



Storage Units - Tests

American National Standard for Office Furniture

American National Standard

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**American National Standard
For Office Furniture**

Storage Units - Tests

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For ANSI/BIFMA X5.9-2004

Foreword

The material presented in this standard was developed as a result of the efforts of the members of BIFMA International and reviewed by a broad representation of interested parties, government organizations and commercial testing and procurement and interior design organizations.

This standard defines specific tests, laboratory equipment, conditions of test, and recommended minimum levels to be used in the test and evaluation of the performance, durability, and structural adequacy of storage units used in offices.

The original work on this standard was completed in May 2003 by the BIFMA Engineering Committee and particularly by its Subcommittee on File/Storage Standards. The Subcommittee conducted reviews of the proposed standard to ensure that the tests accurately describe the proper means of evaluating the safety, durability, and structural adequacy of storage units and related products. The reviews produced the various test procedures that improve the procedures and provide consistency. The proposed new standard was submitted to the membership of BIFMA International and approved in March 17, 2004. A canvass of interested parties and stakeholders was conducted in accordance with the requirements of an ANSI accredited standard. After completion of the canvass process, the standard was subsequently submitted to the American National Standards Institute for approval as an American National Standard. Approval by ANSI was given on November 17, 2004 after a thorough review of the process used by BIFMA International.

Suggestions for the improvement of this standard are welcome. The suggestions should be sent to email@bifma.org or BIFMA International, 2680 Horizon SE, Suite A1, Grand Rapids, MI 49546.

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BIFMA X5.9-2004

Storage Units - Tests

1 Scope

This standard is intended to provide a common basis for evaluating the safety, durability and structural performance of storage units. It provides test methods and performance requirements for freestanding, mobile, and wall-mounted storage units. Where a product may be covered by more than one ANSI/BIFMA standard, the manufacturer shall determine which standard provides most appropriate test conditions. Vertical files shall only be tested under X5.3 Vertical Files - Tests.

This standard specifies acceptance levels to help ensure reasonable safety and performance independent of construction materials, manufacturing processes, mechanical designs, or aesthetic designs. These tests are not intended to assess a product that has been in use.

The intention of this standard is to describe the means of evaluating function and safety of storage units without restricting construction materials, manufacturing processes, or mechanical and aesthetic designs. The acceptance levels herein are based on the actual field and test experience of BIFMA International members.

2 Definitions

Note: Refer to BIFMA PD-1 Industry Definitions for related terms not included in this standard. Otherwise, the common dictionary definition shall be used for terms not defined in this section or in BIFMA PD-1. In the case of a conflict between the definitions in this standard and PD-1, the definitions in this standard shall apply.

- 2.1 acceptance level:** The performance level required to pass the test.
- 2.2 adjustable glides:** Support devices for leveling and/or stabilizing a storage unit. (Alternately referred to as "glides," "levelers," "adjustable supports," or "height adjusters.")
- 2.3 cabinet:** The case and the full complement of extendible elements.
- 2.4 case:** The cabinet shell and all structural parts, including the sides, back, top plate, bottom plate, front framing, vertical uprights and any other fixed member, excluding extendible elements.
- 2.5 clear dimensions:** The clear dimensions of the extendible element or storage component are defined by the sides of the largest rectilinear box (with specific height limitations as Noted in 2.5.2 below) that fits into the space. For extendible elements, the box must clear all stationary elements as the extendible element is taken through its full range of travel.
- 2.5.1 clear depth:** The horizontal dimension of the box in the front-to-back direction. The clear depth is not reduced by the presence of a compressor.
- 2.5.2 clear height:** The vertical dimension of the box.
- Exceptions:
- In the case where there is no bottom for the extendible element, the maximum clear height value used for the clear space calculation shall not exceed 305 mm (12 in.).
 - In the case where there is a unit bottom the maximum clear height value used for the clear space calculation shall not exceed 457 mm (18 in.).
 - For shelves that extend, the maximum clear height value used for the clear space calculation shall not exceed 305mm (12 in.).
- 2.5.3 clear width:** The horizontal dimension of the box from side-to-side.
- 2.6 clear space:** The volume defined by the product of the clear dimensions, e.g., clear space = clear depth x clear width x clear height (Note exceptions in 2.5.2).
- 2.7 closed:** The extendible elements of the storage unit are fully retracted into the case and/or doors are in the position, blocking entry into the unit.
- 2.8 compressor:** A device used to restrict the movement of the filed material.
- 2.9 counterweights:** A device or material used to improve resistance to tipping of a storage unit. These items may be supplied as original manufacturer's equipment, or as a manufacturer's option, installed according to the manufacturer's instructions.
- 2.10 cycle:** A complete operation of loading and unloading or stress reversal; one complete revolution; to operate in a cyclic fashion.
- 2.11 display shelf:** A shelf with a sloping surface and retaining flange or edge.

- 2.12 doors:** A barrier by which an area is closed or opened. Types include: horizontal receding, vertical receding, tambour, sliding, vertical swinging, horizontal swinging, bi- fold, accordion, and others.
- 2.13 extendible element:** A movable load bearing storage component, including, but not limited to: drawers, shelves, and filing frames. (This excludes doors, writing shelves, and keyboard support surfaces.)
- 2.14 force:** A vector quantity, expressed in newtons (N) or Pounds-Force (lbf.), that tends to produce an acceleration of a body in the direction of its application.
- 2.15 fully extended:** The extendible element pulled out to the limit of its stops.
- 2.16 functional load:** The level of loading believed to be typical of hard use.
- 2.17 ganging:** Two or more storage units secured together in a group, side-to-side, rear-to-rear, or a combination of the two.
- 2.18 interlock:** A device that controls the extension of extendible elements to maintain the stability of the unit.
- 2.19 latching mechanism:** a keyless device designed to keep extendible elements and doors in their closed position that requires active participation from the user to disengage the device. Interlock and anti-rebound mechanisms are not considered latching mechanisms.
- 2.20 lbf.:** Abbreviation for pounds-force. The corresponding unit in the SI (Système Internationale) is the newton (N).
- 2.21 leveled:** A condition where the storage unit, when installed, adopts and maintains a true horizontal and vertical attitude. Leveling may be accomplished by, but not limited to, the use of adjustable glides or shimming.
- 2.22 load:** The weight to which a structure is subjected; a weight or force applied to a product; a force acting on a surface, usually caused by the action of gravity.
- 2.23 lock:** A device that secures the stationary and extendible elements of the storage unit against undesired access or opening.
- 2.24 loss of serviceability:** The failure of any component to carry its intended load or to perform its normal function. Unless otherwise specified, cracked or broken glass is considered a loss of serviceability.
- 2.25 N (newton):** A unit of force in the SI (Système Internationale), also known as the Metric System.
- 2.26 out stops:** A device that limits the travel of the extendible element in a direction away from the product.
- 2.27 pedestal:** A self-contained unit less than or equal to 787 mm (31in.) in height with a depth equal to or greater than its width, and having extendible elements or doors. The extendible elements are typically used for multi-functional general storage or filing. It may be freestanding, mounted under a horizontal surface, or mobile. Pedestal tops may be configured to accommodate seating or storage.
- 2.28 product safety label:** A sign, label, cord tag or decal affixed to the product that provides safety information about that product. Product safety signs or labels may identify the

hazard, the degree or level of seriousness, the probable consequences of involvement with the hazard, and how the hazard can be avoided.

- 2.29 proof load:** A level of loading in excess of hard use.
- 2.30 pull:** The feature used to facilitate the opening and closing of an extendible element. Pull refers to both projecting and recessed features.
- 2.31 shelf:** A horizontal surface that is attached to a vertical support(s) and is used to store materials. Shelves are not intended to provide seating capability.
- 2.32 stability:** The ability of a storage unit to resist tipping under normal loading and use conditions.
- 2.33 stability device:** A device that provides stability to the unit. Typically used devices are interlock systems, casters on extendible elements, counterweights, etc.
- 2.34 stops:** Devices that limit travel of extendible elements or doors.
- 2.35 storage component:** A load-bearing element used as part of a storage unit, including, but not limited to: drawers, shelves, and filing frames. (This excludes writing shelves.)
- 2.36 storage units:** An office furniture product used for storage of other objects. Storage units include, but are not limited to, bookcases, wardrobes, cabinets, wall-mounted or exterior-mounted elements (such as shelf assemblies or paper management accessories), freestanding and mobile pedestals, etc. Office storage units are typically products not specifically covered by other BIFMA standards.
- 2.37 suspension:** The system that is used to facilitate the movement of the extendible element in and out of the unit (often referred to as "slides" or "supports").
- 2.38 test platform:** The horizontal hard surface (concrete or other unyielding surface) on which the storage unit is placed during testing.
- 2.39 tip over:** The condition where the unrestricted storage unit will not return to its normal upright position.
- 2.40 TV/Multimedia Cabinet:** A unit that provides space for the storage/use of a television and associated electronic components.
- 2.41 unit bottom:** the lowest horizontal fixed surface of a unit. It is used to enclose or partially enclose the unit and/or protect its contents. Unit bottom may also be used to store materials.
- 2.42 unit height:** the vertical distance of a storage unit from the floor or test platform to its highest load-bearing surface. The height measurement is taken with adjustable glides at the midpoint of their adjustment but not to exceed 13 mm (0.5 in.). The height of wall-mounted units shall be based on the manufacturer's minimum recommended mounting height.
- 2.43 unit top:** the highest horizontal surface of a unit. It is used to enclose or partially enclose the unit and/or protect its contents. Unit top may also be used to store materials and/or accommodate a person's ability to sit.
- 2.44 writing shelf:** A moveable, typically stowable surface that is not intended to carry loads greater than defined in Table 1 (page 18), whose primary function is to support ancillary office tasks, such as writing and short term reference material handling.

2 General

3.1 Types of Tests

3.1.1 The testing and evaluation of a product in accordance with this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

3.1.2 The types of tests to be employed fall into the following general categories:

- a) static load applications;
- b) dynamic load applications;
- c) durability tests.

3.1.3 Each manufacturer's model or unit type in any configuration shall comply with applicable requirements when tested in accordance with this standard. Only worst-case models need to be tested for a specific unit type. A worst-case condition shall be representative of all models or units of the type tested. If "worst-case condition" is not readily evident, a case-by-case product line analysis by the manufacturer in consultation with the designated testing facility may be necessary, taking into consideration any special attributes, methods of construction, materials, and/or design features, etc.

3.1.4 Tests may be conducted on a series of storage units and not a single storage unit. Only one storage component of each type and size, as applicable, per storage unit needs to be tested. However, when a test requires that functional loads and proof loads be applied as part of the test criteria, they shall be applied to the same storage components in the same storage unit.

Note: If storage units are intended for wall hung applications, the unit including interfacing hardware and/or brackets must also meet the applicable static and durability tests within this standard.

3.1.5 The tests may be conducted in any sequence.

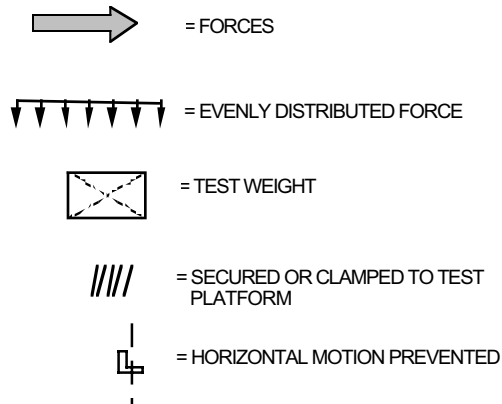
3.2 Manufacturer's Instructions

When a manufacturer provides specific assembly/installation instructions, product safety labels, or maintenance adjustments that may be required in order to keep the product in good operating condition, these instructions shall be followed during testing unless otherwise specified by the test procedures herein.

3.3 Figures

Figures provided in this standard are intended as guidelines only and may not be representative of all possible test configurations.

3.4 Figure Symbols



3.5 Tolerances

Unless otherwise specified, tolerances on test equipment, measuring equipment and loading devices, shall be:

- Test Weights, forces, velocities, and time, $\pm 5\%$
- Linear measurements, ± 1.5 mm (1/16 in.)
- Angles, ± 5 degrees
- Level, within 5 mm per meter (1/16 in. per linear foot)
- Cycle requirements are minimums

Test weights, forces, dimensions, angles, time, rates and velocities shall be targeted at the nominal values specified.

3.6 Recommended Test Report Format

When a test report is required, the following information should be included:

1. A title: (i.e., "Test Report");
2. Name and address of the laboratory, and the location where the tests were carried out, if different from the address of the laboratory;
3. Unique identification of the report (such as serial number) and on each page an identification in order to ensure that the page is recognized as part of the test report and a clear identification of the end of the test report;
4. Name and address of the client (where applicable);
5. Description and unambiguous identification of the item tested (i.e., model number, manufacturing date, etc.);
6. Characterization and condition of the test item;
7. Date of receipt of the test item;
8. Date(s) of the performance of test;
9. Identification of the test method used;
10. Any additions to, deviations from, or exclusions from the test method (such as environmental conditions);
11. The name(s), function(s) and signature(s), or equivalent identification of the person(s) authorizing the test report;
12. Where relevant, a statement to the effect that the results relate only to the items tested;
13. Date of issue of the report;
14. Test results with, where appropriate, the units of measurement and a statement of compliance/non-compliance with requirements and/or specifications;
15. A statement that the report shall not be reproduced, except in full, without the written approval of the laboratory.

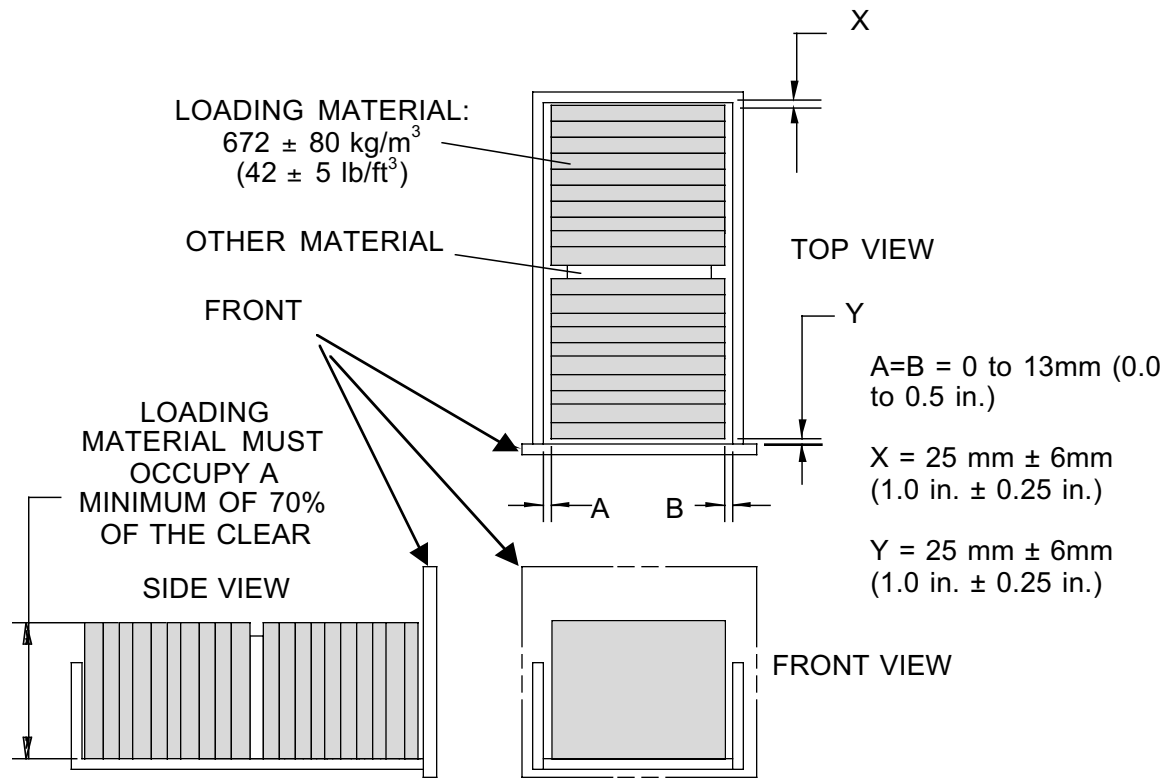


Figure 3a - Loading Configuration for Extendible Elements (Deeper than Wide) with Bottoms

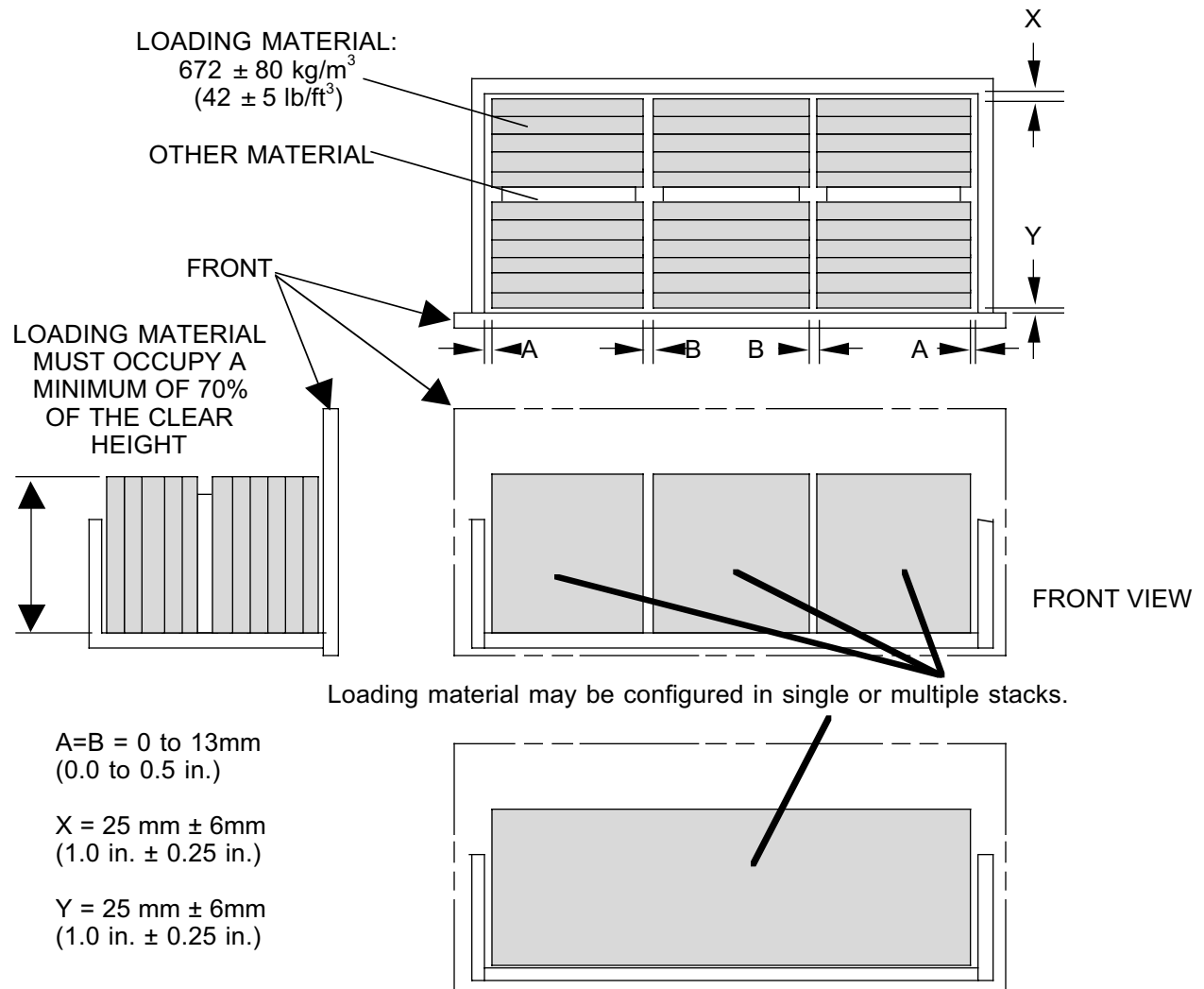


Figure 3b - Loading Configuration for Extendible Elements (Wider than Deep) With Bottoms

3.7 Loading Guidelines

3.7.1 Loading Material for Other Than Extendible elements

Loading material of any density that meets the weight requirements of the test may be used. (Examples: concrete bricks, shot bags, metal plates, sand bags, typical bond copier paper, etc.)

3.7.2 Loading Material for Extendible elements

The functional loading material shall have a density of $672 \pm 80 \text{ kg/m}^3$ ($42 \pm 5 \text{ lb./ft.}^3$). A typical loading material could be 721 kg/m^3 (45 lb./ft.^3) industry standard particleboard or typical bond copier paper. The loading material size may be adjusted to accommodate the size of the extendible element to be tested. If necessary, up to 15% of the weight may be made up of higher density plates placed on edge centered between the other loading material. For extendible elements with clear heights greater than 216 mm (8.5 in.) the loading material shall be placed on its edge to minimize deflection of the extendible element bottom. For extendible elements with clear heights less than 216 mm (8.5 in.) the loading material does not need to be placed on its edge. **Note:** higher density materials may be used for proof loads.

3.7.3 Loading Guidelines for extendible elements with bottom supported loads (See Figures 3(a) and 3(b)) (Note: Where extendible elements have the capability of supporting loads *both* on the bottom and in hanging folders, test in accordance with 3.7.3.)

The clear space within an extendible element shall be loaded using the materials specified in Section 3.7.2. The loading material shall be uniformly distributed front to rear, and side-to-side in the bottom of the extendible element. The gap in the front and the gap in the rear shall each be $25 \text{ mm} \pm 6 \text{ mm}$ ($1.0 \text{ in.} \pm 0.25 \text{ in.}$). The front and rear air gaps shall be free of any materials. The loading materials may be adjusted with the use of rigid materials (such as expanded polystyrene foam, steel, etc.) in order to obtain the specified front and rear air gaps. See Figure 3a for extendible elements which are deeper than wide. See Figure 3b for extendible elements which are wider than deep.

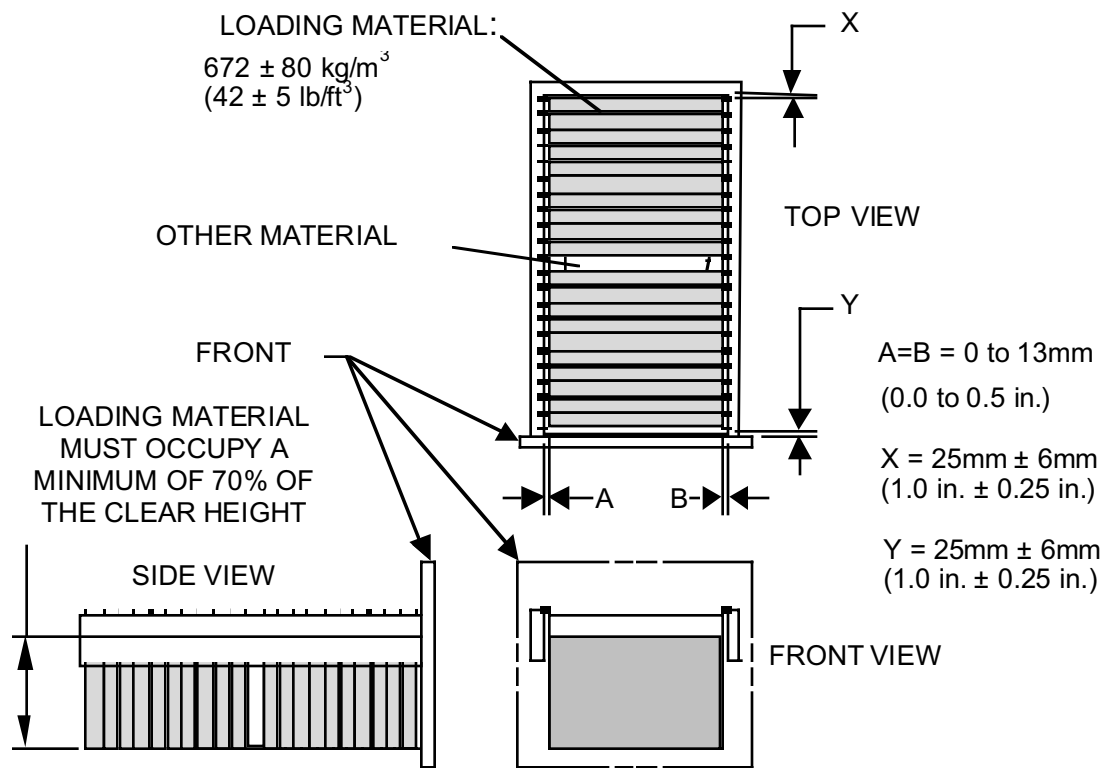


Figure 3c - Loading Configuration for Extendible Elements (Deeper than Wide) without Bottoms.

