exercised when heavy loads are applied to the cabinet and appropriate safety precautions taken to insure safety of testing personnel. Properly trained personnel should perform all tests. SEFA assumes no liability for damage or injury as a result of conducting these tests.

The acceptance levels are based on the cumulative field experience and laboratory testing of SEFA members based on actual needs of laboratories. This is a performance- based document. Specifications proscribing specific materials, hardware, finishes, workmanship or construction may or may not meet acceptance levels of this document. If proscriptive components of the specifications conflict with compliance of this document then the Architectural proscribed elements take precedent.

Testing as outlined in this document must be performed and documented by a SEFA-approved independent third party testing facility.

2.0 Purpose

The purpose of this document is to describe the distinguishing performance characteristics of metal laboratory grade furniture and complimentary items. Furniture shall be of a type specifically designed and manufactured for installation and use in a laboratory.

Although aggregate test results may vary from manufacturer to manufacturer, procedures for testing performance criteria shall be as outlined in this document and results made available upon request. It is assumed that the test model reflects the performance criteria for all products regardless of construction, size, or style used. A test unit has been identified in this document with the sole purpose of obtaining continuity for procedures and results in a scientific format.

3.0 Definitions

Acceptance Levels - The acceptance level for each performance criteria is based on the cumulative experience of actual field testing and laboratory results of SEFA members. Acceptance levels describe the expected outcome of each test procedure.

ANSI/BIFMA - ANSI is the American National Standards Institute. Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer. BIFMA is the Business and Institutional Furniture Manufacturer's Association, an association of manufacturers of desk products and the like.

Apparatus - A machine or group of machines and accessories.

Arithmetic Mean - A number obtained by dividing the sum of a set of quantities by the number of quantities in a set; average.

ASTM - American Society for Testing and Materials.

Base Cabinets - A base cabinet is a storage device consisting of two ends, a back, a face and may or may not include a top or top frame. The face may be open, to access the storage area, or may be outfitted with one or more drawers and/or doors. A base cabinet is always placed on the floor and normally supports a surface. The top surface is normally no more than 42" (1,067mm) off the floor surface.

Best Practices - When given a choice of grade, the "best practice" is to select one that offers a well defined degree of control over the quality of workmanship, materials, and installation of a project. SEFA-8 Recommended Practices are written from a view of high quality laboratory furniture.

Cabinet Depth (Deep) - Given a front, bottom, two sides, and a top, the cabinet depth is a measure of the side of the cabinet, in its normal upright position, from the outside back to the outside front excluding doors and door fronts.

Cabinet Height (High) - Given a front, bottom, two sides, and a top, the cabinet height is a measure of the side of the cabinet, in its normal upright position, from the bottom edge of the side to the top, excluding any surface.

Cabinet Width (Wide) - Given a front, bottom, two sides, and a top, the cabinet width is a measure of the front of the cabinet in its normal upright position from one side to the other.

Casework - Base and wall cabinets, display fixtures, and storage shelves. The generic term for both "boxes" and special desks, reception counters, nurses stations and the like. Generally includes the tops and work surfaces.

Chase (Plumbing Area) - Space located behind the back of the base cabinet used to house plumbing or electric lines.

Combination Unit - A base unit of the type that has both door(s) and drawer(s).

Counter Mounted Cabinet - A counter mounted cabinet is a wall cabinet (usually with a height of approximately 48" [1,219mm] and is typically mounted on the work surface or shelf, as in a reagent shelf).

Cupboard (Door Unit) - That portion of the cabinet with no drawer(s) that may be enclosed by doors.

Drawer - A sliding storage box or receptacle opened by pulling out and closed by pushing in.

Free Standing - Requiring no support or fastening to other structures.

Hardware - Items such as screws, pulls, hinges, latches, locks, and drawer slides used in the construction of casework.

High Density Shielding - A barrier made of lead.

Joinery - The junction of two pieces intended to be permanently connected.

Laboratory Furniture - Furniture designed and manufactured for installation and use in a laboratory.

Latch - A piece of hardware designed to hold a door closed.

Leveling Screws (Levelers) - Threaded components designed to allow adjustment of the cabinet vertically as needed for leveling.

Nominal Dimensions - Not all cabinet manufacturers produce product to the identical dimensions. All dimensions given in this document are accurate to within five percent, which is considered nominal.

Permanent Damage - Destruction to material or joinery that would require repair in order to return to its original state.

Permanent Deformation - Deflection that has exceeded the limits of the product, thus changing the original shape of the product

Permanent Deterioration - Erosion or corrosion of material such that the component will never return to its original shape.

Permanent Failure - See "permanent damage."

Pulls - Articles of hardware used to grasp and open/close the door or drawer (see also hardware).

Rack Resistance - The ability of a product to resist stresses that tend to make the product distort and the drawers to become misaligned.

Rail - A horizontal member extending from one side of the cabinet to the other.

Reagent - A substance used because of its chemical or biological activity.

Removable Back - A panel located on the inside back of the base cabinet, which is removable in order to gain access to utilities.

Stainless Steel - Iron based alloys containing more chromium than the 12% necessary to produce passivity (less reactive), but less than 30%.

Submersion - Covered with water.

Tables - An article of furniture having a flat, horizontal surface supported by one or more support members (legs), and a frame (apron).

Tall Cabinet (Full Height Unit) - A tall cabinet is a storage device that consists of two ends, a top and bottom panel, a back and a face. The face may be open to access the storage area or may be outfitted with one or more drawers and/or door(s). A tall cabinet is always placed on the floor and is nominally 84" (2,134mm) high.

Torsion - A force acting at a distance which tends to twist or rotate an object or cabinet.

Uniformly Distributed - A force applied evenly over the area of a surface.

Unobstructed Entry - A cabinet is deemed to be unobstructed if access to the entire storage area is completely without obstacle.

Upright Position - A cabinet oriented in its intended position.

Wall Cabinet - A wall cabinet is a storage device consisting of two ends, a back, a top, bottom, and a face. The face may be open to access the storage area or may be outfitted with one or more door(s). The wall cabinet usually does not include a drawer. A wall cabinet is always mounted on a vertical surface such as a wall, a divider, panel or some other vertical structure. A wall cabinet is usually less than 48" (1,219mm) high.

Work Surface - A normally horizontal surface used to support apparatus at a convenient height above the floor. Work surfaces are normally positioned atop a base cabinet or table structure.

3.1 Description of Testing Apparatus

Solid Steel Bar - A square solid steel bar 2 1/2" (63mm) square, 28 1/4" (717mm) long, weighing 50 pounds (22.679 Kg).

Sand or Shot Bag (10 pounds [4.545 Kg]) - A bag of plastic or cloth with the approximate dimensions 10 9/16" (268mm) x 11" (279mm) as in typical "gallon size re-closable storage bags." Filled with enough sand or shot so that contents weigh 10 pounds (4.545 Kg).

Sand Bag (20 pounds [9.071 Kg]) - Two 10 pound (4.545 Kg) sand bags bound together.

Shot Bag (100 lbs. [45.359 Kg]) - A plastic or cloth bag of sufficient size to contain 100 pounds (45.359 Kg) of shot.

Cycling Mechanism - Per ANSI BHMA 156.9.-2003

Steel Rod - A 2" (51mm) diameter by 12" (305mm) long rod, approximately 10 pounds (4.535 Kg) in weight.

Hot Water - To be considered "hot water," the temperature of the water must be between 190° F to 205° F (88° C to 96° C).

One Pound Ball - Solid steel sphere approximately 2" (51mm) in diameter.

Hardwood Corner Block - A block of hardwood 2" (51mm square) by 1" (25.4 mm) high.

4.0 Base Cabinets

4.1 Description of Test Cabinet

The base cabinet shall be a combination of cupboard and drawer per Figure 1. The base cabinet shall have nominal dimensions $\pm 1"$ (25.4mm) of 48" (1,219.2mm) wide, 35" (889.0mm) high, and 22" (558.8mm) deep. The drawer shall be above the cupboard, full width and approximately one-fourth the height of the cabinet's face opening. The inside depth of the drawer shall be no less than 18" (457.2mm). The drawer in the full open position shall expose no less than 2/3 of the drawer interior. Cupboard shall be double-door design and provide unobstructed entry into the cabinet interior with the doors open. The unit shall contain one adjustable shelf. The cabinet back shall be the removable type (per manufactures standard design as used for access to the plumbing or chase area) with the removable panel removed.

The cabinet shall be free standing, squared and leveled and sitting 1" (25.4mm) off the floor on all four leveling screws. When leveling screws are not required, the cabinet shall be squared and leveled and sitting 1" (25.4mm) off the floor atop four hardwood corner blocks 2" (50.8mm) square and 1" (25.4mm) high. A top of 1" (25.4mm) thick 37-50 pcf medium density fiberboard shall be freely positioned on the cabinet without glue or fasteners of any kind. The top dimensions will be such that it will overhang the cabinet perimeter by 1" (25.4mm). Its weight shall be included in the test as live load. Before conducting the test, a visual examination shall be conducted to verify that the unit configuration and setup conditions are appropriate. Operate doors and drawers. Doors should be free moving and latch properly. Inspect the unit for dimensions and note the fit of doors and drawers to the cabinet body. Open and close the drawer. The drawer should be free moving and function as specified by the manufacturer. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

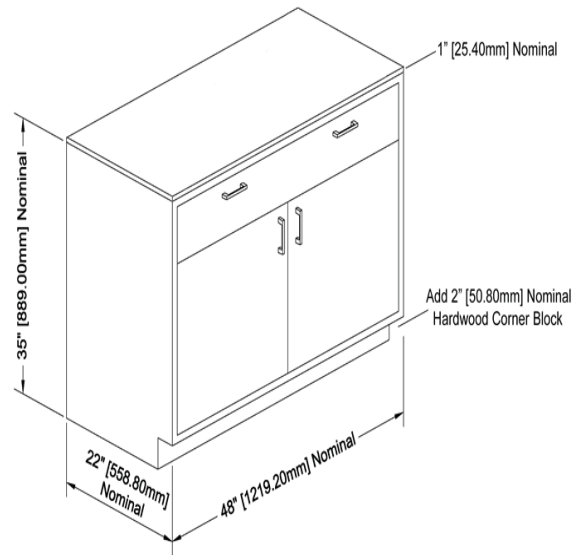


Figure 1. Description of Test Base Cabinet

4.2 Cabinet Load Test -

4.2.1 Purpose of Test

The cabinet load test will challenge the structural integrity and load bearing capability of the cabinet construction. This test will demonstrate the ability of the cabinet to support heavy applied loads. This is not intended to test the functional characteristics of the cabinet under heavy loads.

4.2.2 Test Procedure

Verify that the cabinet is level and supported only by the levelers. Load the cabinet top by using 2000 pounds (907.2 Kg) of solid steel bars (per Section 3.1) stacked five high and spaced per Fig 2. After ten minutes, unload the cabinet.

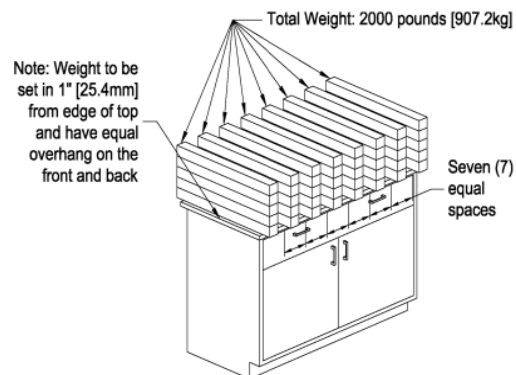


Figure 2. Cabinet Load Test Configuration

4.2.3 Acceptance Level

The cabinet will have no signs of permanent failure. After the load is removed, inspect the levelers. Any deformation shall not interfere with the function of the leveling system.

4.3 Cabinet Concentrated Load Test

4.3.1 Purpose of Test

The purpose of this test is to challenge the functional characteristics of the cabinet when subjected to a concentrated load on the center of the cabinet top.

4.3.2 Test Procedure

Using solid weights or 10 pound (4.535 Kg) sand bags (per Section 3.1), apply a total of 200 pounds (90.718 Kg) to the top of the cabinet along the cabinet centerline (see Figure 3). Operate doors and drawers.

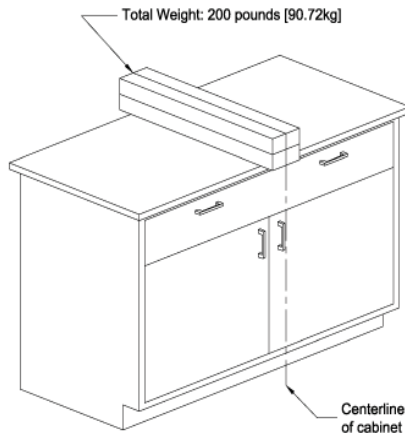


Figure 3. Base Cabinet Concentrated Load Test

4.3.3 Acceptance Level

Door and drawer operation shall be normal under condition of test load. There shall be no signs of permanent deformation to front rail, cabinet joinery, doors, or drawers.