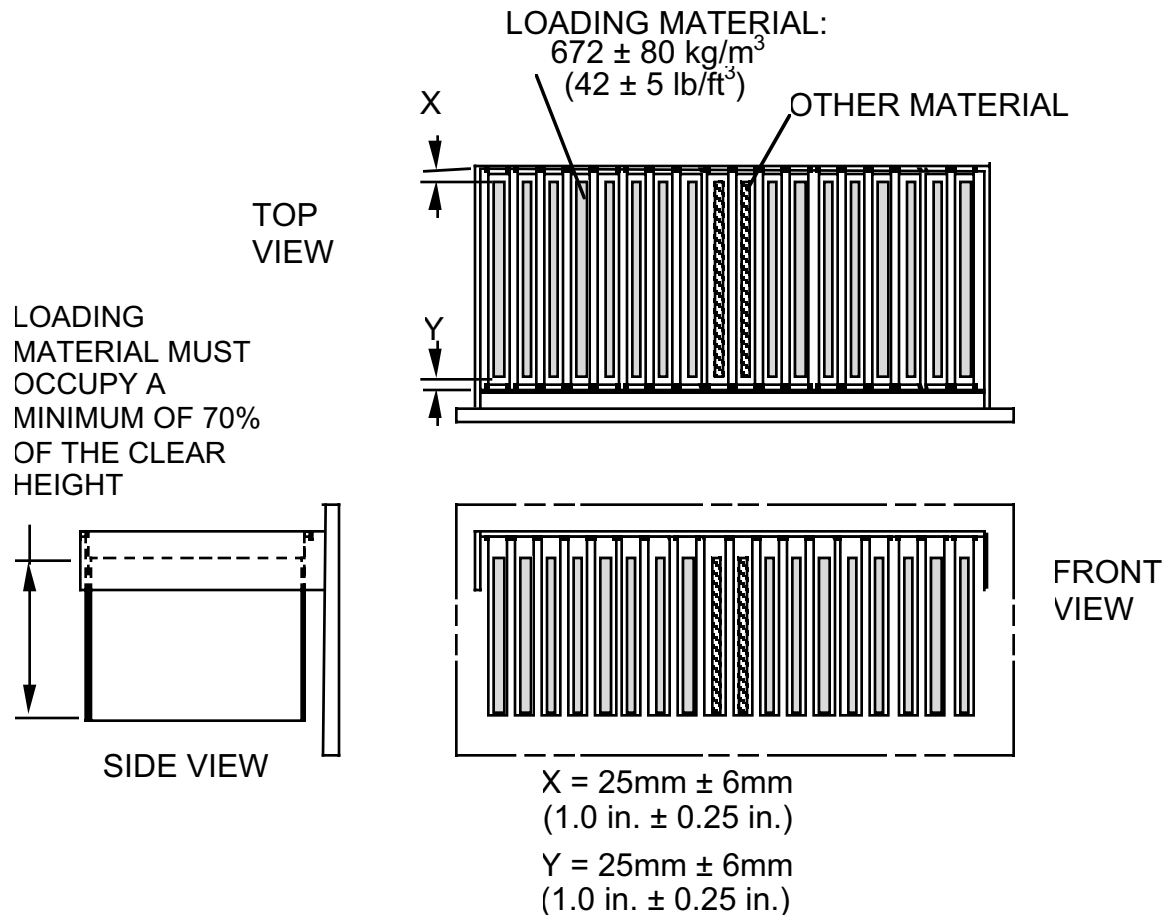


Figure 3d - Loading Configuration for Extendible Elements (Wider than Deep) Without Bottoms.

3.7.4 Loading – Guidelines for extendible elements for hanging-file supported loads

(See Figure 3c and 3d)

The loading material specified in Section 3.7.2 shall be placed in hanging file folders of the appropriate size. The loading material shall be uniformly distributed front to rear, and side-to-side. The gap in the front and the gap in the rear shall each be $25 \text{ mm} \pm 6 \text{ mm}$ ($1.0 \text{ in.} \pm 0.25 \text{ in.}$). The loading materials may be adjusted with the use of rigid materials (such as expanded polystyrene foam, steel, etc.) in order to obtain the specified front and rear air gaps. The front and rear air gaps shall be free of any materials. See Figure 3c for extendible elements which are deeper than wide. See Figure 3d for extendible elements which are wider than deep.

3.7.5 Loading of Surfaces

Loads may be secured to surfaces.

Table 1 Test Loads

Item	Specifications	Functional Load		Proof Load	
		Concentrated	Distributed	Concentrated	Distributed
Unit Top	Unit height > 1830 mm (72 in.)	N/A	63 kg/m ² (0.09 lb./in. ²)	N/A	99 kg/m ² (0.14 lb./in. ²)
Unit Top	Unit height > 965 mm ≤ 1830 mm (> 38 in. ≤ 72 in.)	N/A	183 kg/m ² (0.26 lb./in. ²)	N/A	275 kg/m ² (0.39 lb./in. ²)
Unit Top	Unit height ≤ 965 mm (≤ 38 in.).	91 kg (200 lb.)	183 kg/m ² (0.26 lb./in. ²)	136 kg. (300 lb.)	275 kg/m ² (0.39 lb./in. ²)
Shelf	Calculate load based on the clear space above the surface ¹ , but height dimension not > 305mm (12 in.)	N/A	470 kg/m ³ (0.017 lb./in. ³)	N/A	720 kg/m ³ (0.026 lb./in. ³)
Unit Bottom	Calculate load based on the clear space above the surface ¹ , but height dimension not > 457mm (18 in.)	N/A	470 kg/m ³ (0.017 lb./in. ³)	N/A	720 kg/m ³ (0.026 lb./in. ³)
Door Shelves	All	N/A	0.018 kg/mm (1 lb./in.)	N/A	N/A
Display Shelf	All	N/A	0.027 kg/mm (1.5 lb./in.)	N/A	0.040 kg/mm (2.25 lb./in.)
Extendible elements	Calculate load based on the clear space (see 2.5.)	N/A	470 kg/m ³ (0.017 lb./in. ³)	N/A	720 kg/m ³ (0.026 lb./in. ³)
Center/Pencil Drawers	N/A	N/A	2.3 kg (5 lb.)	N/A	N/A
Adjustable Keyboard	width ≤ 914 mm (width ≤ 36 in.)	N/A	30 kg (66 lb.)	N/A	45 kg (100 lb.)
Adjustable Keyboard	width > 914 mm (width > 36 in.)	N/A	45 kg (100 lb.)	N/A	68 kg (150 lb.)
Writing Shelves	All Sizes	N/A	11 kg (25 lb.)	N/A	N/A
Clothes Rail	All Sizes	30 kg/m 1.7 lb./in.	N/A	N/A	N/A

¹ The available space above the surface shall be determined using the concept of the largest rectangular box that will fit into the space. This concept is similar to that described in Section 2.5 "Clear Dimensions".

Table 2
Television/Video Display Load Parameters

Maximum screen diagonal measurement recommended for use with surface mm (in.)	Total Weight kg (lbs.)
Up to 330 mm (13 in.)	11.4 kg (25 lb.)
355 - 407 mm (14-16 in.)	15.9 kg (35 lb.)
432 - 508 mm (17-20 in.)	22.7 kg (50 lb.)
533 - 610 mm (21-24 in.)	31.8 kg (70 lb.)
635 - 686 mm (25-27 in.)	43.1 kg (95 lb.)
711 - 813 mm (28-32 in.)	61.4 kg (135 lb.)
838 - 889 mm (33-35 in.)	79.5 kg (175 lb.)
914 -1016 mm (36-40 in.)	109.1 kg (240 lb.)
Note: these loads shall be applied by uniformly distributing 25% of the applicable load across the television/video display surface. Apply the remaining 75% of the load so that it is centered (front-to-back) and evenly distributed side-to-side across a line 100 mm (4 in.) in from the front edge of the swivel tray. Secure the load to prevent movement during the test.	

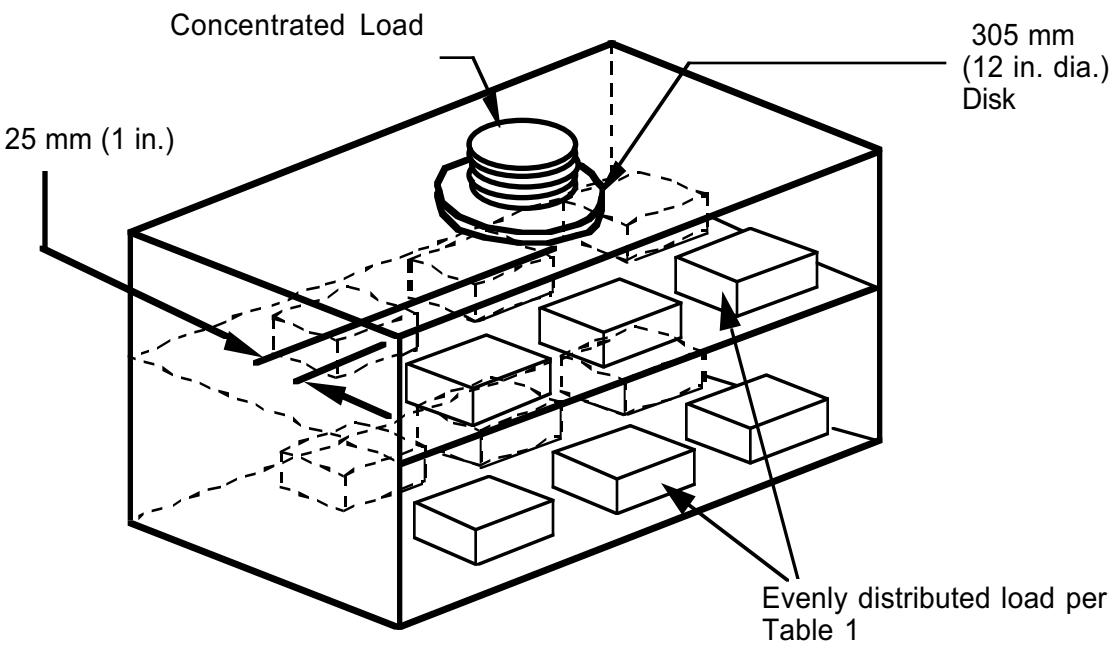


Figure 4 - Unit Strength Test

4 Unit Strength Test (See Figure 4)

4.1 Purpose of Test

The purpose of this test is to evaluate the ability of the storage unit to withstand static loads when loaded to its full capacity.

4.2 Functional Load Test

4.2.1 Test Setup

- a) The unit shall be leveled in its normal operating position and may be secured to prevent tipping. The method of securing shall not affect the load application.
- b) Load all of the unit's elements with the specified distributed functional top, shelf and component loads described in Table 1 (page 18) plus the concentrated load for clothes rails, if applicable, as described in Section 18.
- c) Open all extendible elements. If the unit contains an interlock that will not allow all extendible elements to be opened simultaneously, open the largest capacity extendible element. For Type II storage units (see Table 3, page 42), open only the largest capacity extendible element.
- d) Distributed loads shall be evenly distributed front to back and left to right on shelves, tops and bottoms.

4.2.2 Test Procedure

- a) Loads shall be allowed to remain for 60 minutes.
- b) Without removing any loads, perform the Pull Force Test in Section 20 on each extendible element.
- c) For units ≤ 965 mm (38 in.) high remove the distributed top load and replace with the concentrated functional top load. The concentrated load shall be applied through a 305 mm (12.0 in.) diameter disk 25 mm (1.0 in.) from the unit's edge at its apparent weakest point (or centered front to back if the top is less than 356 mm [14 in.] deep). If the weakest point is not obvious, several load applications may be necessary to properly test the product.
- d) Allow the loads to remain for 60 minutes.
- e) Remove the concentrated top load. Perform the Pull Force Test in Section 20 on each extendible element.

4.2.3 Acceptance Level

There shall be no loss of serviceability. Each of the extendible elements shall meet the pull force requirements of Section 20.

4.3 Proof Load Test

4.3.1 Test Setup

Continue using the functionally loaded unit from 4.2.2.

4.3.2 Test Procedure

Note: Testing of storage components (paragraphs d, e, & f) may be conducted in conjunction with top loadings in sections a, b, & c.

- a) Replace any top load with the distributed proof top load (as specified in Table 1 – see page 18). The load shall be evenly distributed front to back and left to right on the top.
- b) If the unit is less than or equal to 965 mm (38 in.) high, allow the load to remain for 15 minutes. Then remove the distributed proof top load and replace with the concentrated proof top load. The concentrated load shall be applied through a 305 mm (12.0 in.) diameter disk 25 mm (1.0 in.) from the unit's edge at its apparent weakest point (or centered front to back if the top is less than 356 mm [14.0 in.] deep at the apparent weakest point). If the weakest point is not obvious, several load applications may be necessary to properly test the product. The loads shall remain for an additional 15 minutes.
- c) If the unit is greater than 965 mm (38 in.) high, allow the loads to remain for a total of 30 minutes.
- d) Determine the storage component of each type (shelf, extendible element, extendible shelf, component construction, suspension design, etc.) with the largest available clear space. If two or more components have identical clear space, select one of the components for further testing.
- e) Replace the functional load on a component selected in d) with the proof load per Table 1 (page 18).
- f) If extendible, fully extend the loaded component.
- g) Allow the load to remain in/on the component for 15 minutes. Replace the proof load with the functional load and, if the component is an extendible element, close it.
- h) Repeat e) through g) for the largest of each component type(s) as determined in e).

4.3.3 Acceptance Level

Application of the proof loads shall cause no sudden and major change in the structural integrity of the storage unit or its components. Loss of serviceability is acceptable.

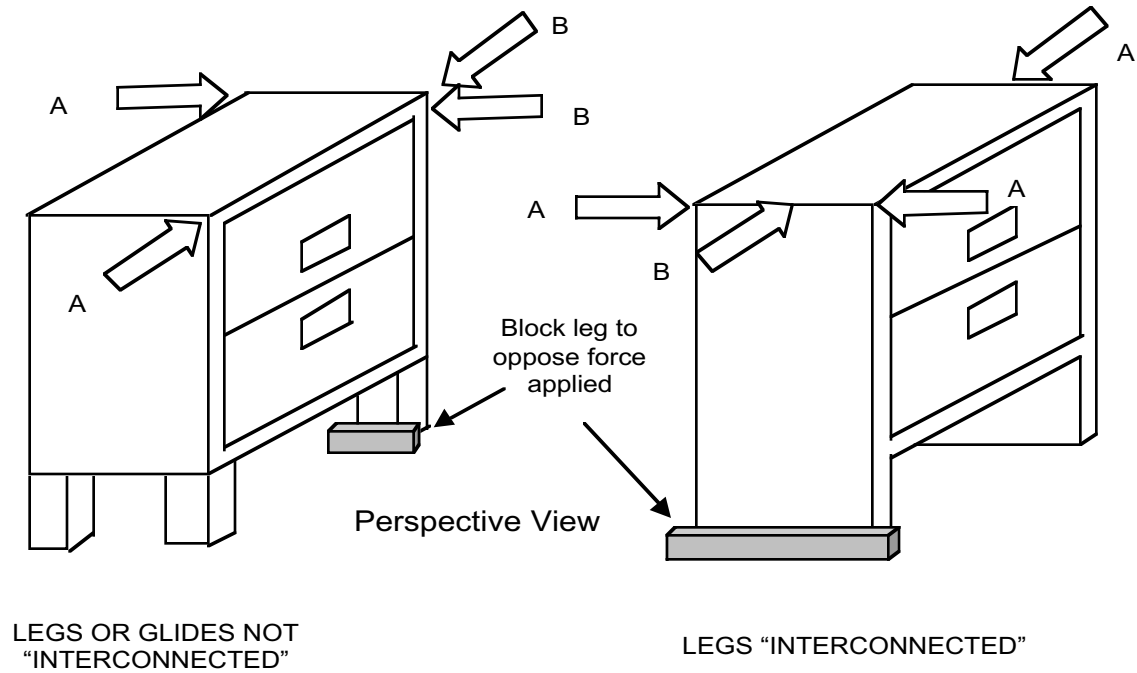


Figure 5 - Leg/Glide Assembly Strength Test Configurations

5 Leg/Glide Assembly Strength Test (See Figure 5)

5.1 Purpose of Test

The purpose of this test is to evaluate the ability of storage units to withstand the forces encountered during handling or moving. This test does not apply to units with casters.

5.2 Test Setup

5.2.1 The unloaded unit shall be positioned on a test platform and leveled. The leg/glide assembly to be tested shall be restrained from movement in the horizontal direction by an obstruction(s) not greater than 13mm (0.5 in.) in height, as needed to oppose each force as it is applied. If the unit has glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position.

5.2.2 Calculate Functional Force "A" ("A" forces represent forces encountered by "leading edge" legs during movement of the unit):

- a) For units weighing greater than or equal to 18 kg. (40 lbs.), calculate the Functional Force "A" as follows (not to exceed 445 N (100 lbf.):

$$"A" = 0.5 \times (\text{unit weight, kg}) \times 9.8 + 222 \text{ N}$$

$$["A" = 0.5 \times (\text{unit weight, lb.}) + 50 \text{ lbf.}]$$

- b) For units weighing less than 18 kg (40 lbs.), calculate the Functional Force "A" as follows

$$"A" = 0.5 \times (\text{unit weight, kg}) \times 9.8 + 44 \text{ N}$$

$$["A" = 0.5 \times (\text{unit weight, lb.}) + 10 \text{ lbf.}]$$

5.2.3 Calculate the Functional Force "B" as $(0.5 \times "A")$. ("B" forces represent lower levels of force on any legs that are not "leading edge" legs).

5.2.4 Calculate the Proof Forces "A" (not to exceed 667 N (150 lbf.)) and "B" as follows:

$$\text{Proof Force "A"} = 1.5 \times (\text{Functional Force "A"}).$$

$$\text{Proof Force "B"} = 1.5 \times (\text{Functional Force "B"}).$$

5.3 Functional Test Procedure

- a) Apply a horizontal force to the unit in line with the leg/glide assembly as high as possible on the unit, but not higher than 1600 mm (63 in.). If any of the leg/glide assemblies lift off the test platform as a result of the force application, lower the load application point to prevent lifting. (These load applications may be applied starting at the approximate center of gravity of the unit, then moving upward to find the tip point.)
- b) Gradually apply the horizontal functional forces ("A" and "B"), one at a time, as described in Figure 5. If the loading results in horizontal rotational movement of the unit, additional blocking of the remaining legs may be required to prevent rotational movement. Any additional blocking may not provide support or lessen the test loads.

- c) Repeat Steps a) and b) for each unique type or non-symmetrically placed supporting member on the storage product. It is not necessary to repeat tests on legs or support members of identical construction.
- d) If the leg/glide assembly being tested is attached to a unit with an extendible element or door, perform the pull force test per Section 20 on each type and size of extendible element or door.

5.4 Functional Test Acceptance Level

No loss of serviceability shall occur as a result of the application of the functional loads. After application of the functional loads, each extendible element or door shall meet the pull force requirements of Section 20.

5.5 Proof Test Procedure

Repeat Steps 5.3(a) through 5.3(c) applying the specified proof load.

5.6 Proof Test Acceptance Levels

Application of the proof loads shall cause no sudden and major change in the structural integrity of the storage unit or its components. Loss of serviceability is acceptable.

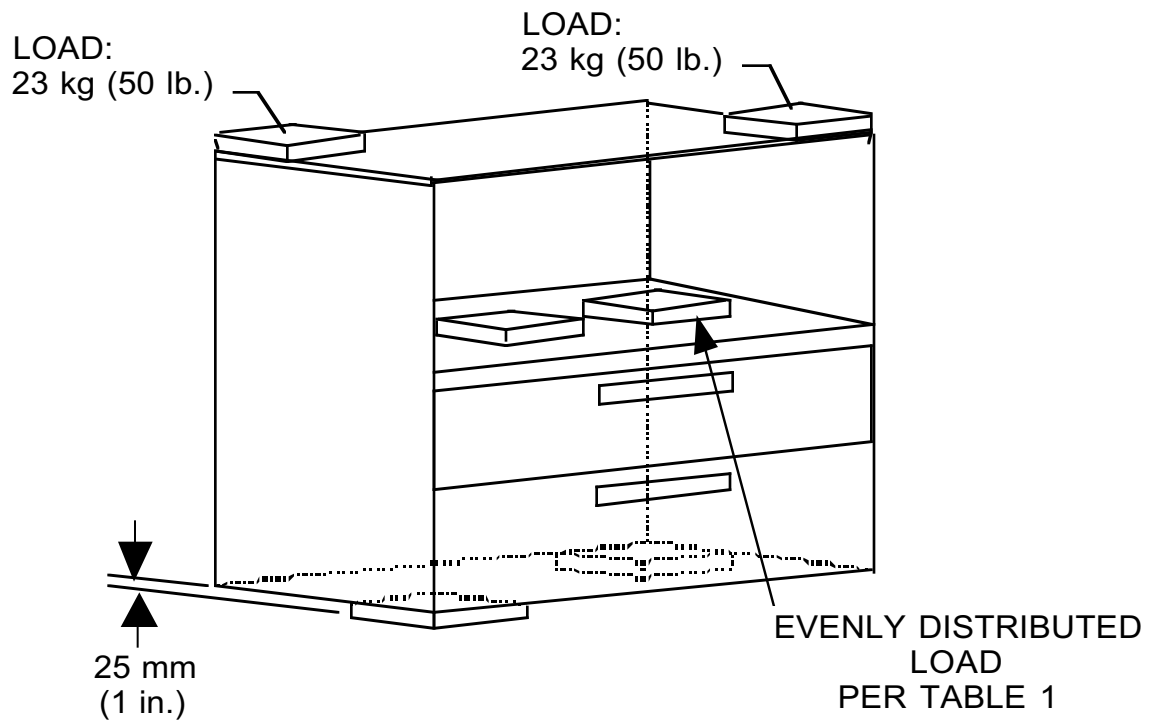


Figure 6 - Racking Resistance Test

6 Racking Resistance Test (See Figure 6)

6.1 Purpose of Test

The purpose of this test is to evaluate the ability of the storage unit to resist torsional racking that may occur during movement. This test does not apply to Type II Storage Units (see Table 3 page 42.)