4.4 Cabinet Torsion

4.4.1 Purpose of Test

This test will evaluate the structural integrity of the cabinet construction when subjected to a torsional load.

4.4.2 Test Procedure

The cabinet shall be tested in its normal upright position, raised not less than four-inches off the floor and supported on rear and one front corner. The area of support under the cabinet shall be located not more than 6" (152.4mm) in from each supported corner. Secure the cabinet diagonally from the unsupported corner with seven solid steel bars per Section 3.1 (350 pounds (158.757 Kg) of weight), to prevent overturning. Apply four solid steel bars (200 pounds [90.718 Kg] of weight) to the unsupported corner for a period of 24 hours (see Figure 4). Remove weight and place cabinet on the floor in its normal upright position. Observe cabinet joinery. Level the cabinet and measure the face and back of the cabinet across the diagonal corners.

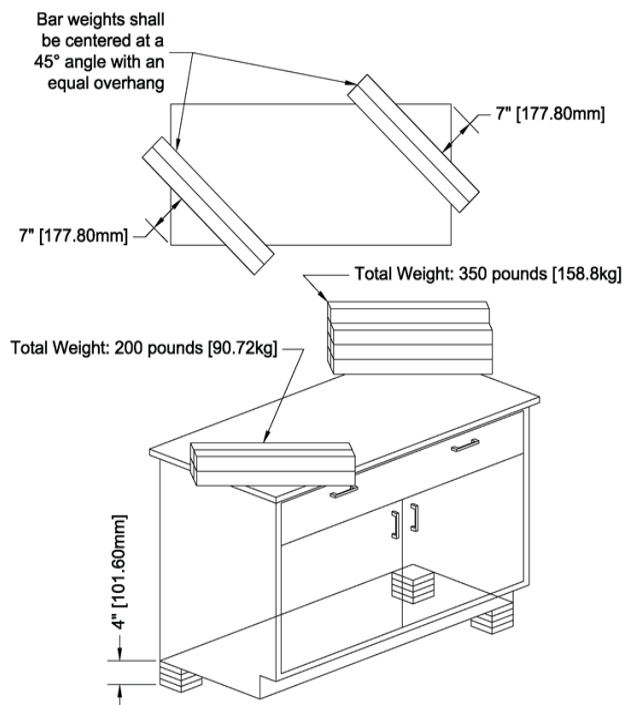


Figure 4. Base Cabinet Torsion Test Procedure

4.4.3 Acceptance Level

When returned to normal position, the operation of the cabinet shall be normal, and there will be no permanent damage. The difference between the two measurements taken from measuring the diagonal corners shall be no more than 1/8" (3.175mm).

4.5 Cabinet Submersion Test

Not applicable to Metal Casework

4.6 Spill Containment Test

Not applicable to Metal Casework

5.0 Doors

5.1 Door Hinge Test

5.1.1 Purpose of Test

This test will demonstrate the durability of the door, door attachment and its hardware (hinge leaf, screws, etc.) to an applied load of 200 pounds (90.72 Kg).

5.1.2 Test Procedure

Remove the shelf for this test. With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. With cabinet door opened 90-degrees, hang a sling made up of two 100 pound (45.359 Kg) weights (shot bags or solid weights) over top of the door at a point 12" (304.8mm) out from the hinge centerline (see Figure 5). Slowly move door through two full cycles of the hinge at 160-degree arc. Remove weight and swing door through its full intended range of motion and close door.

5.1.3 Acceptance Level

The open door shall withstand a load of 200 pounds (90.72 Kg) when applied at a point 12"(304.8mm) from the hinge centerline without permanent damage. Operation of the door, after test shall show no significant permanent damage that will cause binding of the door or hinges or that will adversely affect operation of the catch.

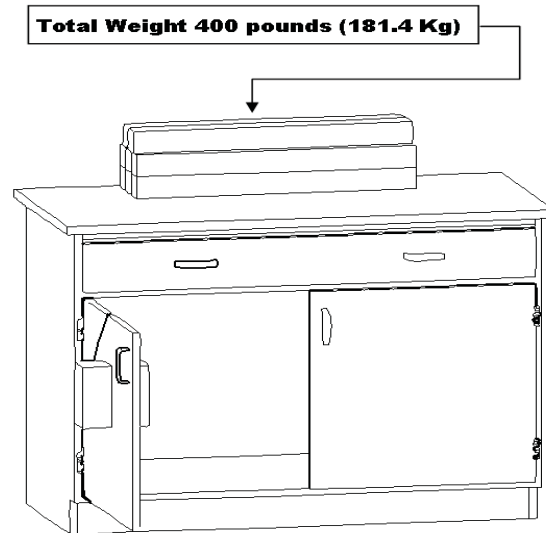


Fig 5 Base Cabinet Door Load Configuration

5.2 Door Impact Test

5.2.1 Purpose of Test

This test will demonstrate the resistance of a 240 inch-pound (27.1 N-m) impact to the door face. Only units that extend below the work surface should be subjected to this test. This test should not be inclusive of glass doors.

5.2.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to prevent overturning. A 20 pound (9.07 Kg) sand bag (Section 3.1) shall be suspended and dropped

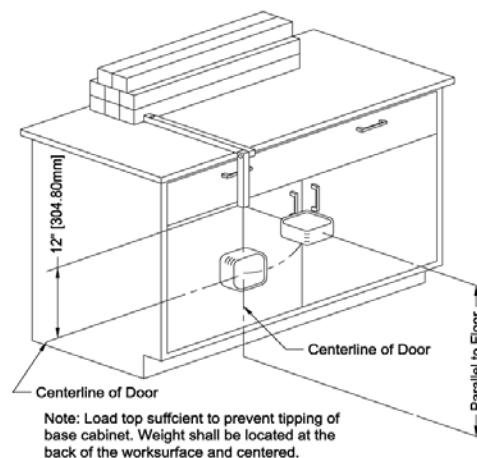


Figure 6. Base Cabinet Door Impact Test Configuration

to provide an impact of 240 inch-pounds (27.1 N-m) at the center of the closed door. (See Fig 6.)

5.2.3 Acceptance Level

After the test, the door and catch shall operate normally and show no signs of permanent damage. A dent or depression is an indication of permanent damage. This test is not intended to evaluate the cabinet finish.

5.3 Door Cycle Test

5.3.1 Purpose of Test

This test will demonstrate the durability of the door hinge hardware to withstand 100,000 cycles as a reliable measure for longevity).

5.3.2 Test Procedure

This test shall be in conformance to the ANSI test procedure A156.9, Grade 1, requirements for cycle testing of doors. A cycling mechanism shall swing door 90-degrees. Door shall operate for 100,000 cycles with a speed not greater than 15 cycles per minute.

5.3.3 Acceptance Level

Door shall operate for the full cycle period without deterioration that will significantly affect the function of the door. The door shall operate freely without binding.

6.0 Drawers

6.1 Drawer Static Test

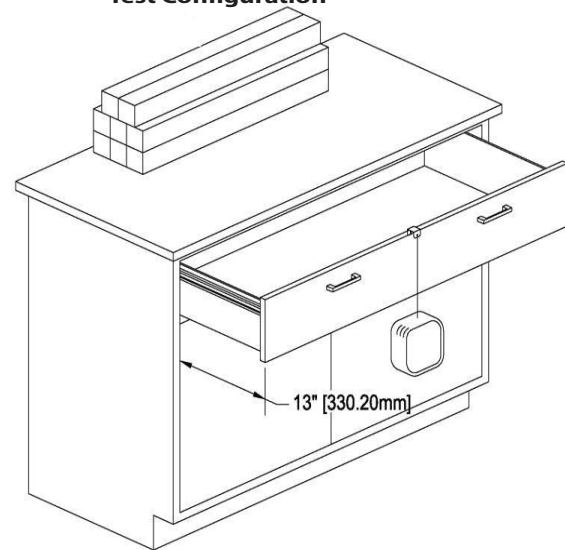
6.1.1 Purpose of Test

This test will demonstrate the ability to support a point load given to the front of the drawer and will challenge the drawer suspension system and the attachment of the drawer head to the drawer.

6.1.2 Test Procedure

With unit and top set as described in Section 4.1, add sufficient weight to the top in order to

Fig. 6 Base Cabinet Drawer Static Load Test Configuration



Note: Load top sufficient to prevent tipping of base cabinet. Weight shall be located at the back of the worksurface and centered.

prevent overturning. Open the drawer to 13" (330.2mm) of travel and hang 150 pounds (68.03 Kg) from the drawer head at the centerline of the drawer for five minutes. Remove the weight and operate the drawer through the full cycle.

6.1.3 Acceptance Level

There shall be no interference with the normal operation of the drawer and the drawer head should remain tightly fastened to the drawer.

6.2 Drawer and Door Pull Test

6.2.1 Purpose of Test

This test will evaluate the strength of the pull and pull hardware.

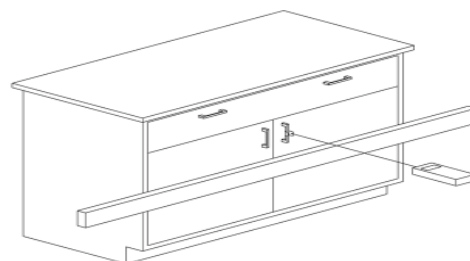


Figure 8. Base Cabinet Door and Drawer Pull Horizontal Load Test Configuration

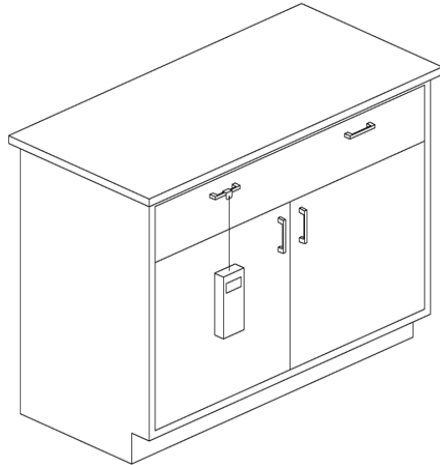


Figure 9. Base Cabinet Door and Drawer Pull Vertical Load Test Configuration

6.2.2 Test Procedure

Pulls are to be installed in accordance with manufacturer’s practice using specified attaching hardware and method. Block door and drawer closed. Using a force gauge attached with a 1” (25.4mm) wide bracket (see Figure 8), apply a force of 50 pounds (22.68 Kg), for 15 seconds, perpendicular to each pull. Revise setup to apply force downward (see Figure 9).

6.2.3 Acceptance Level

Pulls shall resist force without breakage. After completion of test and removal of weight, there shall be no significant permanent deformation.

6.3 Drawer Impact Test

6.3.1 Purpose of Test

This test will demonstrate the resistance to impact of the drawer bottom.

6.3.2 Test Procedure

Remove drawer; support each corner with 2”x2”x1” (50.8 x 50.8 x 25.4 mm) supports. Drop a 10 pound (4.545 Kg) sand or shot bag from a height of 24” (609.6 mm) into the bottom of the drawer at the center of the width of the drawer.

Remove the sand or shot bag.

6.3.3 Acceptance Level

No damage or breakout of the drawer bottom.

6.4 Drawer Internal Rolling Impact Test

6.4.1 Purpose of Test

This test will evaluate the strength of the drawer head, bottom, and back as a result of opening and closing the drawer with a rolling load.

6.4.2 Test Procedure

Position the drawer on a table at a 45-degree angle per Figure 7. Place a 2” (50.8mm) diameter by 12” (304.8mm) long steel rod (approximately 10 pounds [4.545 Kg]) 13” (330.2mm) from the target impact area such that the rod will roll freely to impact the back of the drawer. Subject the back to three impacts and reverse the drawer to subject the front to three additional impacts.

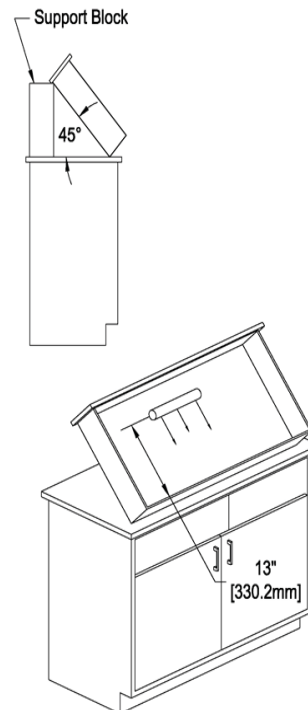


Figure 10. Base Cabinet Drawer Internal Rolling Impact Test Configuration

6.4.3 Acceptance Level

The drawer shall show no permanent damage. All joinery shall be intact and the drawer, when replaced in the unit, shall operate normally. Minor scratches and dents are acceptable.