6.2 Test Setup

- a) The storage unit shall be placed on a test platform. If the storage unit is equipped with glides, place them in their fully retracted position.
- b) The storage unit shall be placed on four blocks each 152 mm (6 in.) square by 25 mm (1 in.) high flush with the edges of the cabinet.
- c) Apply the distributed functional load to the applicable elements as specified in Table 1 (page 18). Shelf loads shall be evenly distributed front to back and left to right. Distributed loads shall be configured as described in Section 3.7 for extendible elements.
- d) Close all extendible elements after loading them in Step (c).
- e) The top of the unit shall be loaded as follows. 23 kg (50 lb.) weights shall be loaded on top of the cabinet at each of two opposing corners [45 kg. (100 lb.) total]. The weights shall be applied through 230 mm x 230 mm (9 in. x 9 in.) area flush with the outermost edges of the unit top.

6.3 Test Procedure

- a) Carefully remove the supports from under the weighted corners.
- b) The storage unit shall remain in this position for 60 minutes.
- c) Replace support blocks or place the unit on the test platform and level the unit.
- d) Perform the Pull Force Test on each extendible element as defined in Section 20.

6.4 Acceptance Level

The storage unit shall have no loss of serviceability. All extendible elements shall be tested to and meet the pull force test as defined in Section 20.

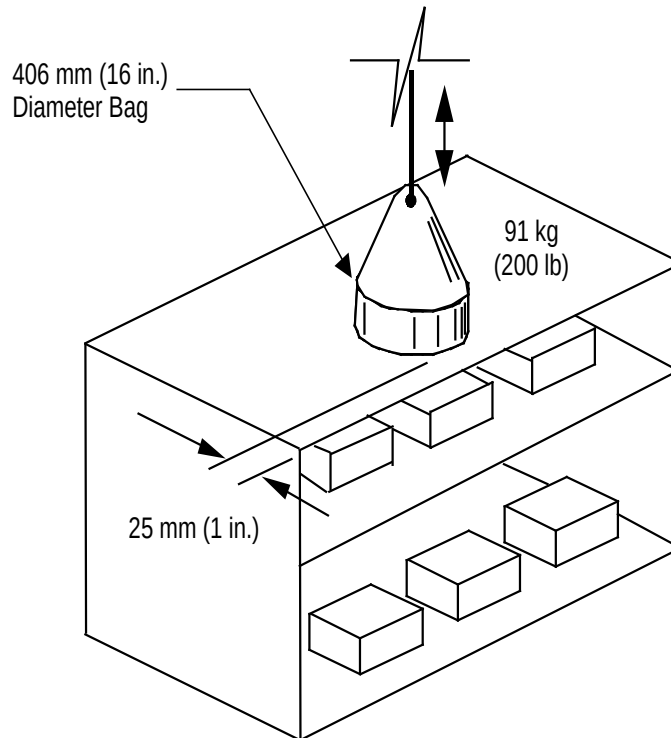


Figure 7a - Top Load Ease Test - Cyclic

7 Vertical Load Durability Tests

7.1 Top Load Ease Test - Cyclic (See Figure 7a)

7.1.1 Purpose of Test

The purpose of this test is to evaluate the durability of the unit to withstand cyclic loading of the unit top. This test applies to units with tops less than or equal to 965 mm (38 in.) in height including mobile and freestanding pedestals.

This test does not apply to:

- units with cushioned or contoured seating surfaces (See Section 7.2).
- shelves or adjustable keyboard surfaces. (If it is unclear whether the surface is a unit top or a shelf, this test applies.)
- units with tops less than 406 mm (16 in.) in depth.
- units with integral (non-detachable) overhead storage units, hutches, etc. that limit the useable depth of the top or with designs that interfere with a person's ability to sit on the surface.

7.1.2 Test Setup

- a) The unit shall be placed on the test platform, leveled, and restrained to prevent movement. Units with tops that are height adjustable shall be tested at the midpoint of adjustment or 965 mm (38 in.), whichever is lower.
- b) All extendible elements shall be tested to and meet the pull force test requirements of Section 20.
- c) All elements shall remain loaded with the functional load per Table 1 (page 18) and then closed for the duration of the test.
- d) For units with a unit top greater than or equal to 457 mm (18 in.) deep, a 91 kg (200 lb.) weight applied by means of a 406 mm $\pm$ 51 mm (16 in. $\pm$ 2 in.) diameter bag shall be positioned on the unit top with the edge of the bag within 25 mm (1 in) from the edge of the surface at the apparent weakest point. For unit tops less than 457 mm (18 in.) deep, center the bag on the available surface depth.
- e) The cycling device shall be set to operate at a rate of 14 $\pm$ 6 cycles per minute.

7.1.3 Test Procedure

- a) The bag shall be raised until the entire weight is off the unit top and then eased (without impact) onto the surface so that it takes the entire weight without any support from the cycling device.
- b) Repeat Step (a) for a total of 20,000 cycles.
- c) Remove the bag and perform the pull force test in Section 20.

7.1.4 Acceptance Level

There shall be no loss of serviceability. Upon completion of the cycling test, the extendible element(s) shall meet the pull force requirements of Section 20.

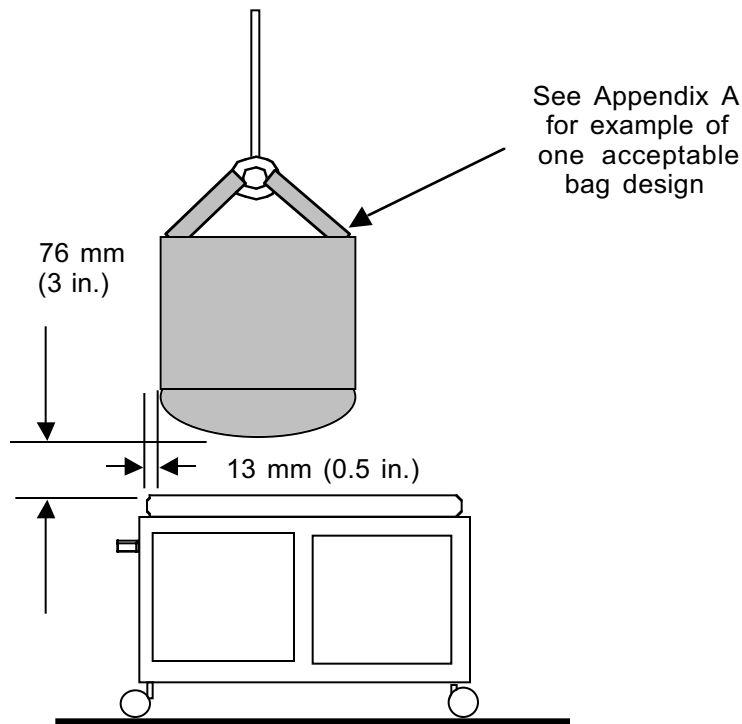


Figure 7b – Drop Test – Dynamic – for Units with Seat Surfaces

7.2 Drop Test – Dynamic – for Units with Seat Surfaces (See Figure 7b)

7.2.1 Purpose of Test

The purpose of this test is to evaluate the ability of the unit to withstand heavy and abusive impact forces on the seating surface. This test applies to all pedestals and storage units with cushioned or contoured seating surfaces.

7.2.2 Test Setup

- The unit shall be placed on a test platform.
- If adjustable features are available, set these adjustments at midpoint of any adjustment ranges. Casters, if present, shall be initially placed at the apparent worst-case position.
- A test bag as shown in Appendix A or other fixture that gives an equivalent impact shall be attached to a device permitting a free fall to the seating surface as shown in Figure 7b.
- The bag shall be centered side-to-side on the seating surface and the edge of the bag shall be 13 mm (0.5 in.) back from the front edge of the seating surface.

7.2.3 Test Procedures

- a) A test bag approximately 406 mm (16 in.) in diameter containing sand and/or shot weighing 91 kg (200 lb.) shall be raised 76 mm (3 in.) above the uncompressed seat and allowed to free fall onto the seating surface one time. (See Figures 7b).
- b) Remove the bag and evaluate the product in accordance with the acceptance level in 7.2.4.

7.2.4 Acceptance Level

There shall be no sudden and major change in the structural integrity of the storage unit or its components. Loss of serviceability is acceptable.

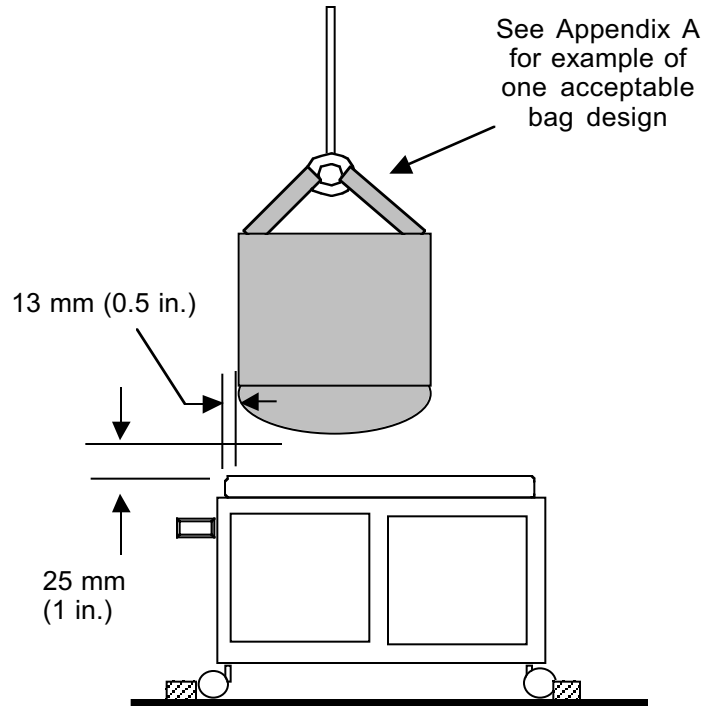


Figure 7c – Durability Test for Units with Seating Surfaces – Cyclic Impact

7.3 Durability Test for Units with Seating Surfaces – Cyclic Impact (See Figure 7c)

7.3.1 Purpose of Tests

The purpose of these tests is to evaluate the ability of the unit to withstand fatigue stresses and wear caused by downward vertical force(s) on the seating surfaces. This test applies to all pedestals and storage units with cushioned or contoured seating surfaces.

7.3.2 Test Setup

- a) The unit shall be placed on a test platform and be restrained in a manner that will maintain the impact location on the seat. The method of restraint shall not add support or structure to the unit, or inhibit movement of the unit's response to the impact. Casters, if present, shall be initially placed at the apparent worst-case position.
- b) If adjustable features are available, set these adjustments at midpoint of any adjustment ranges.
- c) Units with less than 44 mm (1.75 in.) of cushioning materials in the seat shall have foam added to bring total cushioning thickness to 50 mm $\pm$ 6 mm (2 in. $\pm$.25 in.). Any

additional foam added to the top of the seat shall have a 25% Indentation Force Deflection (IFD) of $200\text{ N} \pm 22\text{ N}$ (45 lbf. $\pm$ 5 lbf.).²

- d) A test bag approximately 406 mm (16 in.) in diameter containing sand and/or shot weighing 57 kg (125 lb.), shall be attached to a cycling device, permitting a free fall to the seat as shown in Figure 9h. The free fall shall begin after lifting the test bag 25 mm (1 in.) above the uncompressed surface on the seating surface, as measured at the center of the seating surface. Other methods of creating the impact are acceptable if the impact can be shown as equivalent. The drop height and/or seat height shall be adjusted during the test if the drop height increases by more than 13 mm (0.5 in.). The cycling device shall be set at an appropriate rate between 10 and 30 cycles per minute.
- e) The bag shall be centered side-to-side on the seating surface and the edge of the bag shall be 13 mm (0.5 in.) back from the front edge of the seating surface.

7.3.3 Test Procedure

The unit shall be tested to 7,500 cycles.

7.3.4 Acceptance Level

There shall be no sudden and major change in the structural integrity of the storage unit or its components. Loss of serviceability is acceptable.

² Specimen thickness 102 mm (4 in.). See Method B₁, Indentation Force Deflection Test, in *Standard Test Methods for Flexible Cellular Materials —Slab, Bonded, and Molded Urethane Foams*, ASTM D 3574-01.

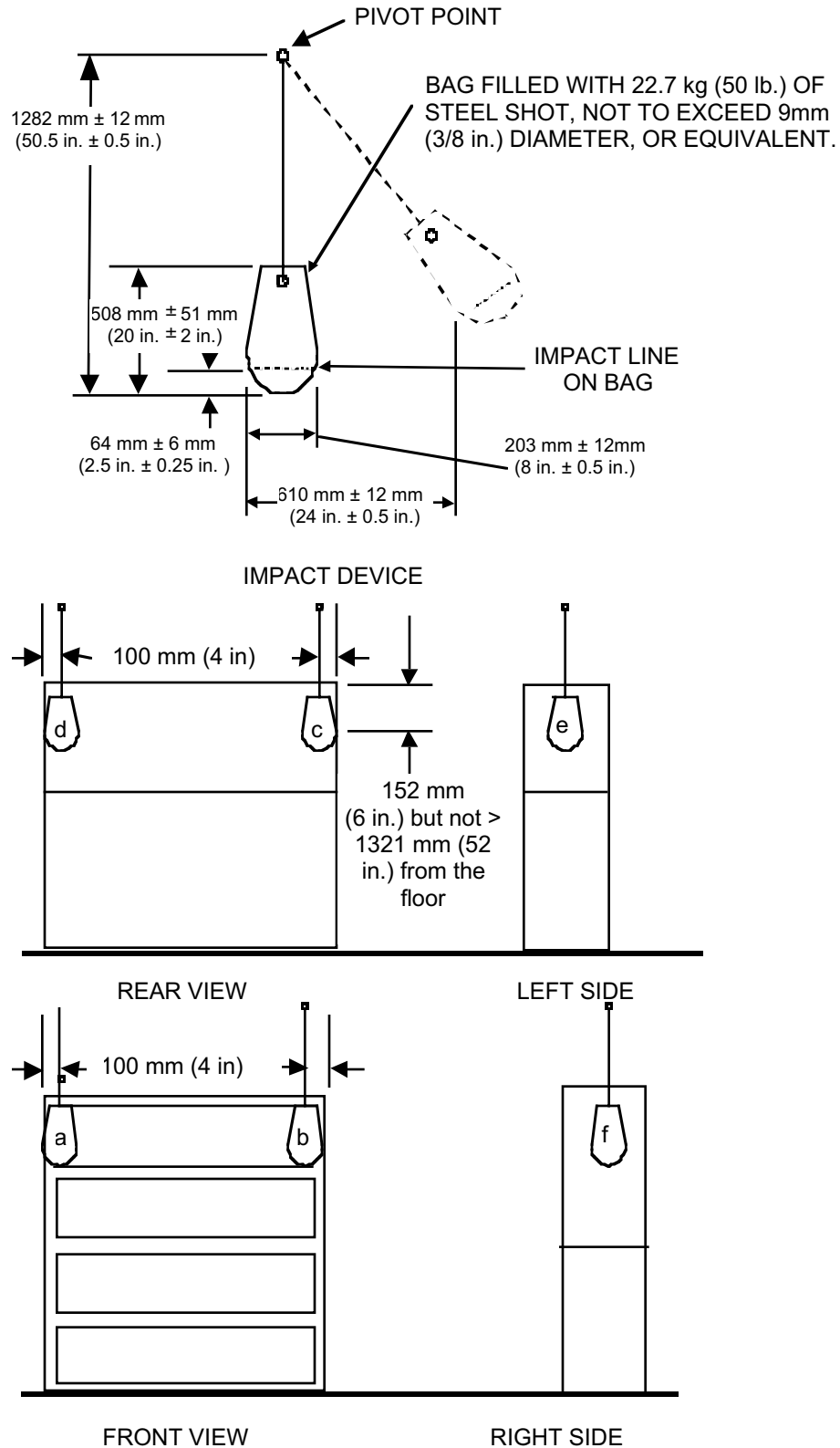


Figure 8a - Horizontal Disengagement Test for Tall Storage Units with Attached or Stackable Components

8 Disengagement Tests

8.1 Horizontal Disengagement Test for Tall Storage Units with Vertically Attached or Stackable Components (See Figure 8a)

8.1.1 Purpose of Test

The purpose of this test is to evaluate the ability of tall storage products with stacked or attached components to resist disengagement. This test applies to storage products with vertically attached or stackable units whose combined height is greater than 1219 mm (42 in.). If manufacturer's instructions indicate that the unit is to be placed against the wall, no back or front horizontal disengagement tests are required.

This test does not apply to unit-mounted privacy screens or screen assemblies with weight of less than 4.9 kg/m² (1 lb./ft².) of surface area (area calculated based on one side only) and total weight not exceeding 18 kg (40 lbs.).

8.1.2 Test Setup

The unit shall be placed on a test platform and leveled. The unit shall be restrained by one of the following methods:

8.1.2.1 Apply a load to the lower part of the unit as follows: determine the storage element with the largest available clear space and apply a proof load per Table 1 (page 18). Apply a functional load per Table 1 to all remaining storage elements in the lower part of the unit. Extendible elements, if any, shall remain closed and locked or secured from opening. The unit shall be blocked to prevent horizontal movement (sliding of the base). The unit shall not be allowed to tip over as a result of the impact force. If the unit tips over as a result of the impact, the lower part of the unit must be secured to the test platform. The method of securing shall not provide support to the attached component(s).

8.1.2.2 The lower part of the unit shall be secured to the test platform. The method of securing shall not provide support to the attached component(s).

8.1.3 Test Procedure

8.1.3.1 Swing a bag that is 203 mm ± 12 mm (8 in. ± 0.5 in.) in diameter, weighing 23 kg (50 lb.) and suspended on a cable, through a horizontal distance of 609 mm (24 in.) from a point that just touches the impact surface. See Figure 8a for a description of the bag impact device.

8.1.3.2 Impact an unloaded unit once at each of the following locations. The impact shall be centered along a line that is 152 mm (6 in.) down from the top edge, but not at a height greater than 1321 mm (52 in.). See Figure 8a for a description of the impact locations:

- a) Impact front of product with impact bag centered 100 mm (4 in.) from its left side,
- b) Impact front of product with impact bag centered 100 mm (4 in.) from its right side,

- c) Impact back of product with impact bag centered 100 mm (4 in.) from its left side,
- d) Impact back of product with impact bag centered 100 mm (4 in.) from its right side,
- e) Impact center of product's left side,
- f) Impact center of product's right side.

8.1.4 Acceptance Level

The attached or stackable units shall not become disengaged from the base storage unit.

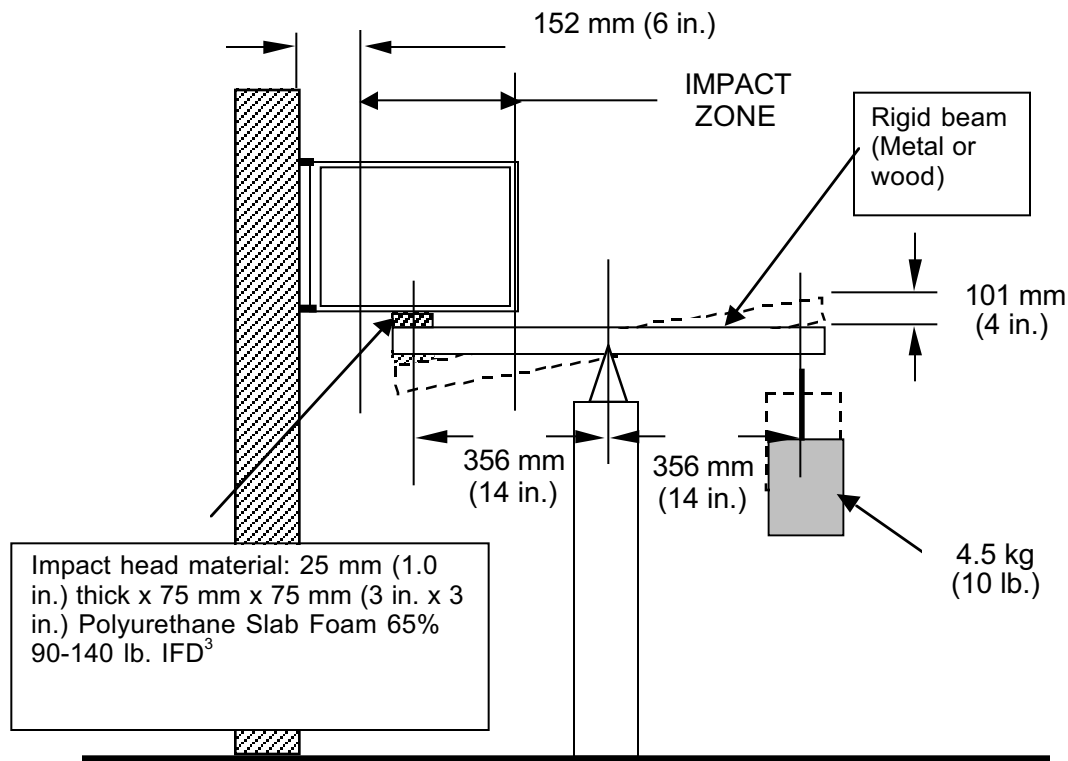


Figure 8b - Upward Impact Force Disengagement Test for Storage Units

8.2 Upward Impact Force Disengagement Test for Storage Units

8.2.1 Purpose of Test

The purpose of this test is to evaluate the ability of a storage component to resist accidental disengagement that may occur as a result of impacts exerted from beneath the component. This test applies to storage components that extend beyond the footprint of the unit or are wall-hung, weigh more than 5 kg (11 lb.) and have depths greater than 180 mm (7.1 in.). This test does not apply to bookcase shelves and other recessed components where the design of the unit is such that attached components would not likely be subjected to upward impacts. This test does not apply to extendible elements.

8.2.2 Upward Impact Force Disengagement Test for Storage Units (See Figure 8b)

8.2.2.1 Test Setup

- a) The unit shall be installed per manufacturer's instructions. The storage unit shall be leveled, and secured against movement. The impact shall be performed at the determined "worst case" location.
- b) Several locations may be impacted to determine the "worst case". The impact locations can be anywhere from 152 mm (6 in.) outward from the attachment point.

8.2.2.2 Procedure

- a) The Impact Device shall be held secure from movement during the test.
 - b) Position the impact head under the component.
- Note:** Impact Head Material: 25 mm (1.0 in.) thick polyurethane slab foam.
(IFD @ 65% 90-140 lb.)³
- c) Level the horizontal arm of the Impact Device.
 - d) A 4.5 kg (10 lb.) weight shall be suspended from a point located 356 mm (14 in.) from the pivot pin at the end opposite the impact head. (The impact head is 356 mm [14 in.] in front of the pivot pin.) The impact arm shall be leveled when the weight is applied and the impact surface is in contact (and compressed) against the impact target.
 - e) The horizontal arm shall be lifted to 102 mm (4 in.) as measured at the location of the weight attachment. The arm shall then be allowed to free-fall so the impact head strikes the component. Impact the unit anywhere along its lower surface, but not closer than 152 mm (6 in.) from its attachment point.

8.2.3 Acceptance Level

The component shall not become disengaged. There shall be no loss of serviceability from the application of the force. If it is unclear whether disengagement to the impacted unit has occurred, apply the appropriate proof load(s) per Table 1 (see page 18). The unit shall not become disengaged from its attachment upon application of the proof load.