6.5 Drawer Cycle Test

6.5.1 Purpose of Test

This test is intended to replicate years of operation of a drawer under full load.

6.5.2 Test Procedure

Attach a bracket to the center of the drawer front by bolting it through the drawer front and body. Attach a cycling mechanism to the bracket using a free floating poly block and pin.

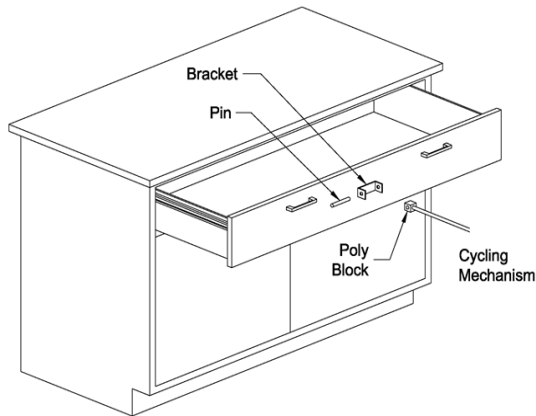


Figure 11. Drawer Cycling Mechanism Test Configuration

Laboratory Load – 100 pounds (45.36kg) A static of 100 pounds (45.35kg) (using ten 10-pound [4.54kg] sandbags per Section No. 3.1) shall be uniformly distributed in the drawer. Measure force required to activate the drawer. Operate from a closed position to within ¼" (6.35mm) of full extension for 50,000 cycles at a rate not to exceed 10 cycles per minute.

Heavy Duty Laboratory Load – 150 pounds (68.04kg) A static of 150 pounds (68.04kg) (using fifteen 10-pound [4.54kg] sand bags per Section No. 3.1) shall be uniformly distributed in the

drawer. Measure force required to activate the drawer. Operate from a closed position to within ¼" (6.35mm) of full extension for 50,000 cycles at a rate not to exceed 10 cycles per minute.

6.5.3 Acceptance Level

The drawer shall operate freely without evidence of dragging, rubbing or binding. The force required to open and close loaded drawer shall not be greater than 8 pounds (3.63kg) to activate hardware.*

**The American's with Disabilities Act (ADA) requires a force no greater than five pounds to activate hardware. The load rating in this document is intended only for testing conditions where loads challenge the durability of the hardware. Under actual conditions, drawer loading should be reduced to levels that result in compliance with ADA as applicable.*

7.0 Shelving

7.1 Description of Test Unit

Metal shelving shall be tested using the following procedure. The shelves to be tested are described in Sect. 4.1 and 9.1 "Description of Test Cabinet".

7.2 Shelf Load Test

7.2.1 Purpose of Test

This test will demonstrate the ability of a shelf and its mounting hardware to support normal laboratory loads.

7.2.2 Test Procedure

A shelf shall be mounted in the manner in which it is designed. Measure the distance from the underside of the shelf to a reference point perpendicular to the center of the shelf. Use shot or sand bags weighing 10 pounds (4.54 Kg) each. Unless otherwise specified, load the shelf uniformly to 40 pounds (18.14 Kg) per square foot of shelf area to a maximum of 200 pounds (90.72 Kg). Measure the deflection on the shelf by measuring the distance to the reference point and calculating the difference between the two

measurements. Record data and remove load from the shelf.

7.2.3 Acceptance Level

The allowable maximum deflection of a shelf is 1/180 of the span and not in excess of .25" (6.35mm). The following formula may be used to calculate the approximate deflection expected from a uniformly distributed load:

$$D(\text{max.}) = 5W L^3 / 384 E I$$

WHERE:

D = Deflection in inches (Maximum 1/180 span, not to exceed .25" (6.35mm).

W = (Design Load) x (Shelf Depth in Inches) x (Shelf Span in Inches) (Design Load = 40 pounds (18.14 Kg) / square foot divided by 144)

"W" shall not exceed 200 pounds (90.72 Kg).

L = Span between supports in inches

E = Modulus of Elasticity Steel = 29×10^6 psi
1-M-2

I = Cross section moment of inertia.

8.0 Cabinet Surface Finish Tests

8.1 Chemical Spot Test

Users should consider the chemical and staining agents that might be used near the laboratory casework. Common guidelines can be found by referring to: The casework manufacturer printed data for chemical and stain resistance, Because chemical and stain resistance is affected by concentration, time, temperature, humidity, housekeeping and other factors, it is recommended that users test samples in their actual environment with the substances they use.

8.1.1 Purpose of Test

The purpose of the chemical spot test is to evaluate the resistance a finish has to chemical spills.

Note: Many organic solvents are suspected carcinogens, toxic and/or flammable. Great care should be exercised to protect personnel and the environment from exposure to harmful levels of these materials.

8.1.2 Test Procedure

Provide 2" x 2" (50.8mm v 50.8mm) 18 gauge CRS test sample with between 2 and 4 mills of the manufacturer's standard paint finish applied. The sample to be tested for chemical resistance as described herein.

Place panel on a flat surface, clean with soap and water and blot dry. Condition the panel for 48-hours at 73° +/- 3°F (23° +/- 2°C) and 50 +/- 5% relative humidity or the currently accepted guideline set by ASTM. Test the panel for chemical resistance using forty-nine different chemical reagents by one of the following methods.

Method A - Test volatile chemicals by placing a cotton ball saturated with reagent in the mouth of a 1-oz. (29.574cc) bottle and inverting the bottle on the surface of the panel.

Method B - Test non-volatile chemicals by placing five drops of the reagent on the surface of the panel and covering with a 24mm watch glass, convex side down.

For both of the above methods, leave the reagents on the panel for a period of one hour. Wash off the panel with water, clean with detergent and naphtha, and rinse with deionized water. Dry with a towel and evaluate after 24-hours at 73° +/- 3°F (23° +/- 2°C) and 50 +/- 5% relative humidity, or the currently accepted guideline set by ASTM using the following rating system.

Level 0 - No detectable change.

Level 1 - Slight change in color or gloss.

Level 2 - Slight surface etching or severe staining.

Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

Note: Percentages are by volume.

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	A
2.	Acetate, Ethyl	A
3.	Acetic Acid, 98%	B
4.	Acetone	A
5.	Acid Dichromate, 5%	B
6.	Alcohol, Butyl	A
7.	Alcohol, Ethyl	A
8.	Alcohol, Methyl	A
9.	Ammonium Hydroxide, 28%	B
10.	Benzene	A
11.	Carbon Tetrachloride	A
12.	Chloroform	A
13.	Chromic Acid, 60%	B
14.	Cresol	A
15.	Dichloroacetic Acid	A
16.	Dimethylformamide	A
17.	Dioxane	A
18.	Ethyl Ether	A
19.	Formaldehyde, 37%	A
20.	Formic Acid, 90%	B
21.	Furfural	A
22.	Gasoline	A
23.	Hydrofluoric Acid, 37%	B
24.	Hydrofluoric Acid, 48%	B
25.	Hydrogen Peroxide, 30%	B
26.	Iodine, Tincture of	B
27.	Methyl Ethyl Ketone	A
28.	Methylene Chloride	A
29.	Monochlorobenzene	A
30.	Naphthalene	A
31.	Nitric Acid, 20%	B
32.	Nitric Acid, 30%	B
33.	Nitric Acid, 70%	B
34.	Phenol, 90%	A
35.	Phosphoric Acid, 85%	B
36.	Silver Nitrate, Saturated	B
37.	Sodium Hydroxide, 10%	B
38.	Sodium Hydroxide, 20%	B
39.	Sodium Hydroxide, 40%	B
40.	Sodium Hydroxide Flake	B
41.	Sodium Sulfide Saturated	B
42.	Sulfuric Acid, 33%	B
43.	Sulfuric Acid, 77%	B
44.	Sulfuric Acid 96%	B
45.	Sulfuric Acid, 77% & Nitric Acid, 70% equal parts	B
46.	Toluene	A
47.	Trichloroethylene	A
48.	Xylene	A
49.	Zinc Chloride, Saturated	B

8.1.3 Acceptance Level

Results will vary from manufacturer to manufacturer due to differences in finish formulations. Laboratory grade finishes shall result in no more than four (4) Level 3 conditions. Individual test results, for the specified 49 reagents, will be verified with the established third party, independent SEFA 8 test submittal form. Suitability for a given application is dependent upon the chemicals used in a given laboratory.

8.2 Hot Water Test

8.2.1 Purpose of Test

The purpose of this test is to insure the surface is resistant to hot water.

8.2.2 Test Procedure

Hot water (190°F to 205°F [88°C to 96°C]) shall be allowed to trickle (with a steady stream and at a rate of not less than 6 ounces [177.44cc] per minute) on the finished surface, which shall be set at an angle of 45°, for a period of five minutes.

8.2.3 Acceptance Level

After cooling and wiping dry, the finish shall show no visible effect from the hot water.

8.3 Impact Test

8.3.1 Purpose of Test

The purpose of this test is to evaluate the ductility of the coating.

8.3.2 Test Procedure

An 18 gauge CRS sample panel shall measure approximately 14" x 24" (355.6mm x 609.6mm). The panel shall have between 2 and 4 mills of the manufactures standard paint finish applied.

Position the panel on a smooth concrete floor. A one-pound ball (approximately 2" [50.8mm] in diameter) shall be dropped from a distance of 12" (304.8mm) onto a flat horizontal surface.

8.3.3 Acceptance Level

There shall be no visual evidence to the naked eye of cracks or checks in the finish due to impact.

8.4 Paint Adhesion Test

8.4.1 Purpose of Test

The paint adhesion test is used to determine the bond of the coating to steel.

8.4.2 Test Procedure

Using one of the samples described in section 10.1.2, perform the following test.

This test is based on ASTM D3359-02 "Standard Test Methods for Measuring Adhesion by Tape Test 1 – Test Method B". Two sets of six parallel lines 2mm apart shall be cut with a razor blade to intersect at right angles thus forming a grid of 25 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. Brush the grid area lightly with a soft brush, and then place a piece of tape over the grid. Rub the tape firmly with the eraser of a pencil to ensure good contact. Remove the tape by rapidly pulling it back upon itself as close to an angle of 180° as possible.

8.4.3 Acceptance Level

A 4B rating or better (ninety five percent or more of the grid area shall show finish intact).

8.5 Paint Hardness Test

8.5.1 Purpose of Test

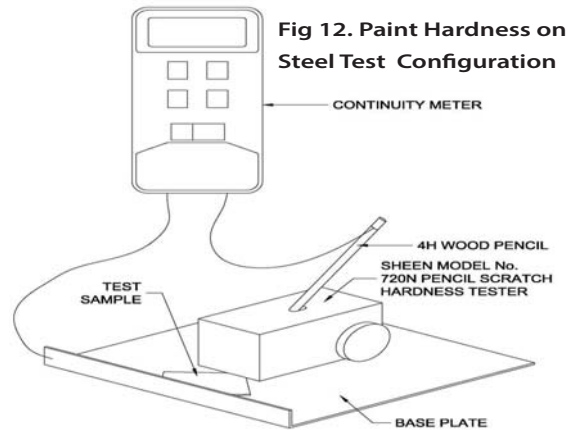
The paint hardness test is used to determine the resistance of the coatings to scratches.

8.5.2 Test Procedure

This test is based on ASTM D3363-0 "Standard Test Method for Film Hardness by Pencil Test 1". Using one of the samples described in section 10.1.2, perform the following test.

Clip a corner of the sample at 45° exposing a raw metal edge. Place the sample on a raw metal

base plate so that the exposed metal edge of the sample makes contact with the turned up side of the base plate (see Figure 12).



Remove approximately 6mm of wood from a 4H pencil, being careful to leave an undisturbed smooth cylinder of lead. Holding the pencil at an angle of 90° to an abrasive paper, rub the lead against the paper maintaining an exact angle of 90° until a flat smooth and circular cross section is obtained. On the other end of the pencil remove approximately 13mm of wood from one half of the pencil (see Figure 13). Install the pencil into a



Fig 13. 4H Pencil Configuration

Sheen model 720N Pencil Scratch Hardness Tester. Connect a continuity meter to the base plate and to the top of the pencil, being sure to make good contact with the exposed portion of the lead.

Following the manufacturers instructions place the tester on the surface of the test sample and push it forward approximately 13mm. Rotate the pencil 90° in the holder and repeat the test to one side of the first test. Repeat this two more times for a total of four tests, each with a different quadrant of the pencil lead.

8.5.3 Acceptance Level

The paint finish shall withstand the abrasion of a 4H pencil without penetrating through to the substrate and completing a continuous circuit.

8.6 Dart Impact Test

Not Applicable to Metal Casework.

8.7 Edge Delaminating Test

Not Applicable to Metal Casework.