³ See Method B₁, Indentation Force Deflection Test, in *Standard Test Methods for Flexible Cellular Materials – Slab, Bonded and Molded Urethane Foams*, ASTM D 3574-01

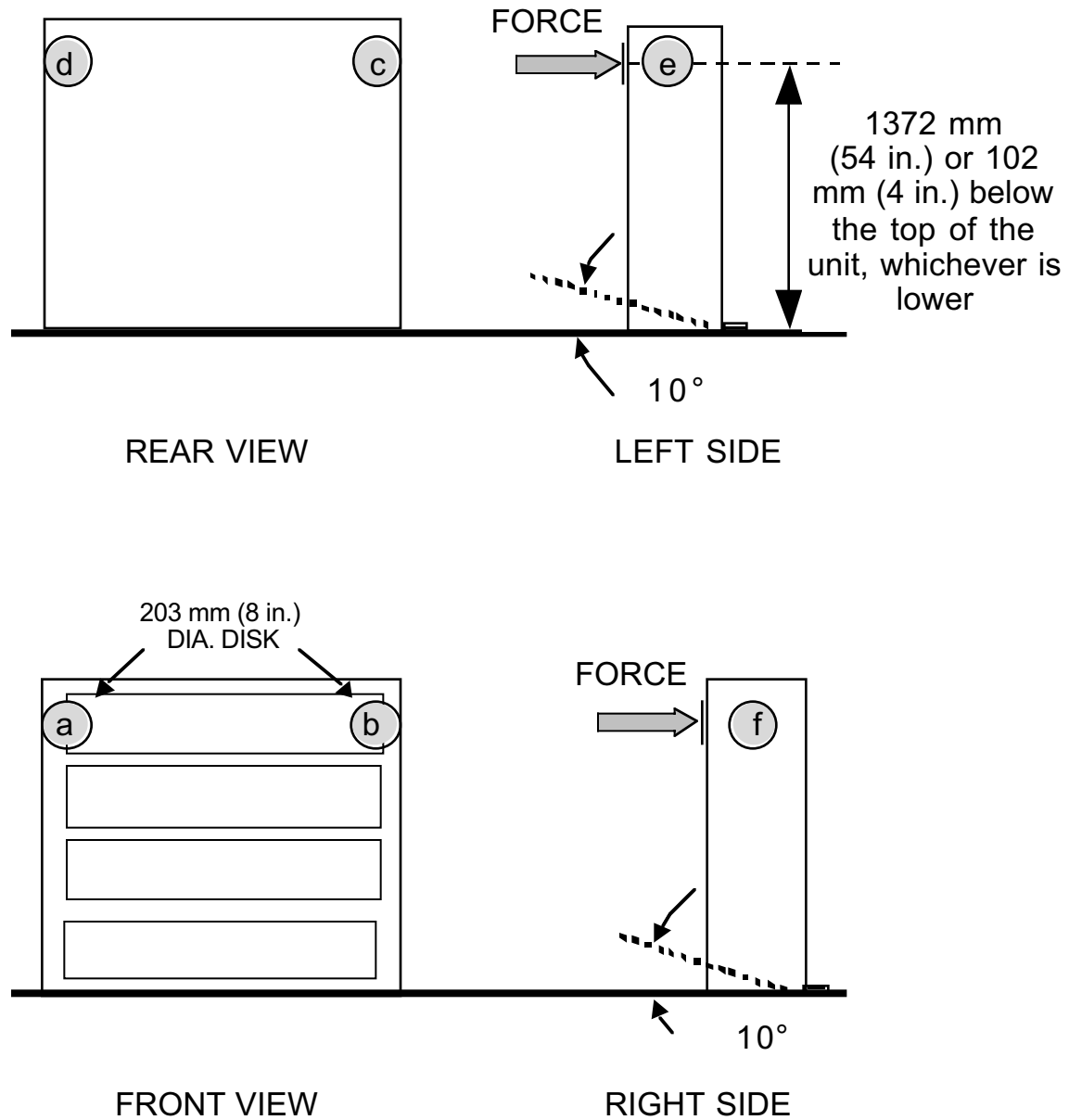


Figure 9a - Horizontal Force Stability Test for Tall Storage Units Without Extendible Elements

9 Stability Tests

Note: For all stability tests, if manufacturer's instructions indicate the unit is to be secured to the permanent building structure, other units, or otherwise restricted in their placement, the test shall be performed with those securing means or placement restrictions in place during the test. Counterweights or other stability devices shall be used in accordance with manufacturer's instructions.

9.1 Purpose of Tests

The purpose of these tests is to evaluate the stability of various types of units.

9.2 Horizontal Force Stability Test for Tall Storage Units Without Extendible Elements (See Figure 9a)

This test applies to any unit that is higher than 1067 mm (42 in.).

Note: If manufacturer's instructions indicate that the unit is to be placed against the wall, no back or front horizontal stability tests are required.

9.2.1 Purpose of Test

The purpose of this test is to evaluate the stability of tall and/or stacked storage units without extendible elements.

9.2.2 Test Setup

The unloaded storage unit shall be placed on a test platform and leveled or positioned in accordance with manufacturer's instructions. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position. Glides, feet or casters shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. If equipped, casters shall be oriented in their least stable position. See Figure 9a. Place an evenly distributed load of 36 kg/m (2 lb./in.) of width on the lowest storage component in the unit. The load may be secured to prevent movement during the test. If so equipped, any doors in the storage unit shall be closed during this test.

9.2.3 Test Procedure

- 9.2.3.1** Apply the horizontal forces through the center of a disk that is 203 mm (8 in.) in diameter.
- 9.2.3.2** Gradually increase the force at the locations specified until 178 N (40 lbf.) is reached, or the product tilts to 10°, whichever occurs first. (Angle measuring device must be accurate to within $\pm 1^\circ$).
- 9.2.3.3** The forces shall be applied one at a time to the following locations located 1372 mm (54 in.) from the floor or 102 mm (4 in.) down from the top edge, whichever is lower. See Figure 9a for a description of the force locations:
- a) Apply force to front of the product at its left side,
 - b) Apply force to front of the product at its right side,
 - c) Apply force to back of the product at its left side,
 - d) Apply force to back of the product at its right side,
 - e) Apply force to the left side of the product,
 - f) Apply force to the right side of the product.

9.2.4 Acceptance Level

The unit shall not tip over, there shall be no loss of serviceability and components shall not become disengaged from the storage unit.

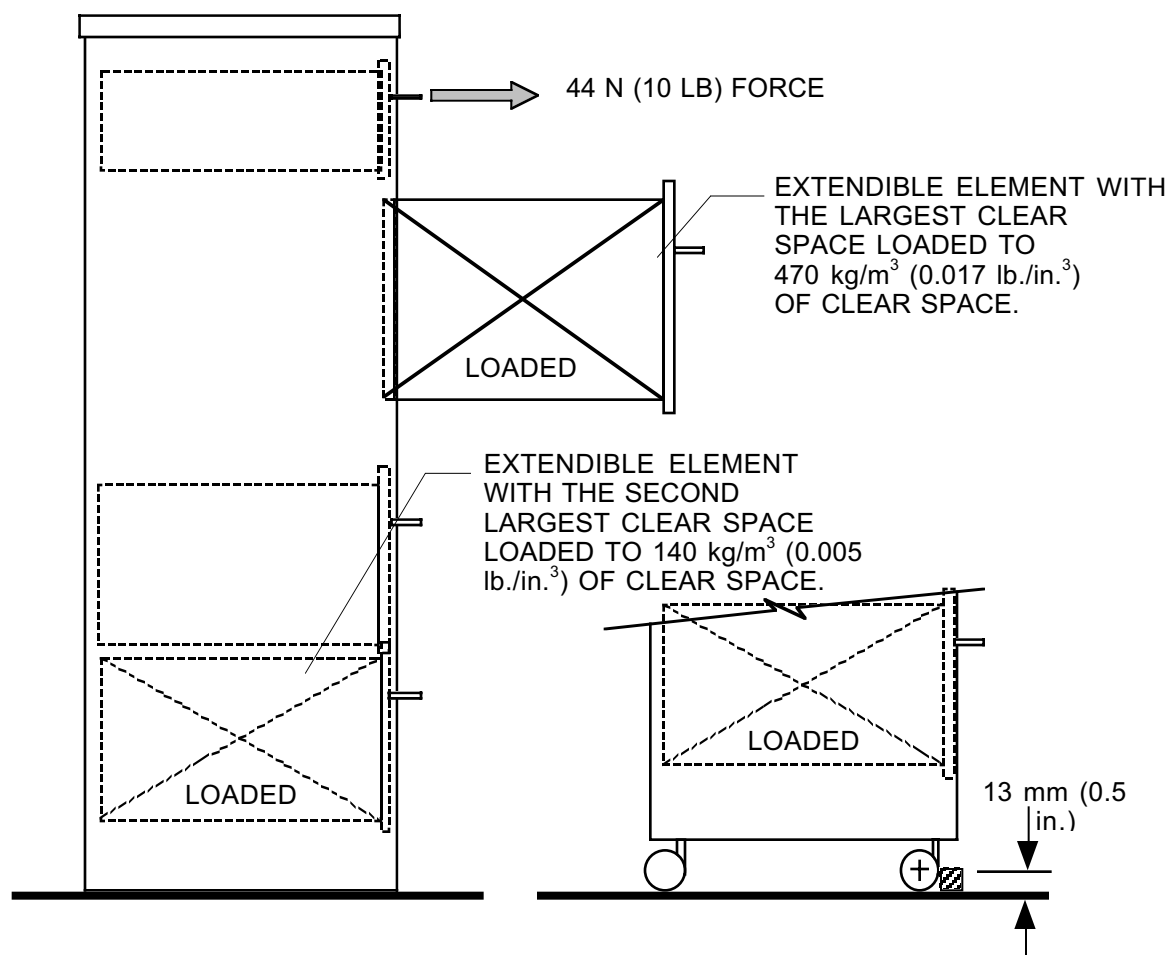


Figure 9b – Stability Test for Type I Units with Extendible Elements

Table 3 – Storage Unit Classification Criteria for Units with Extendible Elements

	WIDTH	HEIGHT*	Applicable Test**
TYPE I:	> 508 mm (20 in.)	<u>OR</u> >787 mm (31 in.)	9.3 and 9.4
TYPE II:	≤ 508 mm (20 in.)	<u>AND</u> ≤ 787 mm (31 in.)	9.5

*The height is determined by the top of the structure of the unit with the glides at their midpoint of adjustment but not to exceed 13 mm (0.5 in.) from the fully retracted position. Add-on seating surfaces are not considered as part of the unit structure for determining height classification. (See Section 9.7 for stability test for units with seat surfaces).

**Reminder — vertical files are excluded from this standard (see Section 1: Scope).

9.3 Stability Test for Type I Units with at least one Extendible Element

(See Figure 9b and Table 3 – page 42)

9.3.1 Purpose of Test

The purpose of this test is to evaluate the stability of Type I storage units with one or more extendible element(s). Note: this test applies to stackable units with extendible components.

9.3.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled or positioned in accordance with manufacturer's instructions. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position. If equipped with casters, each front caster shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. Casters shall be oriented in their least stable position. See Figure 9b. Load shall be configured per Section 3.7.2 (Figure 3a or 3b) if extendible element has a bottom. Load shall be configured per Section 3.7.3 (Figure 3c) if extendible element does not have a bottom. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- b) Determine the extendible element, which when loaded per Table 1 or 2 (page 18 & 19) and fully extended, will provide the least stable condition. More than one load application may be necessary to determine the least stable condition. If there is more than one extendible element of equal size, load the extendible element at the highest position.
(**Note:** care should be taken when loading the extendible element during this Step to prevent the storage unit from tipping over.)
- c) The extendible element or storage component (excluding television/video display support surfaces) with the largest loading capacity (based on clear space) of those remaining shall be uniformly loaded left to right and front to rear to 140 kg/m^3 (0.005 lb./in.^3) of clear space and then closed. For this determination, the clear height shall not exceed 305 mm (12 in.), even if the component is the unit bottom. The extendible element or storage component shall be loaded so that there is no gap front to rear.
- d) All remaining extendible elements and storage components shall remain closed and not loaded.
- e) Those doors that must be opened to allow access to the loaded extendible elements shall remain fully opened during the test. Pocket doors shall be stowed.
- f) Fully extend the loaded extendible element from Step (b).

9.3.3 Test Procedure

A force of 44 N (10 lbf.) shall be applied to the uppermost extendible element, at the center of the pull area, in a horizontal outward direction parallel to the direction of extendible element travel. If this extendible element is not the one identified in 9.3.2 (b), it shall be restrained closed.

9.3.4 Acceptance Level

The storage unit shall not tip over.

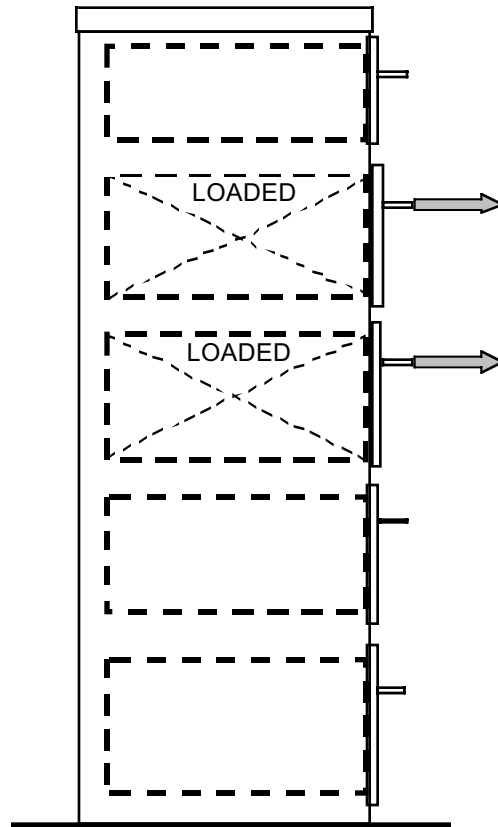


Figure 9c - Stability Test for Storage Units with Multiple Extendible Elements

9.4 Stability Test for Type I Storage Units with Multiple Extendible Elements

(See Figure 9c and Table 3 – page 42)

9.4.1 Purpose of Test

The purpose of this test is to evaluate the stability of Type I storage units (see Table 3) with two or more extendible elements. Note: this test applies to stackable units with extendible components.

9.4.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (1/2 in.) from the fully retracted position. If equipped with casters, each front caster shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. Casters shall be oriented in their least stable position. See Figure 9b.
- b) Determine the two extendible elements that, when loaded and opened, provide the least stable condition. (This may require evaluation of whether interlocked extendible elements can be opened if they are activated simultaneously.) Load these extendible elements with the functional load specified per Table 1 or Table 2 (see page 18 & 19). More than one loading configuration may be required to verify that the least stable condition has been evaluated. Load shall be configured per Section 3.7.2 (Figure 3a or 3b) if extendible element has a bottom. Load shall be configured per Section 3.7.3 (Figure 3c) if extendible element does not have a bottom. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- c) All remaining extendible elements and storage components shall remain closed and not loaded.

9.4.3 Test Procedure

Gradually open two loaded extendible elements simultaneously to the fullest extension the unit will allow. If an interlock device prevents any two extendible elements from being opened simultaneously, open the extendible element with the largest load.

9.4.4 Acceptance Level

The storage unit shall not tip over and the interlock system, if present, shall have no loss of serviceability. If open extendible elements prevent the unit from tipping over due to contact with the test platform, the unit does not meet the acceptance criteria.

Note: The use of devices such as casters on a bottom extendible element is an acceptable method of preventing tipping.

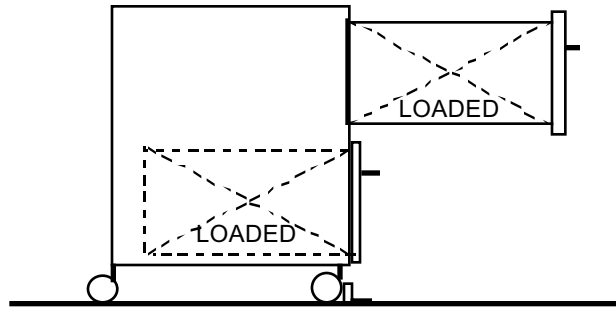


Figure 9d - Stability Test for Type II Storage Units having Extendible Elements

9.5 Stability Test for Type II Storage Units having Extendible Elements

(See Figure 9d and Table 3 – page 42)

9.5.1 Purpose of Test

The purpose of these tests is to evaluate the stability of Type II storage units.

9.5.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled or positioned in accordance with manufacturer's instructions. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position. If equipped with casters, each front caster shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. Casters shall be oriented in their least stable position. See Figure 9d. Load shall be configured per Section 3.7.2 (Figure 3a or 3b) if extendible element has a bottom. Load shall be configured per Section 3.7.3 (Figure 3c) if extendible element does not have a bottom. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- b) Load the extendible element that will cause the least stable condition with the functional load requirement in Table 1 (page 18). (**Note:** when there is more than one extendible element that can cause the equivalent instability, load the extendible element at the highest position.)
- c) The largest extendible element of those remaining shall be loaded uniformly to 140 kg/m³ (0.005 lb./in.³) of clear space.
- d) All elements other than that loaded in b) shall be closed and secured against opening.

9.5.3 Test Procedures 3

The extendible element loaded in 9.5.2 b) shall be fully extended.

9.5.4 Acceptance Level

The unit shall not tip over. If open extendible elements prevent the unit from tipping over due to contact with the test platform, the unit does not meet the acceptance criteria.

Note: The use of devices such as casters on a bottom extendible element is an acceptable method of preventing tipping.

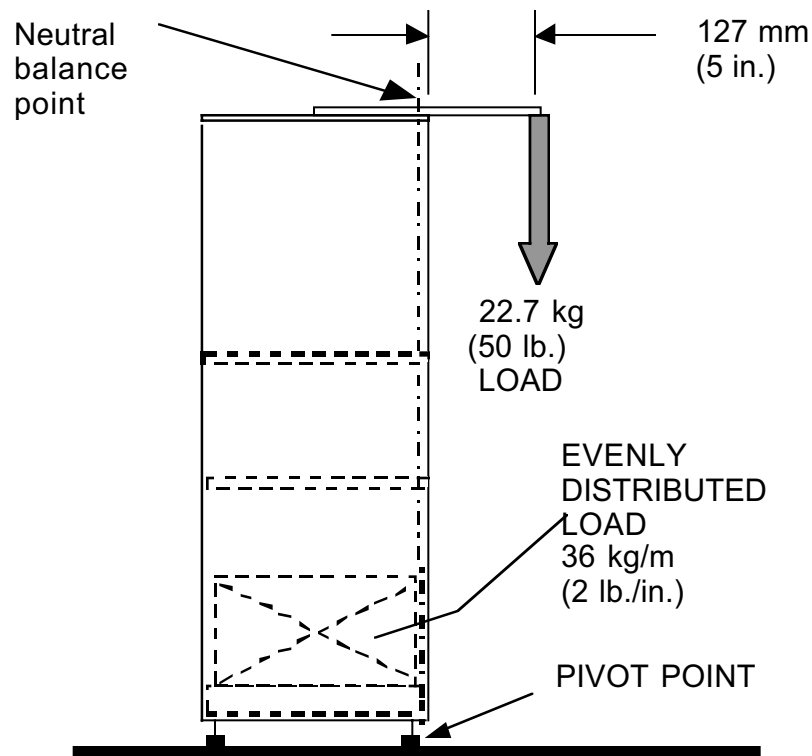


Figure 9e - Vertical Force Stability Test for Units without Extendible Elements

9.6 Vertical Force Stability Test for Units without Extendible Elements

(See Figure 9e)

9.6.1 Purpose of Test

The purpose of this test is to evaluate the stability of storage units that are taller than 1067 mm (42 in.) when subjected to a vertical force.

9.6.2 Test Setup

The unit shall be placed on a test platform and leveled. The glides, feet, or casters shall be blocked or otherwise prevented from moving along the surface. The blocks shall not restrict the tilt of the product. If equipped with casters, each front caster shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. The casters shall be positioned in their least stable position. Place an evenly distributed load of 36 kg/m (2 lb./in.) of width in/on the lowest storage component in the unit. If so equipped, any doors in the storage unit shall be closed during this test.

9.6.3 Test Procedure

Suspend 22.7 kg (50 lb.) load on a vertical line 127 mm (5 in.) in front of the outermost edge of the most forward protruding fixed shelf or top. The fixture used to apply the load shall be neutrally balanced so that it does not affect the stability of the unit. (The center of gravity of the fixture should be directly vertically aligned with the pivot point of the unit.)

9.6.4 Acceptance Level

The unit shall not tip over.

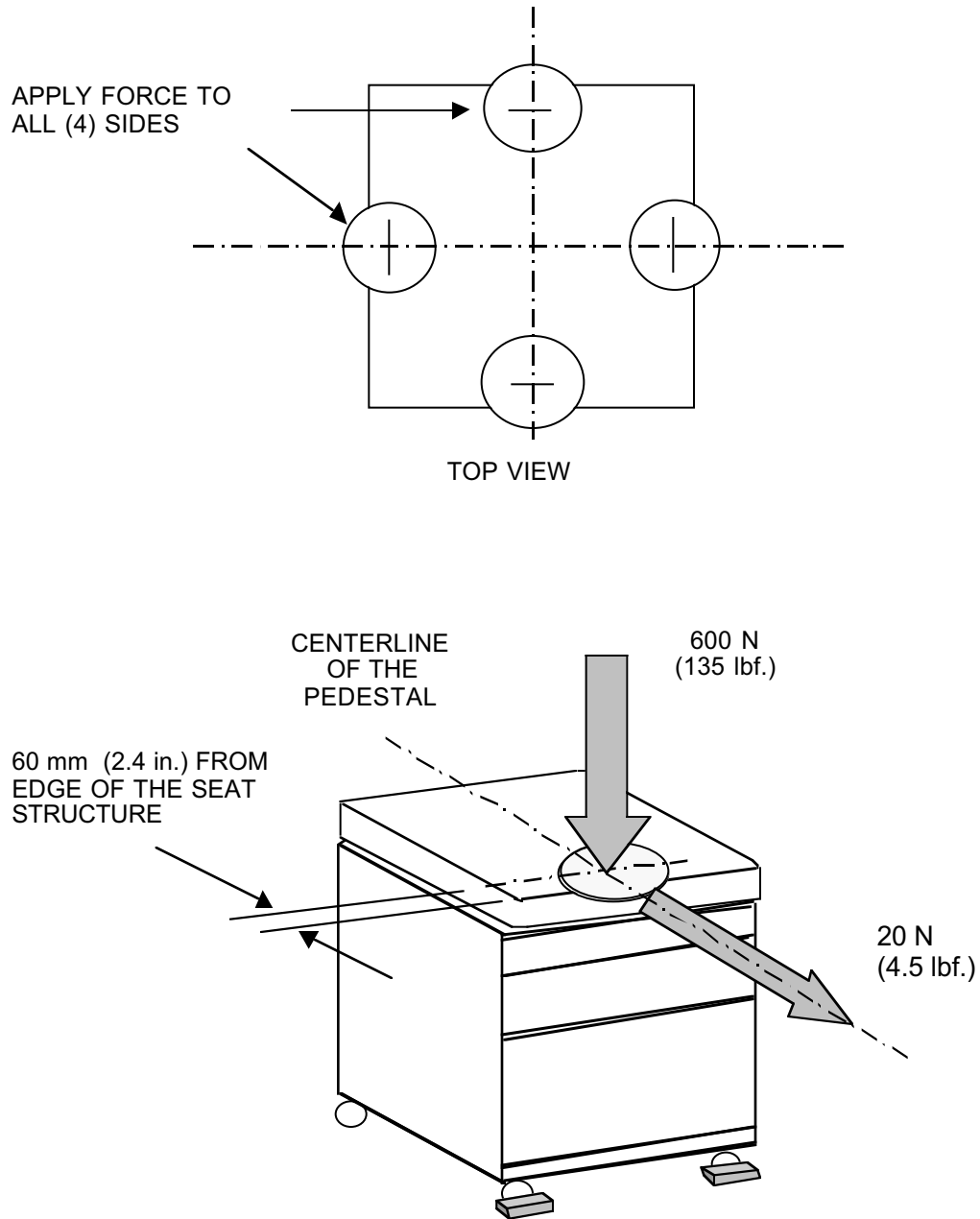


Figure 9f – Stability Test for Pedestals/Storage Units with Seat Surfaces

9.7 Stability Test for Pedestals/Storage Units with Seat Surfaces

9.7.1 Purpose of Test

The purpose of this test is to determine the stability of pedestal/storage units that are also equipped for use as seats (such as those with cushioned or contoured top surfaces).