8.8 Edge Impact Test

Not Applicable to Metal Casework.

8.9 Wear Resistance (Abrasion) Test

Not Applicable to Metal Casework.

9.0 Wall, Counter Mounted, and Tall Units

9.1 Description of Test Cabinet

Evaluation shall be conducted on a wall mounted cabinet with nominal dimensions as follows: 48" (1,219.2mm) +/- 1" wide, 30" (762mm) +/- 1" high, and 12" (304.8mm) +/- 1" deep. The wall cabinet shall be manufactured to manufacturers' standard construction and practices. The wall cabinet shall have two (2) doors and two (2) shelves. Shelves shall be evaluated per Section 7.0 (Shelving). The unit and shelves shall be mounted in a manner recommended by the manufacturer. A visual examination shall be conducted to verify that the configuration and installation comply with these conditions. Discontinue evaluation if unit is not in compliance or if malfunction is noted.

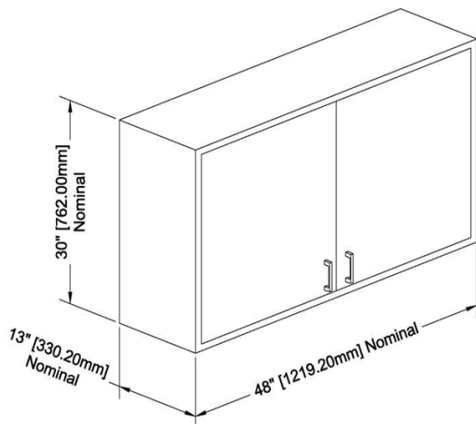


Fig 13. Wall Mounted Cabinet
Description of Test Cabinet

9.2 Wall Cabinet Load Test

9.2.1 Purpose of Test

The wall mounted load test will demonstrate the strength of the back of the wall cabinet as well as the joinery of the cabinet and function of doors when the unit is subjected to loads normally expected for laboratory furniture.

9.2.2 Test Procedure

Using sand or shot bags weighing 10 pounds (4.55 Kg) each, load cabinet bottom, each shelf, and top uniformly with 40 pounds (18.18 Kg) per square foot to a maximum of 200 pounds (90.91 Kg) each. Maximum load to any cabinet shall not exceed 600 pounds (272.73 Kg) (a maximum of 200 pounds [90.91 Kg] loaded to each bottom, a minimum of one shelf loaded per Section 7.0, and the top) regardless of the number of shelves. Test to be performed with doors closed.

9.2.3 Acceptance Level

With weights in place, after a period of 24 hours, operate doors through full travel to verify normal operation of doors. Remove weights and operate doors to verify normal operation. Verify that there is no significant permanent deflection of cabinet top, cabinet back, cabinet bottom, or shelves. After weights are removed, the cabinet shall show no permanent damage to the cabinet, cabinet bottom, or shelves.

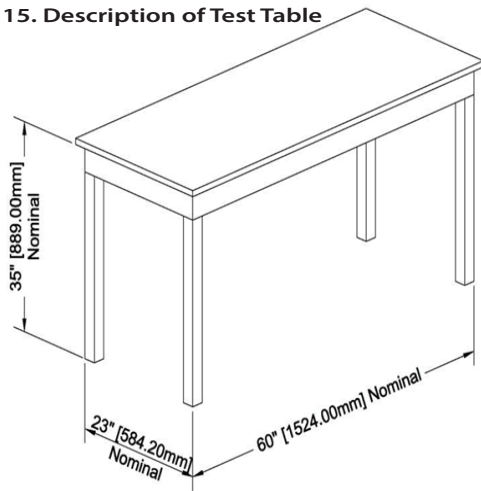
10.0 Tables

10.1 Description of Test Unit

The table for evaluation shall be a standing height, four legged, free standing table. The table shall be nominally ± 1 " (25.4mm) 60" (1,524mm) long, 23" (584.2mm) deep and 35" (889mm) high (see Fig. 15). Leg and apron size and construction shall be to manufacturer's specification. A top of 1" (25.4mm) thick 37-50 pcf medium density fiberboard shall be mounted on the table in the manner recommended by the manufacturer. The top dimensions will be such that it will overhang

the cabinet perimeter by 1". Its weight shall be included in the test as live load. Tables can be represented by a very large range of styles and designs.

Fig 15. Description of Test Table



10.2 Table Static Load

10.2.1 Purpose of Test

This test will challenge the table components to loads that are used in the laboratory.

10.2.2 Test Procedure

Load the table top by using solid steel bars (per Section 3.1), each weighing 50 pounds (22.68 Kg), stacked evenly and spaced per Figure 16. These evenly distributed loads should be no less than 600 pounds (272.16 Kg) for free standing tables. Include the weight of the working surface as live load.

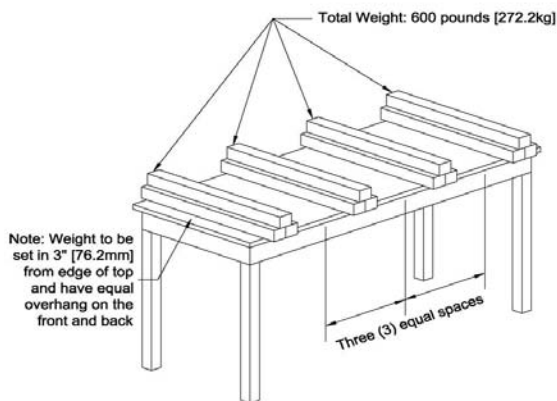


Fig 16. Table Static Test Configuration

10.2.3 Acceptance Level

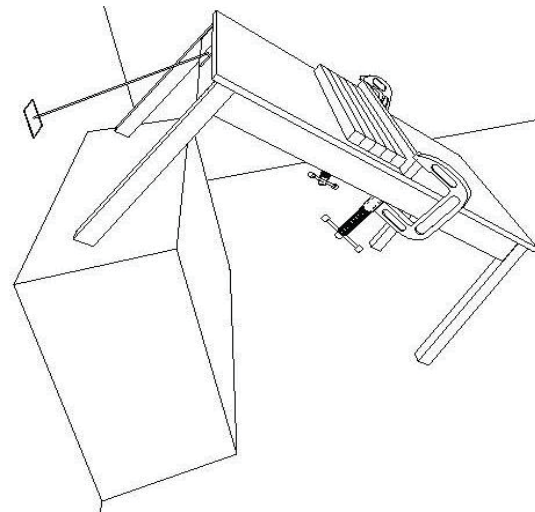
No structural breakage shall result from application of the load. With the full load, the apron rails shall not deflect more than 1/360 of the span of the table and not to exceed 1/8" (3.175mm). In the case of a table with a drawer, the deflection of the rail shall not interfere with the function of the drawer. After the load is removed, inspect the table for structural damage.