9.7.2 Test Setup

- a) The unit shall be placed on a test platform and leveled. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position. All extendable elements and horizontal surfaces shall be unloaded. All doors and extendible elements shall be closed.
- b) If equipped with casters, each front caster shall be blocked with an obstruction or other restraining device 13 mm (0.5 in.) in height affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. If equipped with casters, they shall be positioned in their least stable position. Determine the position along the perimeter of the seating area where an outward horizontal force will most likely overturn the unit. Place a 200 mm, (7.9 in), diameter disk at this position. The center of the disk shall be placed at a point 60 mm (2.4 in) in from the edge of the seat structure at the position determined. Appendix B (Figures 21 & 22) shows examples of load application devices.

9.7.3 Test Procedure

- a) Apply a vertical load of 600 N (135 lbf.), to the disk (See Figure 9f).
- b) Apply a horizontal force to the unit in the plane of the bottom of the disk in the direction most likely to overturn the unit. Several load applications may be required to determine the "worst case".
- c) Gradually increase the force until 20N (4.5 lbf.) is attained.

9.7.4 Acceptance Level

The unit shall not tip over as the result of the force application.

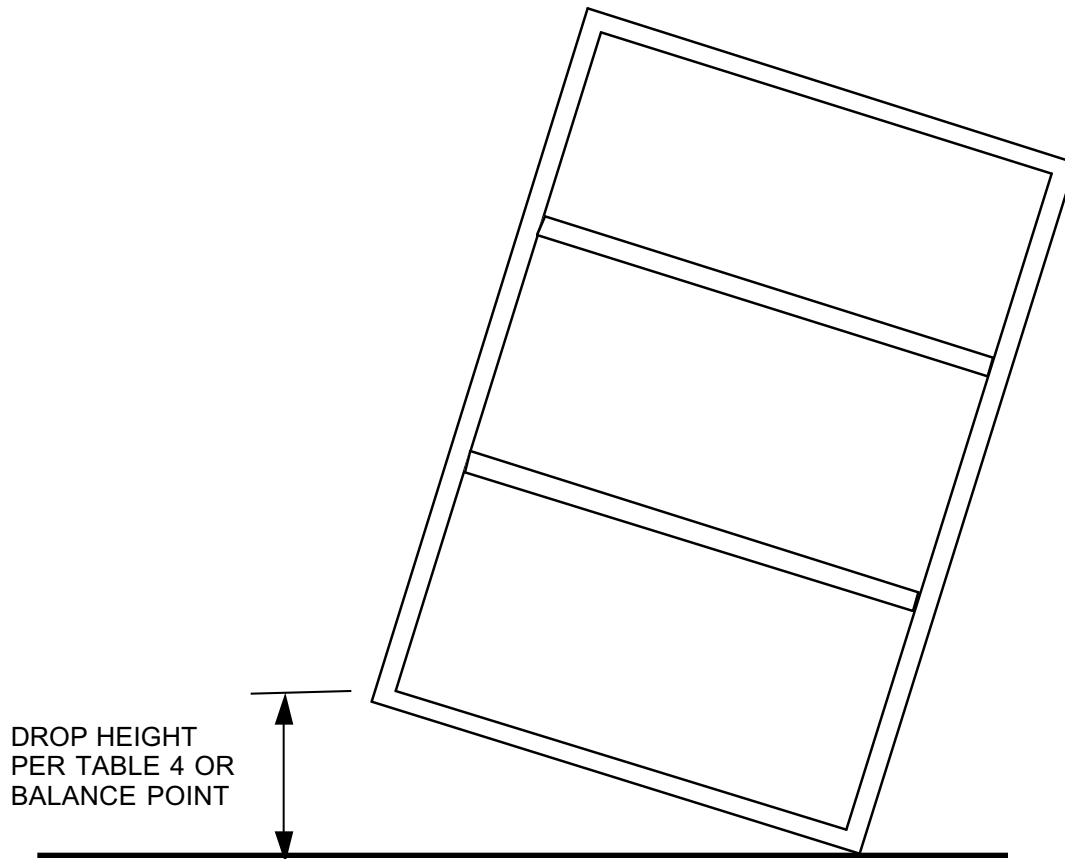


Figure 10 – Storage Unit Drop Test

Table 4

Drop Height for Storage Units

Unit Weight	Drop Height
<45 kg (100 lb.)	180 mm (7.1 in.)
45- 90 kg (100-200 lb.)	120 mm (4.7 in.)
>90 kg (200 lb.)	60 mm (2.4 in.)

10 Storage Unit Drop Test (See Figure 10)

10.1 Purpose of Test

The purpose of this test is to determine the ability of a storage unit to withstand an impact force on the base of the unit. This test does not apply to Type II Storage Units (see Table 3 - Page 42) or storage units with casters.

10.2 Test Setup

On units with adjustable features, set the adjustable features at the midpoint of adjustment.

10.3 Test Procedure

- a) Determine the weight of the unloaded unit to be tested.
- b) The unit shall be placed on a test platform and leveled. If the storage unit is equipped with glides, extend them to their midpoint but not to exceed 13 mm (0.5 in.) from the fully retracted position.
- c) Raise one end of the long axis of the unloaded storage unit so that the bottom of the base is above the test platform to the height given in Table 4 or at the balance point, whichever is lower.
- d) The end of the storage unit being tested shall be released and allowed a free fall to the test platform.
- e) Repeat Steps (c) and (d) for the other end of the storage unit.
- f) Perform the pull force test in Section 20 on all extendible elements.

10.4 Acceptance Level.

There shall be no loss of serviceability. The extendible elements shall meet the pull force test requirements in Section 20.

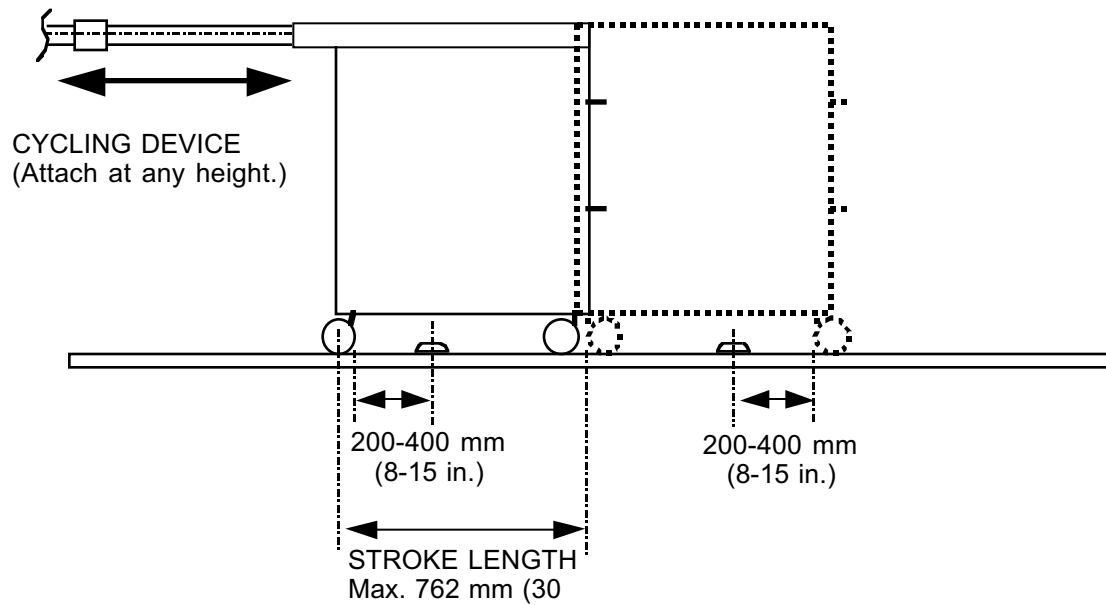
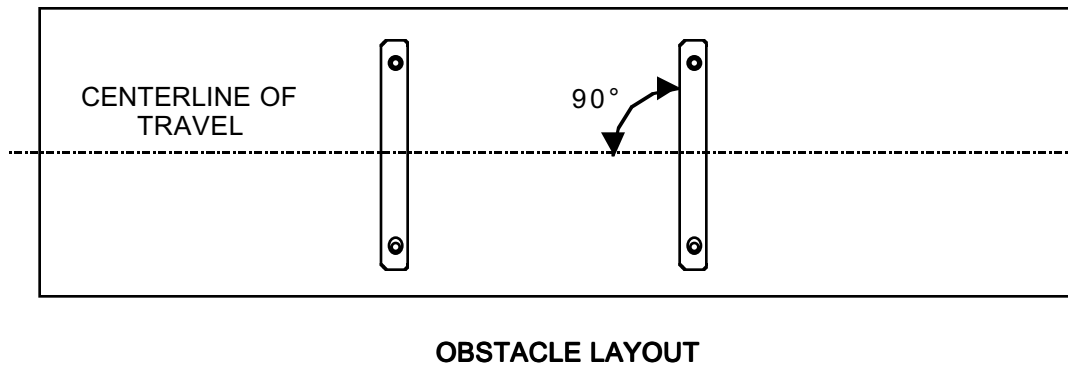
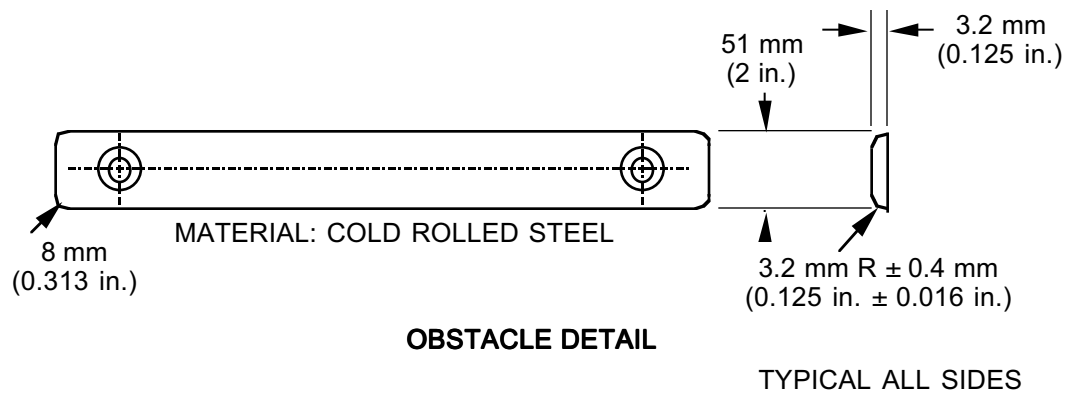


Figure 11 – Movement Durability Test for Mobile Storage Units

Table 5 - Storage Unit Movement Cycle Test Parameters

Unloaded Unit weight	Cycles over obstructions	Cycles over flat surface
Less than or equal to 45 kg (100 lbs.)	2500	0
Greater than 45 kg (100 lbs.)	100	1000

11 Movement Durability Test for Mobile Storage Units (See Figure 11)

11.1 Purpose of Test

The purpose of this test is to evaluate the ability of the mobile storage unit to withstand fatigue, stress, and wear caused by movement.

11.2 Test Setup

- Attach the cycling device to the storage unit. The method of attachment shall not support the unit during the test. The load applied by the attachment device shall be removed from the amount of unit loading — See 11.2 d.
- Mount two obstacles on the platform in accordance with the obstacle layout as shown in Figure 11. The casters shall be free to rotate and swivel.
- Load the unit with the distributed functional load per Table 1 (page 18), with the exception of the unit top and keyboard trays, which shall remain unloaded. Distributed loads shall be evenly distributed front to back and left to right on shelves. Distributed loads shall be configured as described in Section 3.4 for extendible elements. Loads shall be restrained in place to prevent movement during testing.
- A weight equal to that of the force of the cycling device attachment on the unit shall be removed from the total weight in the unit.
- Adjust the length of stroke to a maximum of 762 mm (30 in.) and position the obstacles to ensure that all casters travel over an obstacle twice for each cycle.
- After changing direction at each end of the stroke, provide 200 mm to 400 mm (8 in. to 15 in.) of travel before encountering an obstacle. Only two casters will pass over an obstacle at one time.
- Set the cycling device to operate at a rate of 10 ± 2 cycles per minute. One cycle consists of a forward, then a backward stroke of the machine.

11.3 Test Procedure

Cycle the storage unit over the obstacles for the specified number of cycles per Table 5. If required, remove the obstacles and complete the number of cycles specified in Table 5.

11.4 Acceptance Level

There shall be no loss of serviceability.

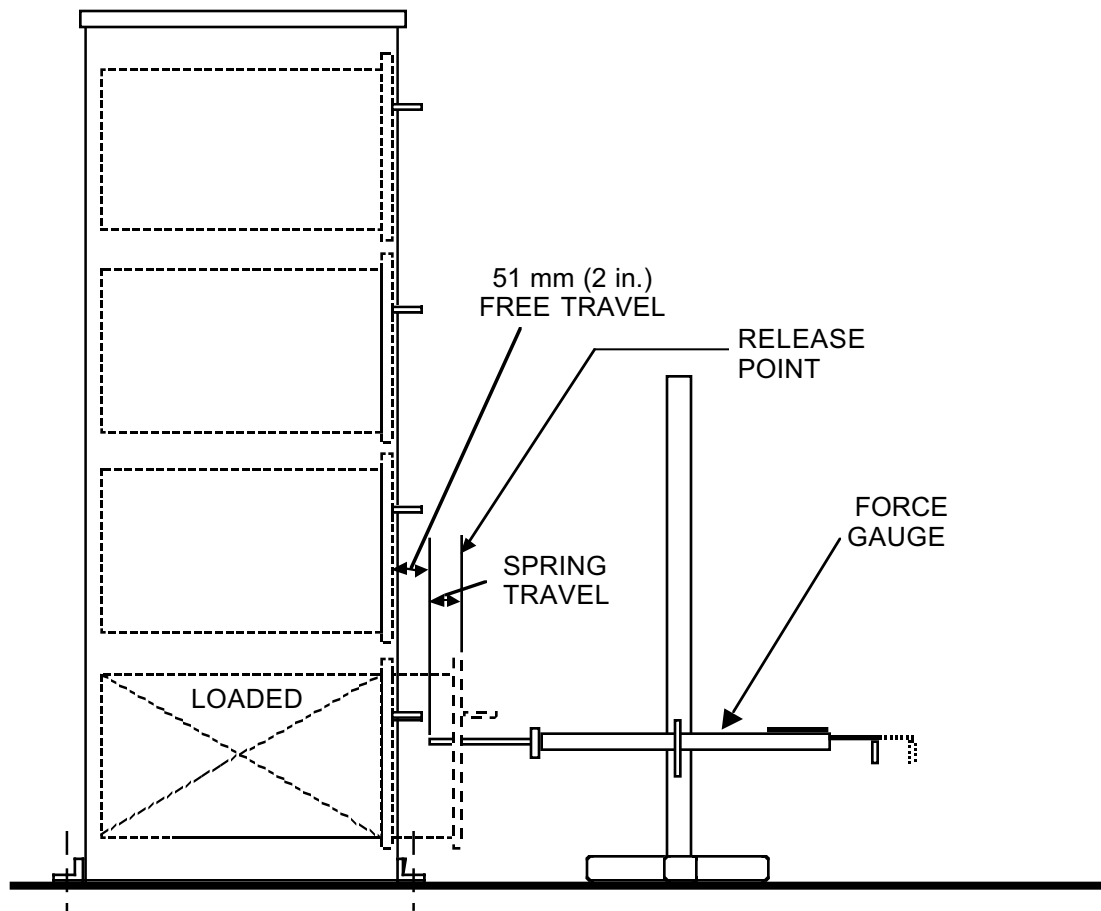


Figure 12 - Rebound Test

12 Rebound Test (See Figure 12)

12.1 Purpose of Test

The purpose of this test is to evaluate the operational characteristics of a loaded extendible element to ensure that it will not bounce back out of the storage unit beyond the acceptance level while being closed. This test does not apply to television/video display support surfaces or mechanisms.

12.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled. The storage unit shall be affixed with obstruction(s) to prevent it from moving. Obstructions shall not interfere with the operation of the extendible element(s) being tested.
- b) The extendible element to be tested shall be loaded to the functional load requirements in Table 1 (page 18). Load per Section 3.7.3 (Figure 3c) if extendible element does not have a bottom. Load per Section 3.7.2 (Figure 3a) or Section 3.7.3 (Figure 3b) if extendible element has a bottom, whichever is worst case (or test to both if the worst case cannot be determined).
- c) Prior to performing test procedure, the extendible element shall be tested to and meet the pull force requirements of Section 20.
- d) A force gauge with a spring rate of 1.75 N/mm (10 lbf./in.) shall be mounted 51 mm (2.0 in.) from the face of the extendible element in its fully closed position per Figure 12.

12.3 Test Procedure

- a) The extendible element shall be opened to a force of 9.8 N per kg (1 lbf./pound) of extendible element load or 178 N (40 lbf.), whichever force is less.
- b) Release the extendible element allowing the force applied by the force gauge to close the extendible element. Record the at rest position of the extendible element after rebound.
- c) Reset the position of the load to meet the gap requirements of Section 3.7.
- d) Repeat Steps (a) through (c) for a total of 5 times.
- e) Repeat Steps (a) through (d) for each remaining type and/or size of extendible member. If there is more than one extendible member or a unique type and size, the one closest to the floor shall be chosen.

12.4 Acceptance Level

Before performing the Rebound Test, the extendible element shall meet the pull force requirements of Section 20. The rebound position of the extendible element shall not exceed 38 mm (1.5 in.) from its closed position after each of the five closings.

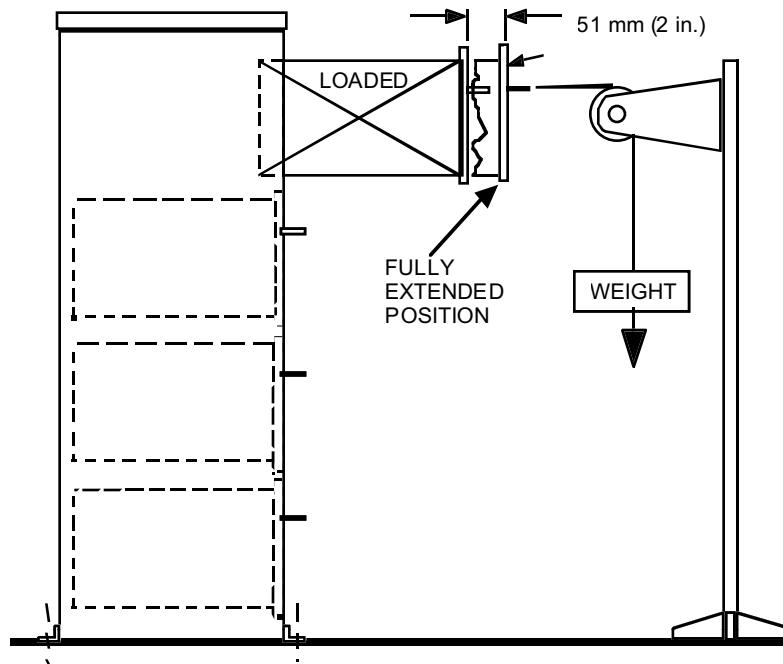
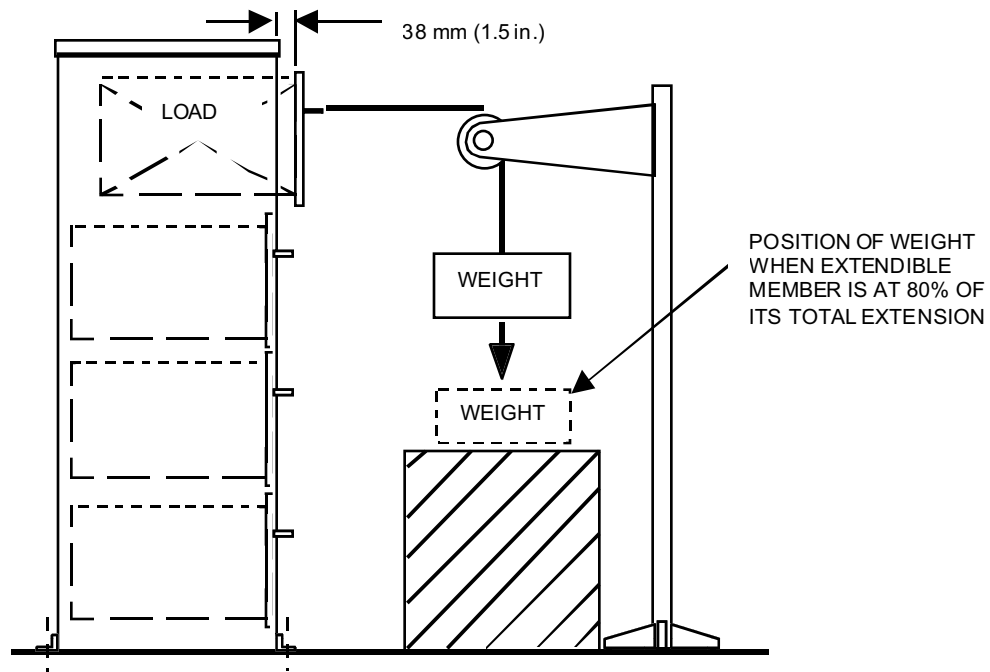


Figure 13 - Out Stop Test

13 Out Stop Test (See Figure 13)

13.1 Purpose of Test

The purpose of this test is to evaluate the ability of extendible elements to withstand excessive pullout forces. This test does not apply to elements with load capacity (per Table 1 – page 18) of less than 7 kg (15.4 lb.) or to television/video display support surfaces/mechanisms.

13.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled. The storage unit shall be affixed with obstruction(s) to prevent it from moving. Obstructions shall not interfere with the operation of the extendible element (s) being tested.
- b) The extendible element to be tested shall be loaded to the functional load requirements in Table 1 (page 18). Load per Section 3.7.3 (Figure 3c) if extendible element does not have a bottom. Load per Section 3.7.2 (Figure 3a) or Section 3.7.3 (Figure 3b) if extendible element has a bottom, whichever is worst case (or test to both if worst case cannot be determined). For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- c) Prior to performing test procedure, the extendible element shall meet the pull force requirements of Section 20.
- d) A cable shall be attached to the most rigid point of the vertical centerline of the extendible element. This may be accomplished by means of a clamp or similar device that does not affect the test results.
- e) The opposite end of the stranded metallic cable shall extend horizontally to a pulley and then downward to an attached weight. Open the extendible element 38 mm (1.5 in.) and determine the minimum weight that will cause the extendible element to open to full extension. Add 2.3 kg (5 lb.) of weight. This combined weight shall be used to conduct the test. The weight shall be restrained after the extendible element reaches 80% of its total extension.