10.3 Table Racking

10.3.1 Purpose of Test

This test will demonstrate the structural integrity of the table construction when subjected to a racking load. Most racking failures occur upon dragging an unloaded table across a floor. The ability of a table to resist a racking load will indicate less damage to the structure. The following tests were based on and adapted from ANSI/BIFMA X5.5-1989 American National Standard for Office Furnishings "Desk Products-Tests." Adjustments have been made to better accommodate the specific applications of tables used in laboratories.

Fig 17. Table Racking Test Configuration



10.3.2 Test Procedure

The table shall have a common two-by-four wood rail clamped on the centerline of the top parallel to the ends of the table. The table shall then be

positioned at 45°, with one pair of legs on the floor and the other raised and supported (see Figure 17). To prevent the table from tipping over, attach a cable to the end rail of the table and to the wall. The attachment of the cable at the wall must be equal to or less than the height of the attachment at the table. The table shall then have 250 pounds (113.398 Kg) of weight (five 50-pound (22.679 Kg) bars) placed on its top and held in place by the two-by-four wood rail. The unit shall remain in this position for seventy-two hours. The unit shall be lowered without shock to the leveled surface and the general operation of the drawers shall be evaluated.

10.3.3 Acceptance Level

When returned to normal position, the operation of the table shall be normal, and there will be no permanent damage.

Endnotes

1This format has been adapted from the BIFMA American National Standard format, X5.5 - 1989.

2Ibid. p 8.

3Ibid. pp 10-26.

4The Concise American Heritage Dictionary, (Boston: Houghton Mifflin Company, 1969), p. 38.

5Architectural Woodwork Institute, Architectural Woodwork Quality Standards Illustrated, 7th Edition Version 1.0, 1997, p A-563.

6E. Paul DeGarmo, Materials and Process in Manufacturing, 5th Edition, (New York: MacMillan Publishing Co., Inc.1979), p 423.

7A. Merriam-Webster, Webster's Ninth New Collegiate Dictionary, (Massachusetts: Merriam-Webster Inc. 1988), p 381.

8U.S. Forest Products Laboratory, Wood Engineering Handbook, (New Jersey: Prentice-Hall, Inc. 1974), p 23-6. 9Architectural Woodwork Quality Standards Illustrated, 7th

Edition Version 1.0, p 38.

9Wood Engineering Handbook, p 23-7.

10BIFMA, American National Standard for Office Furnishings, (ANSI/BIFMA X5.5-1983), p 8-9.

11Webster's Ninth New Collegiate Dictionary, 1988, p 980.

12Metals Handbook Committee, Metals Handbook, 8th Edition, Vol.1 "Properties and Selection of Metals" (Ohio: American Society for Metals, 1969), p 408

LABORATORY FURNITURE CERTIFICATE OF PERFORMANCE

_____ certifies that its laboratory furniture identified as
(Company Name)

_____, has been tested in conformance with the full requirements
(Test Unit)

of the **SEFA 8-M-2016 Recommended Practices** with results noted below.

Full documentation of the test results is available upon request in a bound report that includes a detailed description of the test unit and procedures, witnesses results and appropriate drawings or photographs of the test unit and procedures.

TEST	TEST RESULTS PASS/FAIL	TEST	TEST RESULTS PASS / FAIL	TEST	TEST RESULTS PASS/ FAIL
4.2		6.2		8.2	
4.3		6.3		8.3	
4.4		6.4		8.4	
5.1	@200 lbs.	6.5	@ 100 lbs.	8.5	
5.2		6.5	@ 150 lbs.	9.2	
5.3		7.2	Deflection Measured	10.2	
6.1		8.1	<i>See Attached Form</i>	10.3	
COMPANY INFORMATION			TEST SUPERVISOR INFORMATION		
Name:			Name:		
Address:			Title:		
			Signature:		
Telephone:			COMPANY OFFICER INFORMATION		
Fax:			Name:		
			Title:		
Date:			Signature:		

CHEMICAL RESISTANCE TESTING – 8-M-2016

Date of Test: _____ Sample Description: _____

Type of Material Coated: _____ Coating Type: _____

Rating Scale: **Level 0 – No Detectable Change**
 Level 1 – Slight Change in Color or Gloss
 Level 2 – Slight Surface Etching or Severe Staining
 Level 3 – Pitting, Cratering, Swelling, Erosion of Coating, Obvious and Significant Deterioration.

#	CHEMICAL	RATING	COMMENTS
1	Acetate, Amyl		
2	Acetate, Ethyl		
3	Acetic Acid 98%		
4	Acetone		
5	Acid Dichromate 5%		
6	Alcohol, Butyl		
7	Alcohol, Ethyl		
8	Alcohol, Methyl		
9	Ammonium Hydroxide 28%		
10	Benzene		
11	Carbon Tetrachloride		
12	Chloroform		
13	Chromic Acid 60%		
14	Cresol		
15	Dichloroacetic Acid		
16	Dimethylformamide		
17	Dioxane		
18	Ethyl Ether		
19	Formaldehyde 37%		
20	Formic Acid 90%		
21	Furfural		
22	Gasoline		
23	Hydrofluoric Acid 37%		
24	Hydrofluoric Acid 48%		
25	Hydrogen Peroxide 30%		
26	Iodine, Tincture of		
27	Methyl Ethyl Ketone		
28	Methylene Chloride		
29	Monochlorobenzene		
30	Naphthalene		
31	Nitric Acid 20%		
32	Nitric Acid 30%		
33	Nitric Acid 70%		
34	Phenol 90%		
35	Phosphoric Acid 85%		
36	Silver Nitrate, Saturated		
37	Sodium Hydroxide 10%		
38	Sodium Hydroxide 20%		
39	Sodium Hydroxide 40%		
40	Sodium Hydroxide, Flake		
41	Sodium Sulfide, Saturated		
42	Sulfuric Acid 33%		
43	Sulfuric Acid 77%		
44	Sulfuric Acid 96%		
45	Sulfuric Acid 77%, and Nitric Acid 70%, equal parts		
46	Toluene		
47	Trichloroethylene		
48	Xylene		
49	Zinc Chloride, Saturated		

TEST PERFORMED BY: _____ DATE: _____