13.3 Test Procedure

- a) The extendible element with cable and hanging weight shall be held in a position 38 mm (1.5 in.) from closed and the extendible element shall be released, permitting the extendible element to open rapidly, and allowing it to impact the out stops. Repeat this procedure for a total of 5 times without resetting the air gaps specified in the Loading Guidelines (Section 3.7).
- b) Move the fully extended extendible element 51 mm (2 in.) toward the closed position and then release it rapidly, allowing it to impact the out stop. The distance traveled by the

weight shall not be restrained. This procedure shall be repeated 15,000 cycles at a rate of 14 ± 6 cycles per minute.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only), the extendible element should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing extendible element travel. The resetting interval shall not be less than 500 cycles.

13.4 Acceptance Level

After performing the Out Stop Test, the extendible element shall meet the pull force requirements of Section 20. There shall be no loss of serviceability.

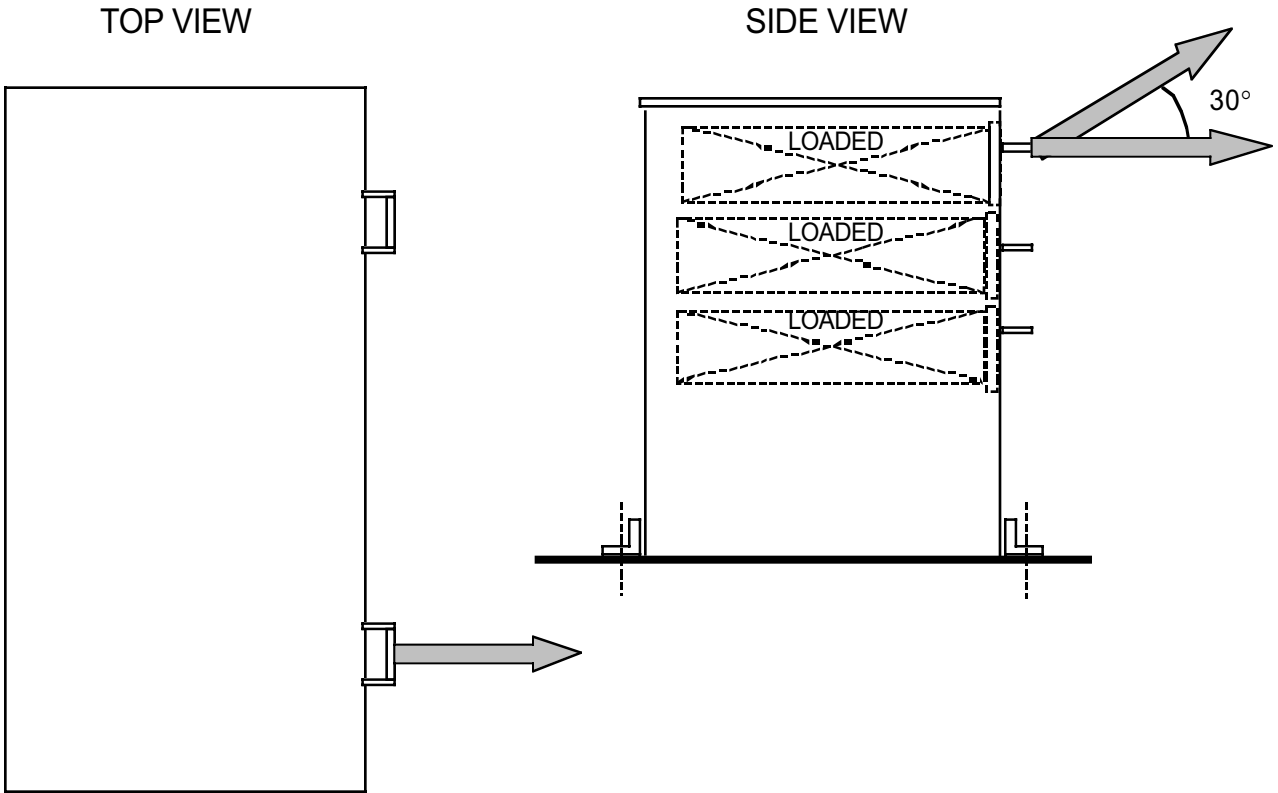


Figure 14a - Force Test for Extendible Element Locks

14 Lock Tests

14.1 Purpose of Tests

The purpose of these tests is to evaluate the ability of locks to function.

14.2 Force Test for Extendible Element Locks (See Figure 14a)

14.2.1 Purpose of Test

The purpose of these tests is to evaluate the ability of locking mechanism, if present, to provide a nominal amount of security for the contents.

14.2.2 Test Setup

14.2.2.1 The unit shall be placed on a test platform, leveled and secured to prevent it from moving. The method of securing shall not interfere with the operation of the extendible element(s) being tested.

14.2.2.2 Close and lock all extendible elements.

14.2.2.3 Depending on the pull configuration, setup test to apply force to the pull as follows:

Center Pull - Center of the pull area.

Wide Pull (Wide pulls are > 33% of the width of the extendible element front).

Three areas (one at a time):

- a) Center of the pull area.
- b) At a distance from the right hand side of the extendible element equal to one-sixth of the extendible element width ± 6 mm (0.25 in.) or the right hand side of the pull, whichever is a greater distance from the edge of the extendible element.
- c) At a distance from the left hand side of the extendible element equal to one-sixth of the extendible element width ± 6 mm (0.25 in.) or the left hand side of the pull, whichever is a greater distance from the edge of the extendible element.

Single Side Pull - Center of the pull area.

Dual Side Pulls - Center of the right hand pull and then the center of the left hand pull.

14.2.3 Test Procedure

- a) A horizontal outward force of 222 N (50 lbf.) shall be applied once at each of the applicable locations indicated in the test setup.
- b) An outward and upward force (30° from horizontal) of 222 N (50 lbf.) shall be applied once at each of the applicable locations indicated in the test setup.

Note: If the extendible element pull design does not allow a user to apply an outward and upward force, Step (b) does not apply.

- c) Repeat Steps (a) and (b) for each extendible element.
- d) Unlock the extendible elements.
- e) All extendible elements in the unit shall be uniformly loaded with the functional load per Table 1 (page 18).

Note: Any uniform loading configuration in Section 3.7 (Figure 3) is acceptable.

- f) The loaded extendible elements shall be closed and locked.
- g) Repeat procedure (a) through (d).

14.2.4 Acceptance Level

The extendible elements shall remain in the normal locked position during application of the forces. There shall be no loss of serviceability of the locking mechanism.

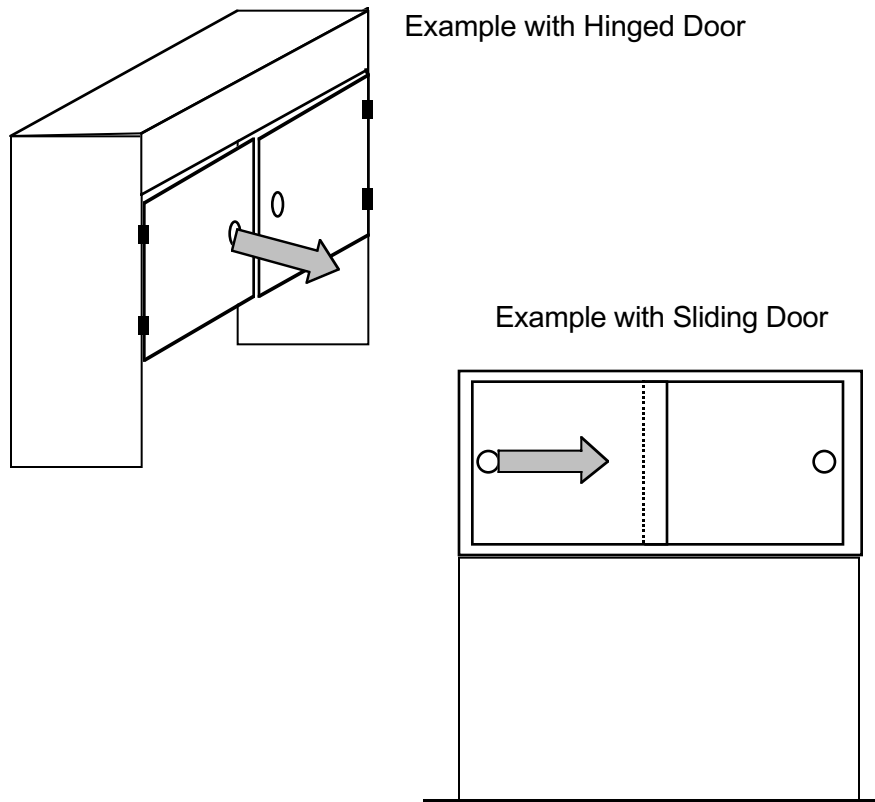


Figure 14b - Force Test for Door Locks

14.3 Force Test for Door Locks (See Figure 14b)

14.3.1 Purpose of Test

The purpose of this test is to evaluate the ability of the locking mechanism to withstand forces applied to the pull area.

14.3.2 Test Setup

- a) The unit shall be placed on a test platform and leveled. The unit shall be secured to prevent it from moving. The method of securing shall not interfere with the operation of the doors being tested.
- b) Close and lock all doors.
- c) Set up the test to apply forces to the center of the door's pull area.

14.3.3 Test Procedure

- a) Apply a force of 222 N (50 lbf.) in the direction of initial door travel.
- b) Repeat Step (a) for each door.
- c) Unlock the door.

14.3.4 Acceptance Level

The doors shall remain in the normal locked position during application of the forces. There shall be no loss of serviceability of the locking mechanism.

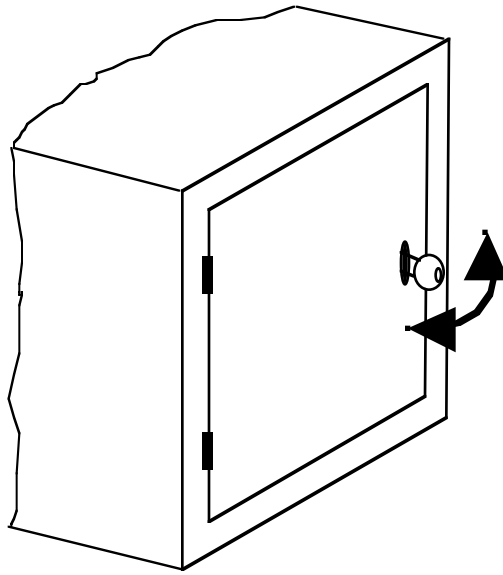


Figure 14c - Locking Mechanism Cycle Test for Locks

14.4 Locking Mechanism Cycle Test for Locks (See Figure 14c)

14.4.1 Purpose of Test

The purpose of this test is to evaluate the durability of locking mechanisms.

14.4.2 Test Setup

- a) The unit shall be placed on a test platform and leveled.
- b) For keyed locks, insert the key into the lock and attach a cycling device to the head of the key. For keyless locks, attach a cycling device to the keypad or unlocking mechanism. If the design of the locking mechanism requires activation of the extendible element to fully evaluate the mechanism, the element may be opened/closed accordingly during the test (this may be done independent of the key cycling)
- c) Set the cycling device to operate at 14 ± 6 cycles per minute.

14.4.3 Test Procedure

Cycle the locking mechanism through its full range of motion for 5000 cycles.

14.4.4 Acceptance Level

There shall be no loss of serviceability of the locking mechanism.

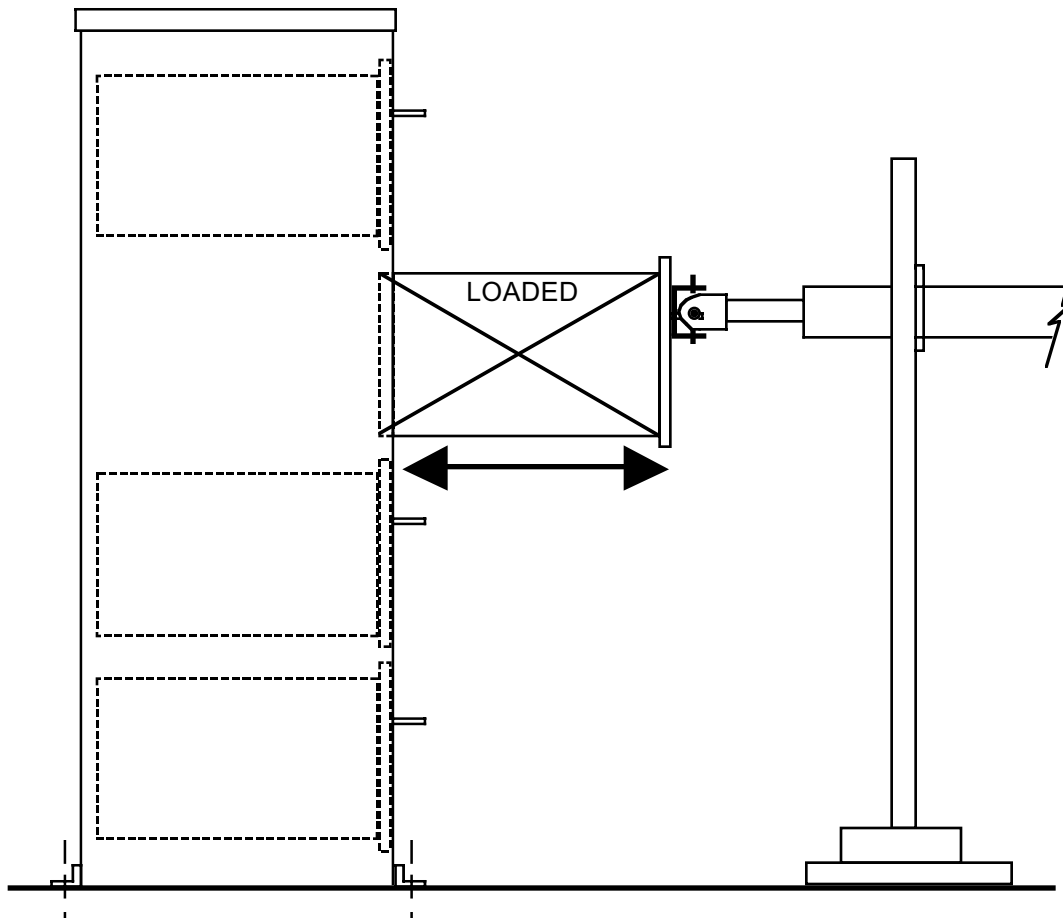


Figure 15a - Extendible Element Cycle Test

15 Extendible Element Cycle Tests (See Figures 15a and 15b)

15.1 Purpose of Tests

The purpose of these tests is to ensure that the suspension system (including interlock, in-stop/anti-rebound, detent mechanisms, etc.) is durable and capable of supporting typical loads while the extendible element is being opened and closed.

15.2 Cycle Tests for Extendible Elements that Do Not Swivel

15.2.1 Cycle Test for Extendible Elements Deeper Than Wide

15.2.1.1 Test Setup

- a) The storage unit shall be placed on a test platform, leveled, and secured against movement.
- b) Prior to performing this test procedure, the extendible element, if equipped with an interlock device, shall meet the interlock test requirements of Section 16 and the stability test requirements in Section 9.4.
- c) Extendible elements shall be uniformly loaded with the functional load per Table 1 (page 18). Load shall be configured per Section 3.7. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- d) Prior to performing test procedure, the extendible element shall be tested to and meet the pull force requirements of Section 20.
- e) The cycling device shall be connected to the center of the extendible member's pull. If equipped with side pulls, the cycling device shall be connected to the center of either pull.
- f) The cycling device shall be set to cause the extendible element to travel within 0 to 6 mm (0 to 0.25 in.) of the closed position to 0 to 6 mm (0 to 0.25 in.) of the fully extended position and return. This motion shall constitute one cycle. The cycling device shall not support or add vertical or horizontal loads to the suspensions. (See Figure 15a.)
- g) The cycling device shall be operated at a rate of 12 ± 4 cycles per minute.

15.2.1.2 Test Procedure

- a) The largest extendible element of each construction/mounting type shall be subjected to 50,000 cycles per 15.2.1.1(c). The suspensions shall not be cleaned or lubricated during the test.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only) the extendible element should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing extendible element travel. The resetting interval shall not be less than 500 cycles.

- b) Upon completion of the cycling, perform the pull force requirements of Section 20.
- c) If the extendible element is equipped with an interlock device, perform the interlock test in Section 16.

15.2.1.3 Acceptance Level

There shall be no loss of serviceability. Before and after the cycle test, the extendible element(s) shall meet the pull force requirements of Section 20. After the cycle test, the extendible elements, if applicable shall meet the interlock test requirements of Section 16. If the unit is equipped with a stabilizing device, it may be necessary to reevaluate the stability of the unit per Section 9.4 to determine if the device performs adequately.

15.2.2 Cycle Test for Extendible Elements Wider Than Deep

15.2.2.1 Test Setup

- 15.2.2.1.1** The storage unit shall be placed on a test platform, leveled, and secured against movement.
- 15.2.2.1.2** Prior to performing test procedure, the extendible element, if equipped with an interlock device, shall meet the interlock test requirements of Section 16.
- 15.2.2.1.3** Extendible elements shall be uniformly loaded with the functional load per Table 1 (page 18). Load shall be configured per Section 3.7. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface.
- 15.2.2.1.4** Prior to performing test procedure, the extendible element shall be tested to and meet the pull force requirements of Section 20.
- 15.2.2.1.5** The cycling device shall be connected to the extendible element pull as follows:
Single Pull (Center or Side Pull) - Single pulls are $\leq 33\%$ of extendible element width. The cycling device shall be connected to the center of the extendible element pull area.
Wide Pull - Wide pulls are $> 33\%$ of extendible element width. The cycling device shall be connected to the following three areas (one at a time):
 a) Center of the pull area.
 b) At a distance from the right hand side of the extendible element equal to one-sixth of the extendible element width ± 6 mm (0.25 in.) or the right hand side of the pull, whichever is a greater distance from the edge of the extendible element.
 c) At a distance from the left hand side of the extendible element equal to one-sixth of the extendible element width ± 6 mm (0.25 in.) or the left hand side of the pull, whichever is a greater distance from the edge of the extendible element.
Dual Pulls - The cycling device shall be connected to the center of the right hand pull and then the center of the left hand pull.
- 15.2.2.1.6** The cycling device shall be set to cause the extendible element to travel within 0 to 6 mm (0 to 0.25 in.) of the closed position to 0 to 6 mm (0 to 0.25 in.) of the fully extended position and return.
- 15.2.2.1.7** The cycling device shall not support or add vertical or horizontal loads to the suspensions. (See Figure 15a)

15.2.2.1.8 The cycling device shall be operated at a rate of 12 ± 4 cycles per minute.

15.2.2.2 Test Procedure

a) The largest extendible element of each construction/mounting type shall be subjected to cycling as defined in Setup Section 15.2.2.1.5 and Table 6 below.

b) The suspensions shall not be cleaned or lubricated during the test.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only) the extendible element should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing extendible element travel. The resetting interval shall not be less than 500 cycles.

c) Upon completion of the cycles, perform the Pull Force Test in Section 20.

d) If the extendible element is equipped with an interlock device, perform the interlock test in on Section 16.

Table 6 - Cycle Test for Extendible Elements Wider Than Deep

Pull Type	Cycles @ Location
single pull $\leq$ 33% extendible element width (center pulls and single side pulls)	75,000 cycles at center of pull.
single pull $>$ 33% extendible element width (wide width pulls)	55,000 cycles at center of pull 10,000 cycles at RH position (see Test Setup) 10,000 cycles at LH position (see Test Setup)
dual pulls	37,500 cycles at center of RH pull 37,500 cycles at center of LH pull

15.2.3 Acceptance Level

There shall be no loss of serviceability. Before and after the cycle test, the extendible element(s) shall meet the pull force requirements of Section 20. After the cycle test, the extendible elements, if applicable shall meet the test requirements of Section 9.4 and Section 16.

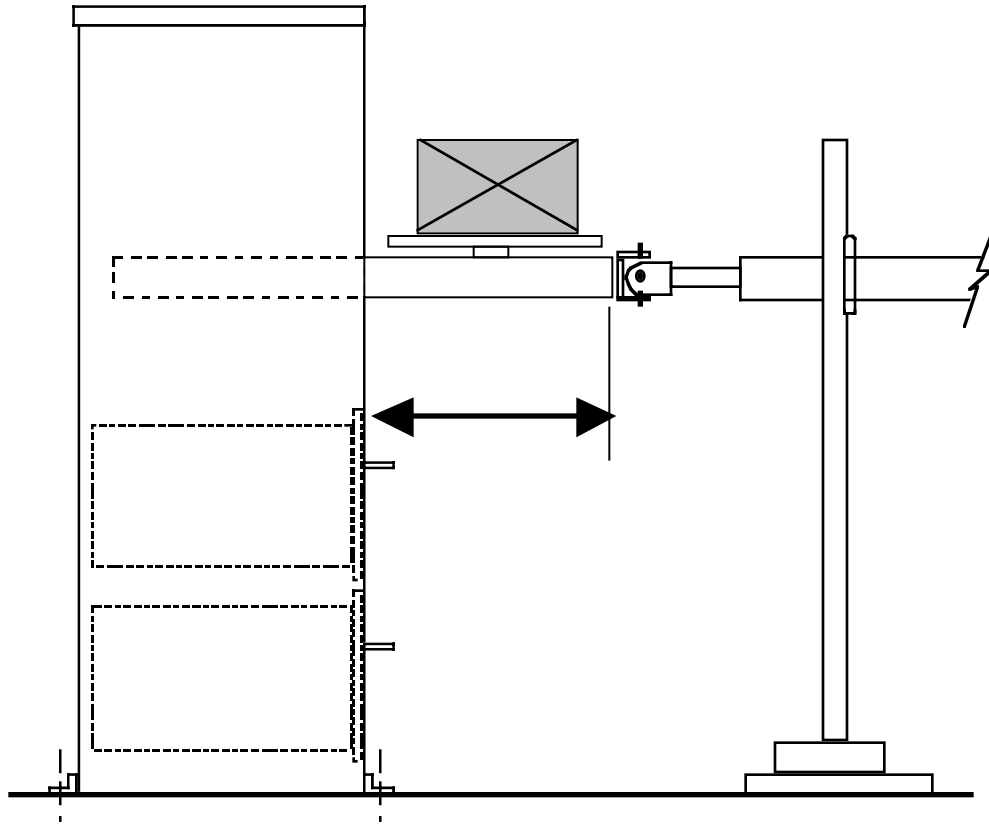


Figure 15b Horizontal Cycle Test for Television/Video Display Terminal Extendible Elements

15.3 Horizontal Cycle Test for Television/Video Display Terminal Extendible Element

15.3.1 Test Setup

- a) The slide-swivel assembly shall be mounted in its normal operating position and secured.
- b) Apply a functional load as specified in Table 2 (page 19) to the slide swivel tray.
- c) The cycling device shall be connected to the center front edge of the extendible element.
- d) The cycling device shall be set to cause the extendible element to travel within 0 to 6 mm (0 to 0.25 in.) of the closed position to 0 to 6 mm (0 to 0.25 in.) of the fully extended position and return (this shall constitute one cycle). The cycling device shall not support or add vertical or horizontal loads to the suspensions. (See Figure 15b.)
- e) The cycling device shall be operated at a rate of 12 ± 4 cycles per minute.

15.3.2 Test Procedure

- a) Cycle the extendible element for a total of 10,000 cycles.
- b) The suspensions shall not be cleaned or lubricated during the test.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only) the extendible element should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing extendible element travel. The resetting interval shall not be less than 500 cycles.

15.3.3 Acceptance Level

There shall be no loss of serviceability. If applicable, the extendible elements shall meet the interlock test requirements of Section 16.

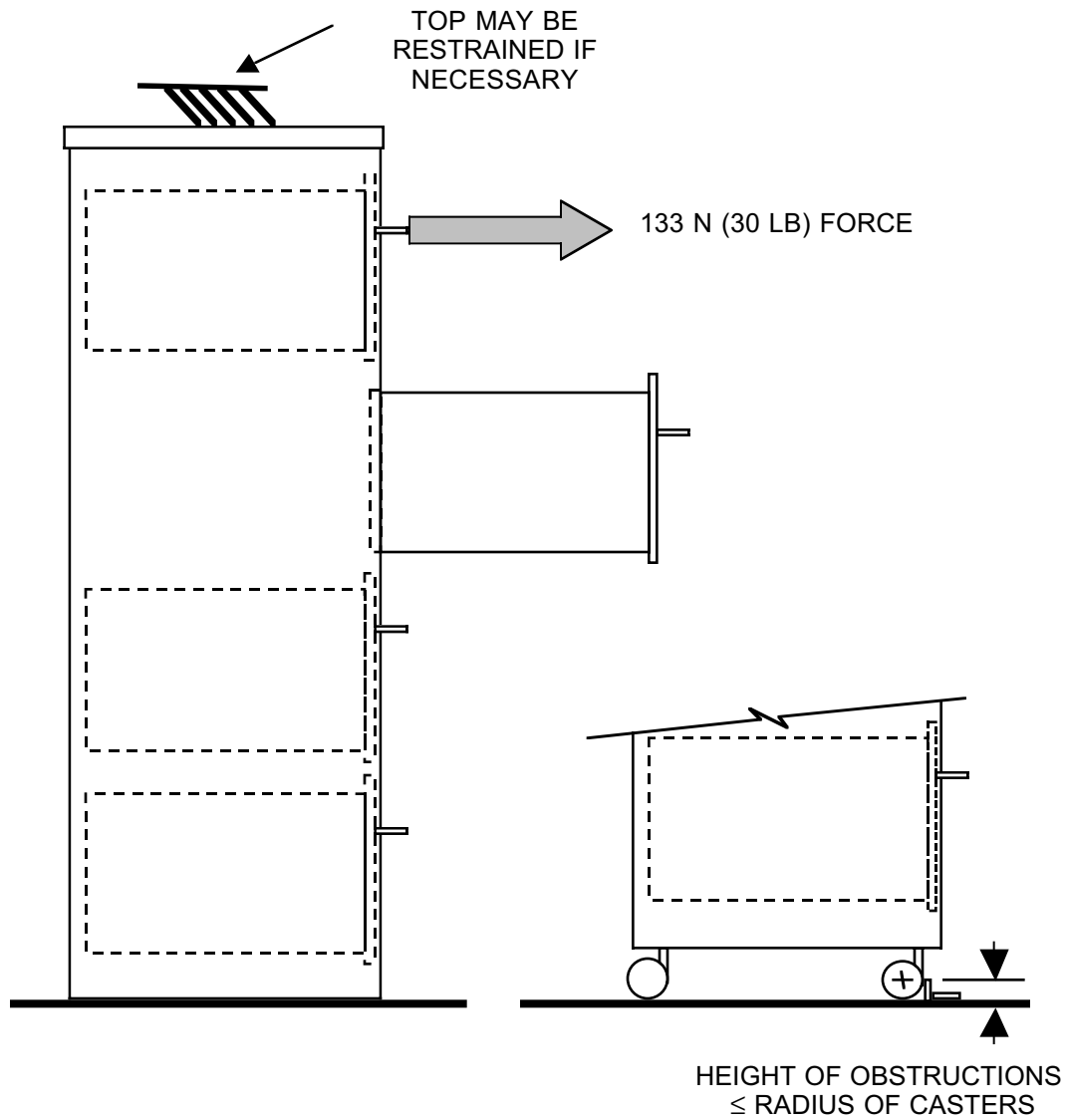


Figure 16 - Interlock Strength Test

16 Interlock Strength Test (See Figure 16)

16.1 Purpose of Test

The purpose of this test is to evaluate the ability of the interlock system to withstand horizontal forces that may be applied to defeat the interlock (if present).

Note: This test may be conducted in conjunction with the Extendible Element Cycle Test (Section 15.)

16.2 Test Setup

- a) The unloaded storage unit shall be placed on a test platform, leveled, and secured against movement in any direction.

16.3 Test Procedure

- a) An extendible element shall be fully extended, and a horizontal force of 133 N (30 lbf.) shall be individually applied to the center of the pull area(s) of the remaining extendible elements, one at a time.
- b) Repeat Step (a) until all possible combinations of extendible elements have been tested.
- c) Load extendible elements with the functional load per Table 1 (page 18).
- d) Repeat Step (a & b) until all possible combinations of extendible elements have been tested.

16.4 Acceptance Level

There shall be no loss of serviceability to the interlock system. The unopened extendible elements shall not bypass the interlock system.

17 Door Tests

The following table provides a guide for the appropriate test by door type.

17.1 Purpose of Tests

The purpose of these tests is to evaluate the performance of storage unit doors..

Table 7 - Door Test Applicability

Door Type/Test	Strength Test	Cycling wear & fatigue	Slam Tests	Lock Tests	Latch Test	Pull Test
Vertically Hinged Doors and Multi-fold Doors	17.2 & 17.3	17.6	17.11	14.3 & 14.4	17.14	20
Horizontally Hinged Doors	Top hinged doors — n/a For bottom hinged doors — see Section 4	17.6, 17.8 & 17.9	17.12 n/a for bottom hinged doors	14.3 & 14.4	17.14	20
Vertical Receding Doors	17.2, 17.3 & 17.4	17.6, 17.7 & 17.9	17.11	14.3 & 14.4	17.14	20
Horizontal Receding Doors	17.5	17.6, 17.8 & 17.9	17.12	14.3 & 14.4	17.14	20
Horizontally Sliding/ Roll Front	n/a	17.6	17.13	14.3 & 14.4	17.14	20
Tambour	n/a	17.6	17.13	14.3 & 14.4	17.14	20

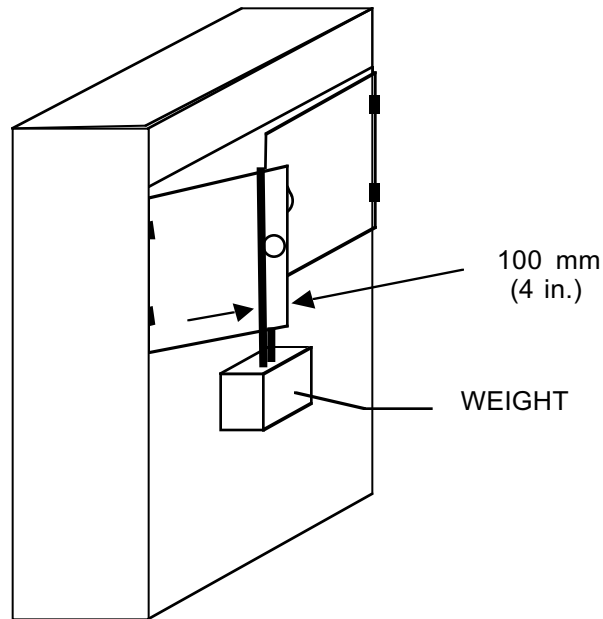


Figure 17a
Strength Test for Vertically Hinged Doors, Bi-fold Doors, and Vertically Receding Doors

17.2 Strength Test for Vertically Hinged Doors, Bi-fold Doors and Vertically Receding Doors (See Figure 17a)

Note this test does not apply to multi-fold (accordion) doors.

17.2.1 Purpose of Test

The purpose of this test is to determine the ability of doors to withstand excessive vertical loads.

17.2.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) Attach the specified load per the Table 8 so that its weight is equally distributed on both sides of the door and so that its center of gravity acts 100 mm (4 in.) from the edge of the door opposite the hinge.

Table 8 – Door Height vs. Load

Door Height	Load
Less than 46 cm (18 in.).	10 kg (22 lb.)
46 cm (18 in.) and greater	20 kg (44 lb.)

Receding doors should be tested in the fully extended position. For bi-fold doors, attach the load so that the weight is applied to the section of the door farthest from the point where the hinge(s) is (are) attached to the frame in a manner that does not affect the operation of the door.

17.2.3 Test Procedure

Cycle the door 10 times from a position 45 degrees from fully closed to a position 10 degrees from fully open (but not more than 135 degrees) and return. For bi-fold doors, cycle the door from a position 50 mm (2 in.) from fully closed to a position 50 mm (2 in.) from fully open and return.

17.2.4 Acceptance Level

There shall be no loss of serviceability to the unit.

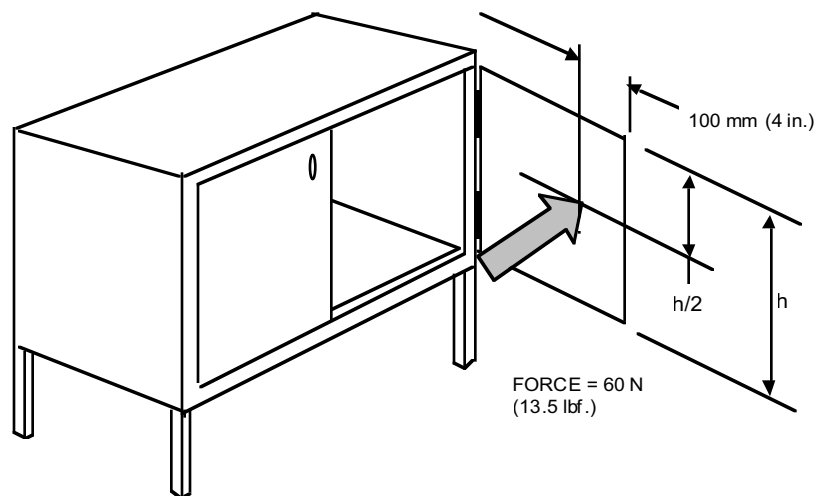


Figure 17b - Hinge Override Test for Vertically Hinged Doors

17.3 Hinge Override Test for Vertically Hinged Doors (See Figure 17b)

17.3.1 Purpose of Test

The purpose of this test is to determine the ability of a vertically hinged door to resist forces that override the hinges.

17.3.2 Test Setup

The unit shall be placed on a test platform, leveled, and secured against movement.

17.3.3 Test Procedure

Apply an 60 N (13.5 lbf.) horizontal force perpendicular to the plane of the door on its horizontal centerline 100 mm (4 in.) from the edge farthest from the hinge, as shown in Figure 17b.

17.3.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

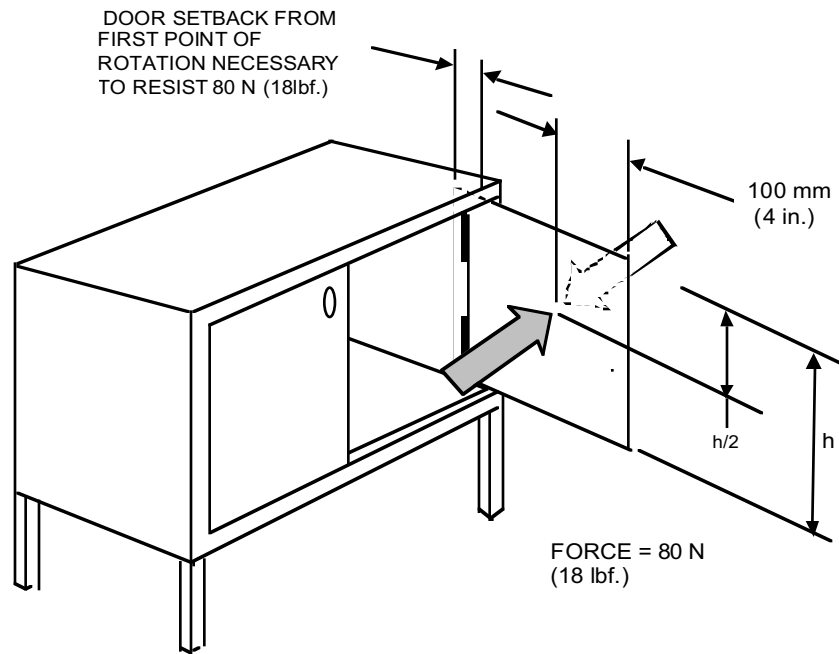


Figure 17c Vertical Receding Doors Strength Test

17.4 Vertical Receding Doors Strength Test

17.4.1 Purpose of Test

The purpose of this test is to determine the ability of a vertical receding door to resist forces that override the pocket.

17.4.2 Test Setup

- The unit shall be placed on a test platform, leveled, and secured against movement.
- Move the door from its stowed position to the first point at which the door will rotate freely towards its closed position.
- Place the receding door in a position rearward from this point until the door will resist an 80N (18 lbf.) force without closing.

17.4.3 Test Procedure

- Apply the 80 N (18 lbf.) horizontal force perpendicular to the plane of the door on its horizontal centerline 100 mm (4 in.) from the edge farthest from the hinge, as shown in Figure 18c.
- Apply the force 10 times.
- Repeat the test with the force application to the opposite side of the door.

17.4.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

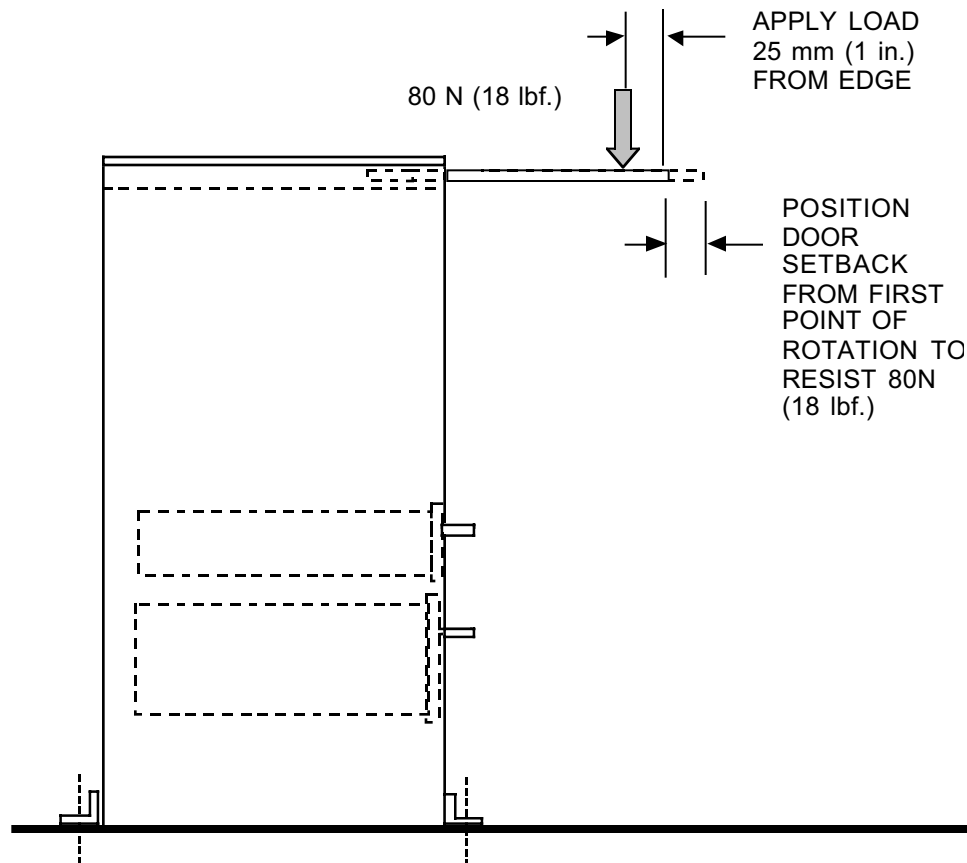


Figure 17d – Horizontal Receding Door Strength Test

17.5 Horizontal Receding Door Strength Test

17.5.1 Purpose of Test

The purpose of this test is to determine the ability of a horizontal receding door to resist forces that override the pocket.

17.5.2 Test Setup

- The unit shall be placed on a test platform, leveled, and secured against movement.
- Move the door from its stowed position to the first point at which the door will rotate freely towards its closed (vertical) position. Place the receding door in a position rearward from this point until the door will resist an 80N (18 lbf.) force without closing.

17.5.3 Test Procedure

- Apply the 80 N (18 lbf.) downward force perpendicular to the plane of the door on its horizontal centerline 25 mm (1 in.) from the edge farthest from the hinge, as shown in Figure 17d.
- Apply the force 10 times.

17.5.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

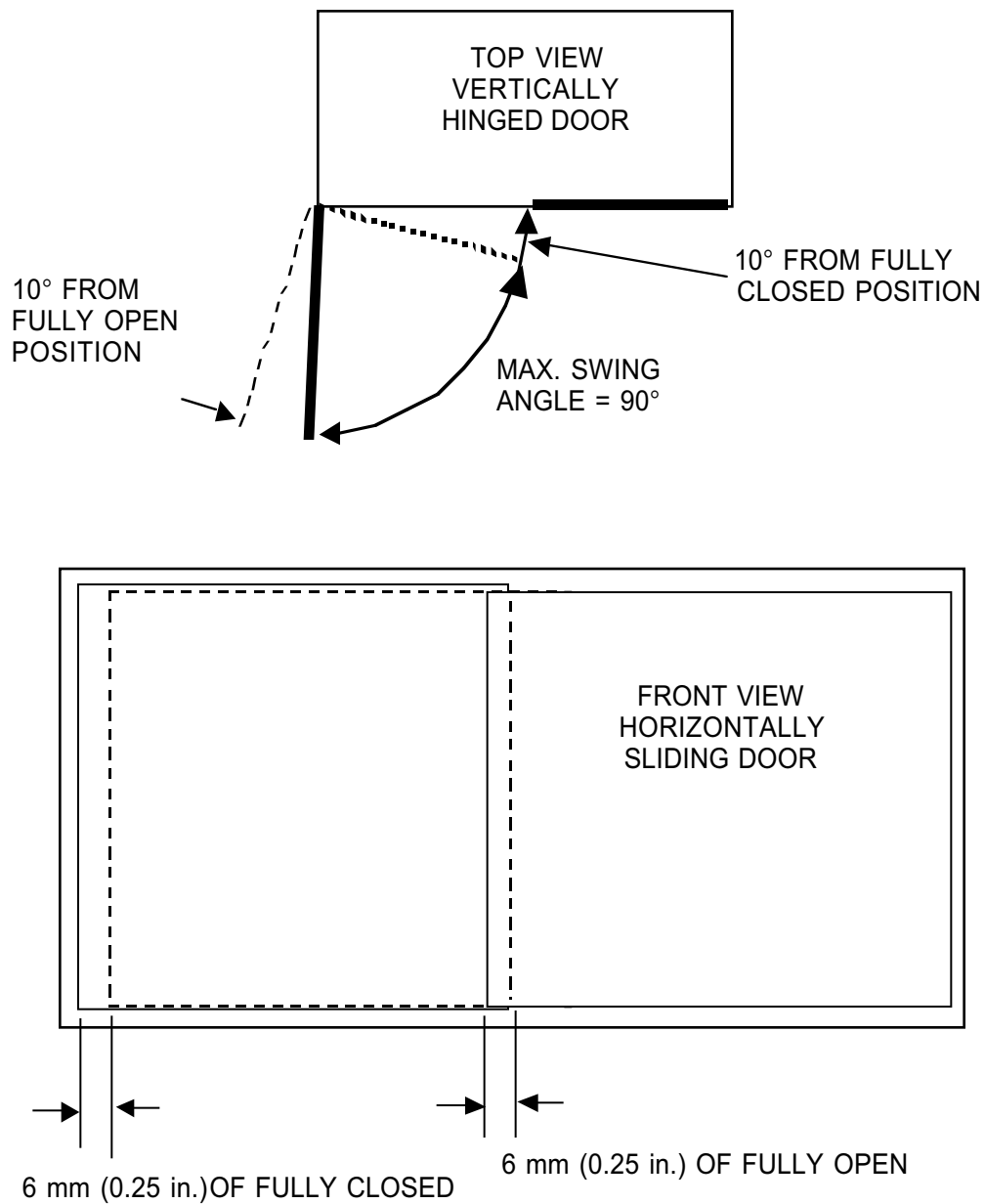


Figure 17e - Wear and Fatigue Test for Hinged and Horizontally Sliding Doors

17.6 Wear and Fatigue Tests for Hinged Doors and Horizontally Sliding Doors

(See Figure 17e)

17.6.1 Purpose of Test

The purpose of this test is to evaluate the resistance of hinged and horizontally sliding doors to wear and fatigue.

17.6.2 Test Setup

17.6.2.1 The unit shall be placed on a test platform, leveled, and secured against movement.

17.6.2.2 Latches may be disabled if not tested in conjunction with the Door Latch Test (Section 17.14). Doors that have the ability to retract may have this feature disabled during the test.

17.6.2.3 Attach the cycling device to the door at its pull area as follows:

Narrow Pull (Center or Side Pull) - Single pulls are $\leq 33\%$ of door width. The cycling device shall be connected to the center of the door pull area.

Wide Pull - Wide pulls are $> 33\%$ of door width. The cycling device shall be connected to the following three areas (one at a time):

- a) Center of the pull area.
- b) At a distance from the right hand side (or top of the door for horizontally sliding doors) equal to one-sixth of the door width (or height for horizontally sliding doors) ± 6 mm (0.25 in.) or from one end of the pull, whichever is a greater distance from the edge of the door.
- c) At a distance from the left hand side (or bottom of the door for horizontally sliding doors) equal to one-sixth of the door width (or height for horizontally sliding doors) ± 6 mm (0.25 in.) or from the other end of the pull, whichever is a greater distance from the edge of the door.

Dual Pulls - The cycling device shall be connected to the center of each of the pulls

- a) Cycle the door from a position 10° from fully closed to a position 10° from fully open and return, not to exceed a maximum swing angle of 90° .
- b) For doors that open and close along a track (such as bi-fold or multi-fold doors) cycle the door from within 6 mm (0.25 in.) of fully closed to within 6 mm (0.25 in.) of fully open and return.

17.6.2.4 The cycling device shall not be used to support or add to the weight of the door during the test.

Table 9 - Wear and Fatigue Tests for Doors

Pull Type	Cycles @ Location
narrow pull $\leq$ 33% door width (center pulls and single side pulls)	20,000 cycles at center of pull.
wide pulls $>$ 33% of door width	10,000 cycles at center of pull 5,000 cycles at one end of the pull (see test setup) 5,000 cycles at the opposite end of the pull (see test setup)
dual pulls	10,000 cycles at center of one pull 10,000 cycles at center of the other pull

17.6.3 Test Procedure

Cycle the door for a total of 20,000 cycles as specified in Table 9. The cyclic rate shall be 12 ± 4 cycles per minute unless the rate is controlled by the door operating mechanisms (pneumatic dampers, etc). If that is the case, the rate shall not exceed the natural rate established by the movement of the mechanism.

17.6.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

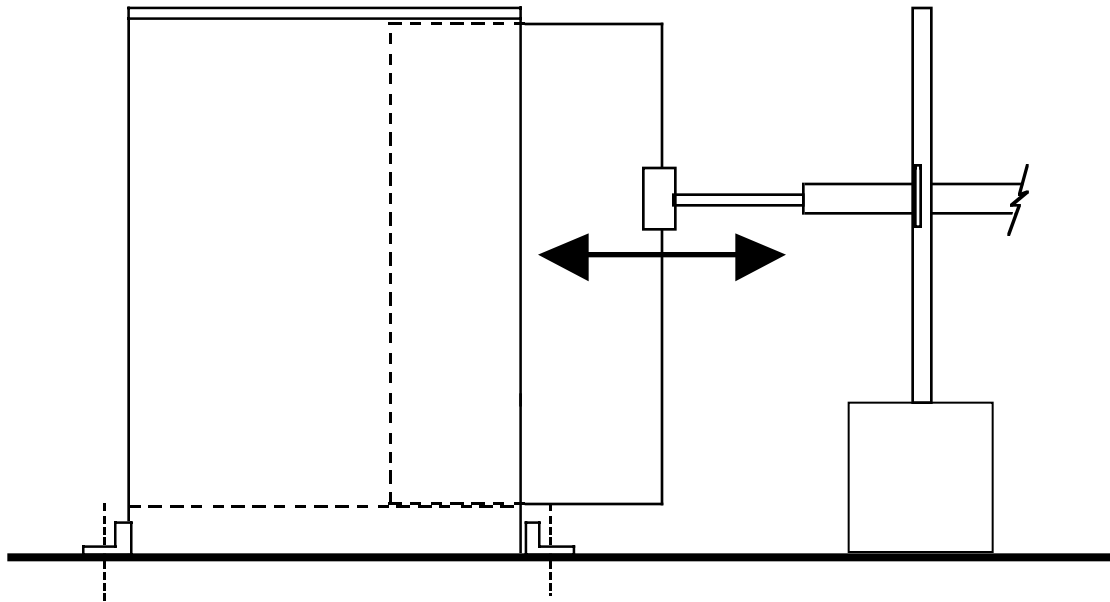


Figure 17f - Wear and Fatigue Test for Vertical Receding Door

17.7 Wear and Fatigue Test for Vertical Receding Door (See Figure 17f)

17.7.1 Purpose

The purpose of this test is to evaluate the resistance of vertical receding doors to wear and fatigue.

17.7.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) The cycling device shall be connected to the leading edge of the door at the center of the pull area. If the unit to be tested has two or more identical doors, only one of them needs to be tested.
- c) If not testing in conjunction with the Door Latch Test (Section 17.14), latches may be disabled.
- d) Prior to performing test procedure the door shall be tested to and meet the pull force requirements of Section 20.
- e) Adjust the cycling device to cause the door to travel between 0 to 6 mm (0 to 0.25 in.) of its fully extended and retracted positions.
- f) The cycling device shall not be used to support or add to the weight of the door during the test.
- g) The cycling device shall be set to operate at 12 ± 4 cycles per minute.

17.7.3 Test Procedure

- a) Cycle the door for a total of 10,000 cycles.
- b) The suspensions shall not be cleaned or lubricated during the test.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only) the door should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing door travel. The resetting interval shall not be less than 500 cycles.

17.7.4 Acceptance Level

After the cycle test, the door shall meet the pull force requirements of Section 20. The door shall have no loss of serviceability.

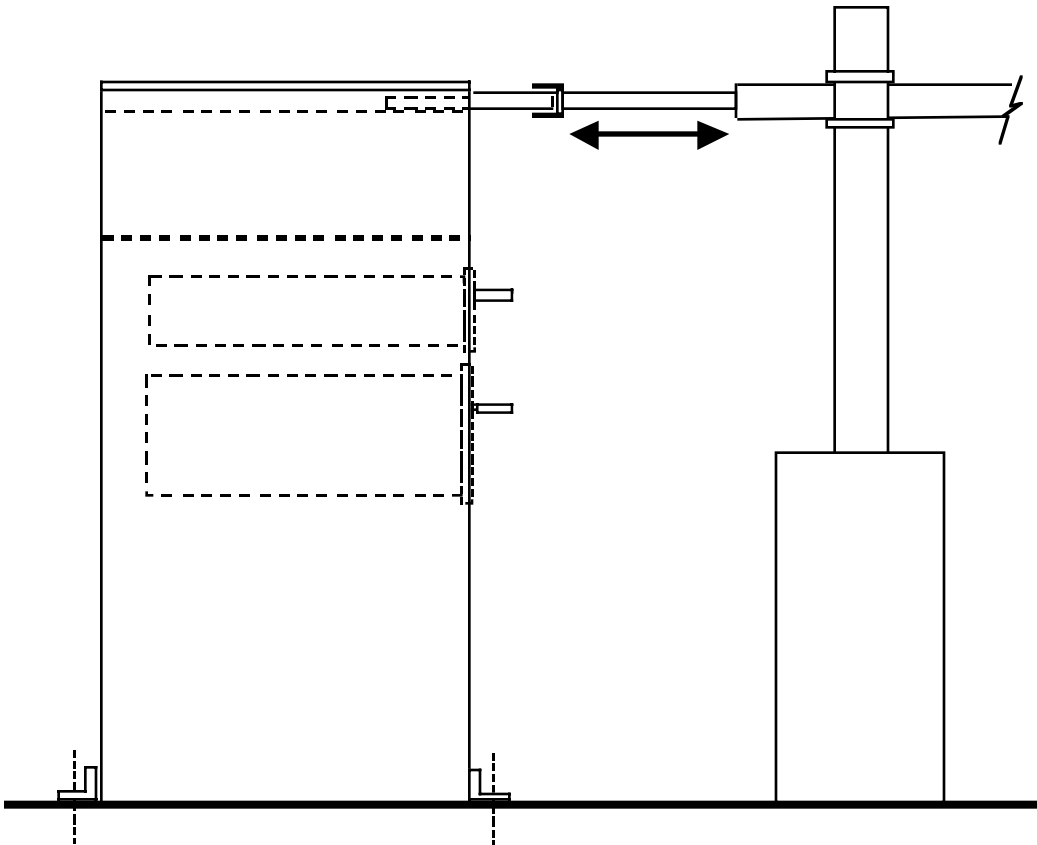


Figure 17g - Wear and Fatigue Test for Horizontal Receding Door

17.8 Wear and Fatigue Test for Horizontal Receding Door (See Figure 17g)

17.8.1 Purpose of Test

The purpose of this test is to evaluate the resistance of horizontal receding doors to wear and fatigue.

17.8.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) The cycling device shall be connected to the leading edge of the door according to the attachment points given in Table 8.
- c) If not testing in conjunction with the Door Latch Test (Section 17.14), latches may be disabled.
- d) Prior to performing test procedure the door shall be tested to and meet the pull force requirements of Section 20. The door may be supported in a horizontal plane during the pull force measurement test.
- e) Adjust the cycling device to cause the door to travel between 0 to 6 mm (0 to 0.25 in.) of its fully extended and retracted positions.
- f) The cycling device shall be used to support the door in a horizontal plane during the test.
- g) The cycling device shall be set to operate at 12 ± 4 cycles per minute.

17.8.3 Test Procedure

- a) The door shall be cycled according to the requirements of Table 8.
- b) The suspensions shall not be cleaned or lubricated during the test.

Note: When necessary to compensate for ball-bearing cage creep (ball-bearing slides only) the door should be reset throughout the test by fully opening and closing the element throughout the test. This interval will depend on a number of variables. The best indicator of the need to reset is increasing pull forces or decreasing door travel. The resetting interval shall not be less than 500 cycles.

17.8.4 Acceptance Level

After the cycle test, the door shall meet the pull force requirements of Section 20. (The door may be supported in a horizontal plane during the pull force test.) The door shall have no loss of serviceability.

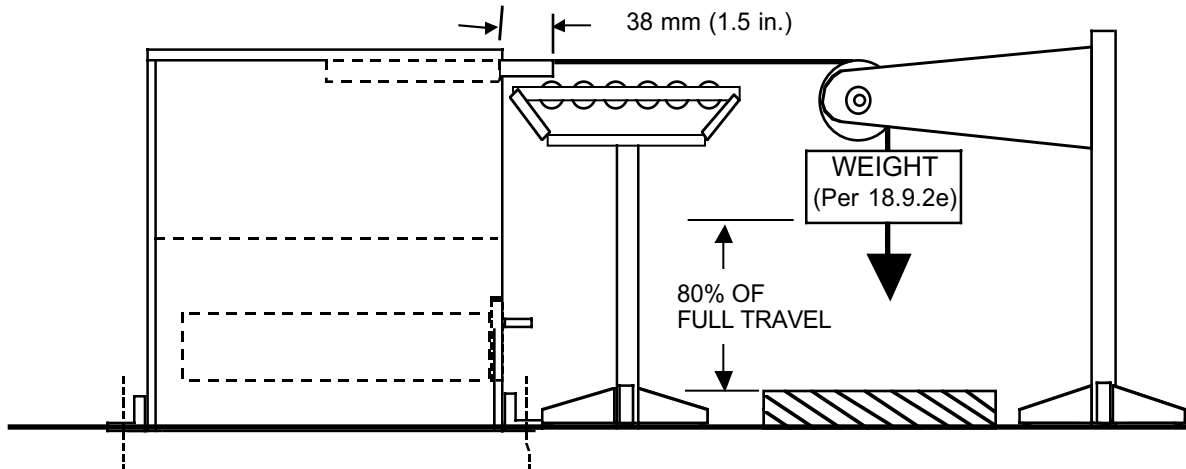


Figure 17h – Out stop Test – Cyclic Impact

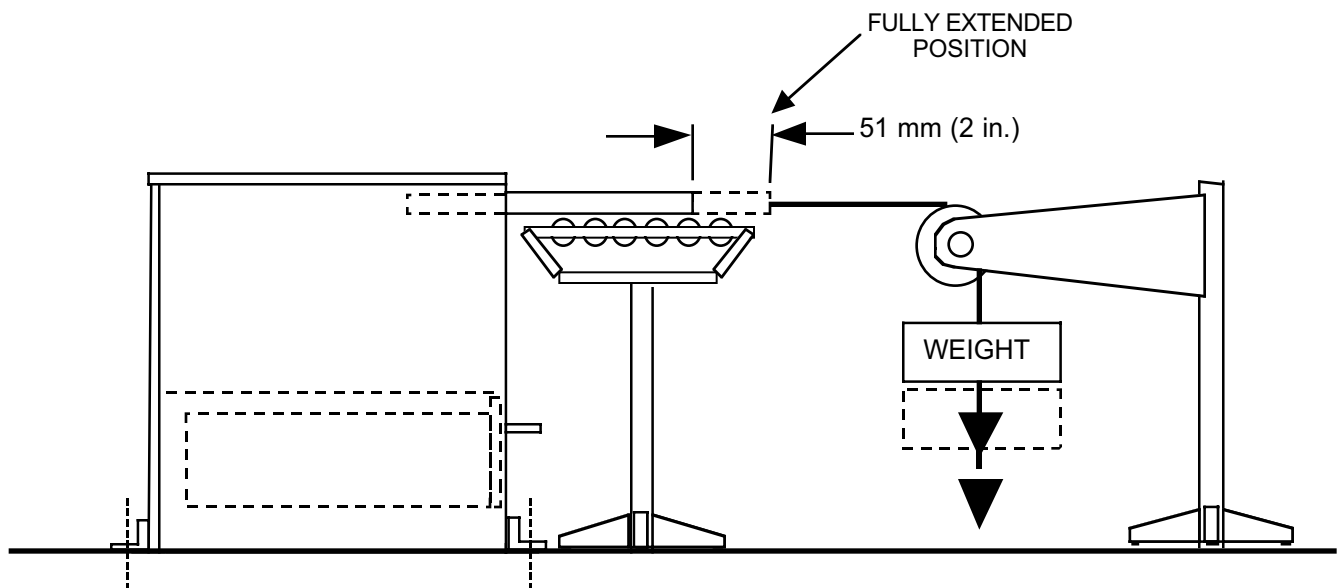


Figure 17i – Out stop Test – Cyclic Durability

Figures 17h and 17i
Vertical and Horizontal Receding Door Out Stop Test – Cyclic Impact

17.9 Vertical and Horizontal Receding Door Out Stop Test – Cyclic Impact

(See Figures 17h)

17.9.1 Purpose of Test

The purpose of this test is to evaluate the ability of vertically or horizontally hinged receding doors to withstand excessive pullout forces.

17.9.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured to prevent it from moving. The method of securing shall not interfere with the operation of the door(s) being tested.
- b) A stranded metallic cable shall be attached at the center of the door or door-pull. This may be accomplished by means of a clamp or similar device that does not affect the test results.
- c) For a horizontally hinged door, the door shall be supported in a horizontal plane during the test. The method of support shall not impede the horizontal travel of the door.
- d) Prior to performing test procedure, the door shall be tested to determine the pull force per Section 20. For a horizontally hinged door the measurement shall be taken with the horizontal support device in place.
- e) The opposite end of the stranded metallic cable shall extend horizontally to a pulley and then downward to an attached weight. Open the door 38 mm (1.5 in.) from its stowed position. Add to the pull force determined in d) 1 kg (2.2 lb.) to the weight on the cable. This combined weight shall be used to conduct the test. The weight shall be restrained after the door reaches 80% of its total extension.

17.9.3 Test Procedure – Cyclic Impact Test

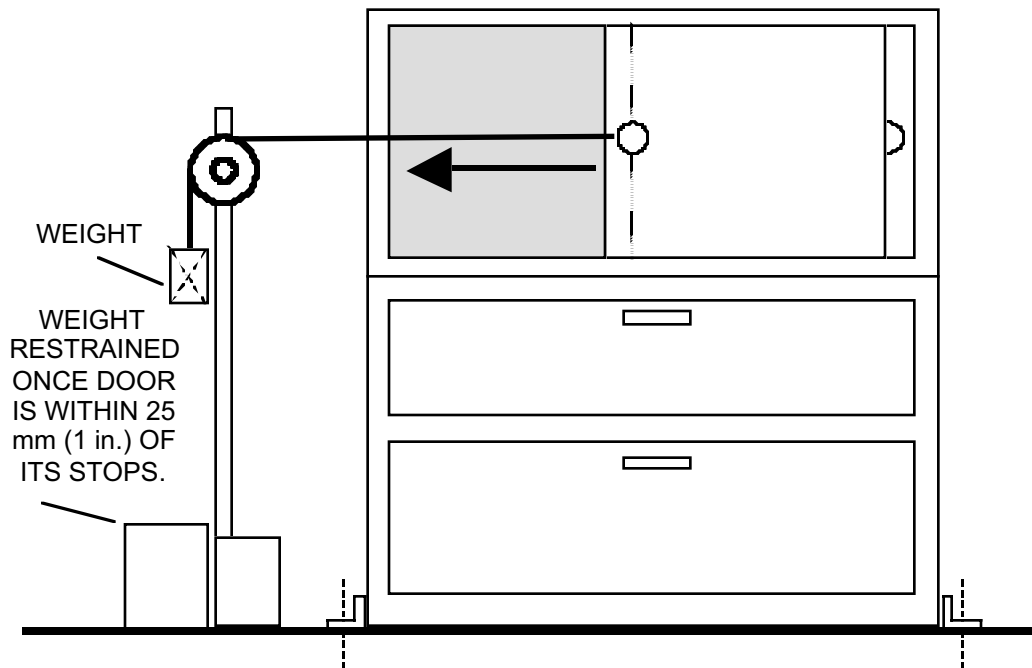
The door with stranded metallic cable and hanging weight shall be held 38 mm (1.5 in.) from the closed position and then released, permitting it to open rapidly (ensuring the weight is restrained according to 18.9.2.e) and impact the out stops. See Figure 17h. Repeat this procedure for a total of 5 times.

17.9.4 Test Procedure – Cyclic Durability Test

- a) Remove the load restraint such that the extendible element will travel to full extension. (See Figure 17i.)
- b) A device shall be used to move the door 51 mm (2 in.) toward the stowed position and then to release it rapidly, allowing it to impact the out stop. This procedure shall be repeated 5000 cycles at a rate of 10 ± 2 cycles per minute.

17.9.5 Acceptance Level

There shall be no loss of serviceability. After performing the Out Stop Tests, the extendible element shall meet the pull force requirements of Section 20.



17j - Slam Open and Closed Test for Doors which Do Not Free Fall

17.10 Slam Open and Closed Test for Doors which Do Not Free Fall (See Figure 17j)

This test applies to doors which slide or roll, open and closed, but not under their own weight.

This test does not apply to doors that are hinged.

17.10.1 Purpose of Test

The purpose of this test is to evaluate the ability of sliding and roll-front doors to withstand excessive pullout forces.

17.10.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) Measure and record the force necessary to slide the door over the first 152 mm (6 in.) of travel.
- c) A cable shall be attached to center of the door's pull area. This may be accomplished by means of a clamp or similar device that does not affect the test results.
- d) The opposite end of the cable shall be attached to a weight that will act to cause the door to open or close. The weight shall be determined from the following equation.
$$\text{Weight (kg)} = 2 \times (\text{Pull Force (N)}) / 9.8 \text{ m/sec}^2 \quad [\text{Weight (lb.)} = 2 \times (\text{Pull Force (lbf.)})]$$
- e) Set up the test device to restrain the weight once the door has moved to within 25 mm (1 in.) of the doorstop to be impacted.

17.10.3 Test Procedure

- a) Move the door, lifting the weight to within 25mm (1 in.) of the doorstop opposite to the one to be impacted.
- b) Release the door, permitting the door to move rapidly, allowing it to impact the doorstop.
- c) Repeat Steps (a) and (b) for a total of 50 times.
- d) Repeat Setup and Procedure Steps (a) through (c) to impact the opposite door stop on the same door.
- e) Repeat Setup and Procedure for each type and size of door.

17.10.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

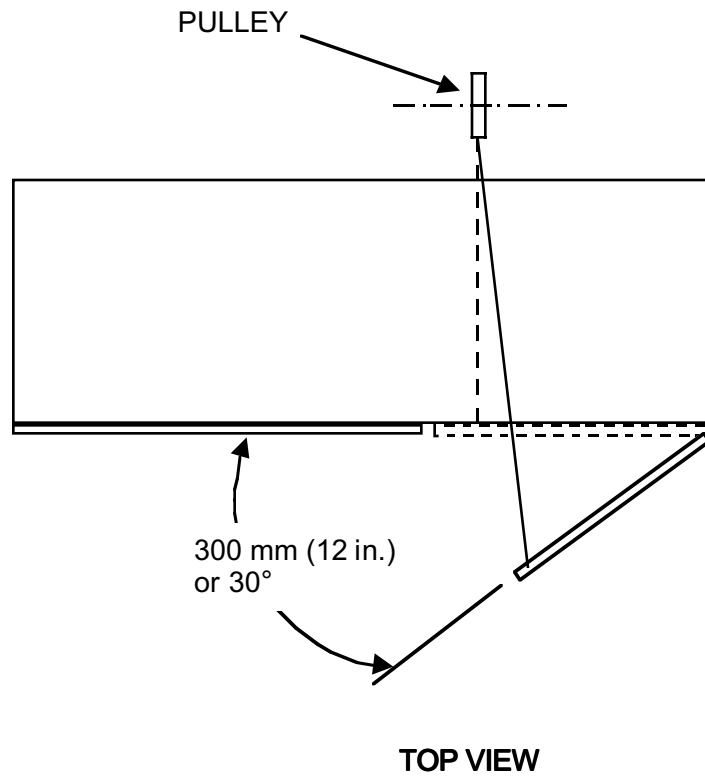


Figure 17k - Slam Closed Test for Vertically Hinged and Vertically Receding Doors

17.11 Slam Closed Test for Vertically Hinged and Vertically Receding Doors

(See Figure 17k)

17.11.1 Purpose of Test

The purpose of this test is to evaluate the ability of the door to withstand forceful (slam) closures.

17.11.2 Test Setup

- a) The storage unit shall be placed on a test platform and leveled. The storage unit shall be affixed with obstruction(s) to prevent it from moving. Obstructions shall not interfere with the operation of the door being tested. Doors that have the ability to retract may have this feature disabled during the test.
- b) Load door shelves according to Table 1 (page 18).
- c) A cable shall be attached to the middle of the door's edge opposite the hinge. Attachment point shall be as near to the door edge as possible without interfering with the door closure. This may be accomplished by means of a clamp or similar device that does not affect the test results.
- d) The opposite end of the stranded metallic cable shall extend horizontally to a pulley similar to that shown in Figure 17k. Open the door 30 degrees and then determine the load that must be applied to the cable assembly to cause the door to close.
- e) Open the door through a distance of 300 mm (12 in.) or 30 degrees, whichever is less. Add 2 kg (4.5 lb.) to the load determined in d). This combined load shall be used to conduct the test. The load shall be restrained after the door reaches a point 10 mm (0.4 in) from closure.

17.11.3 Test Procedure

The door with cable and hanging weight shall be held at 300 mm (12 in.) or 30 degrees from the closed position and then released, permitting the door to close, allowing it to impact the storage unit case. Repeat this procedure for a total of 10 times without resetting the loading gaps.

17.11.4 Acceptance Level

There shall be no loss of serviceability.

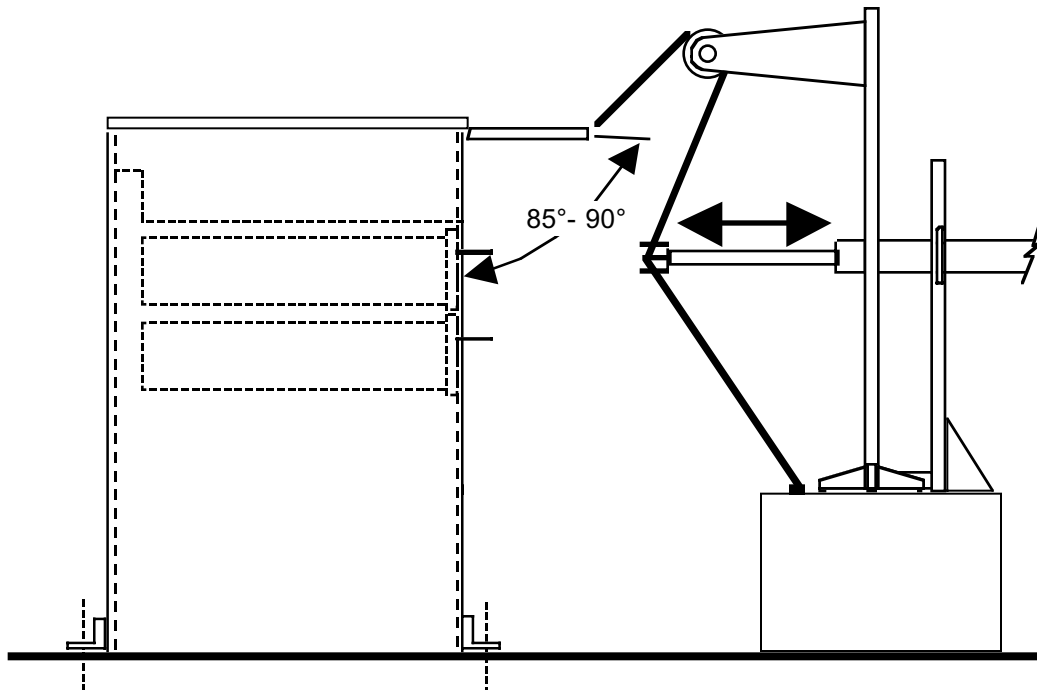


Figure 17L - Drop Test for Horizontally Hinged and Horizontally Receding Doors - Cyclic

17.12 Drop Test for Horizontally Hinged and Horizontally Receding Doors - Cyclic

(See Figure 17L)

17.12.1 Purpose of Test

The purpose of this test is to evaluate the ability of the horizontally hinged door mechanism to withstand lifting and a free fall drop.

17.12.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) The receding door shall be attached at its center to a mechanism that will pull the door up to an 85 degree to 90 degree angle from the closed-door position.
- c) The mechanism shall release the door, allowing it to fall freely against the unit.

17.12.3 Test Procedure

The door shall be lifted and dropped 500 times at a rate not to exceed 10 cycles per minute.

17.12.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components. Cracked or broken glass is considered a loss of serviceability.

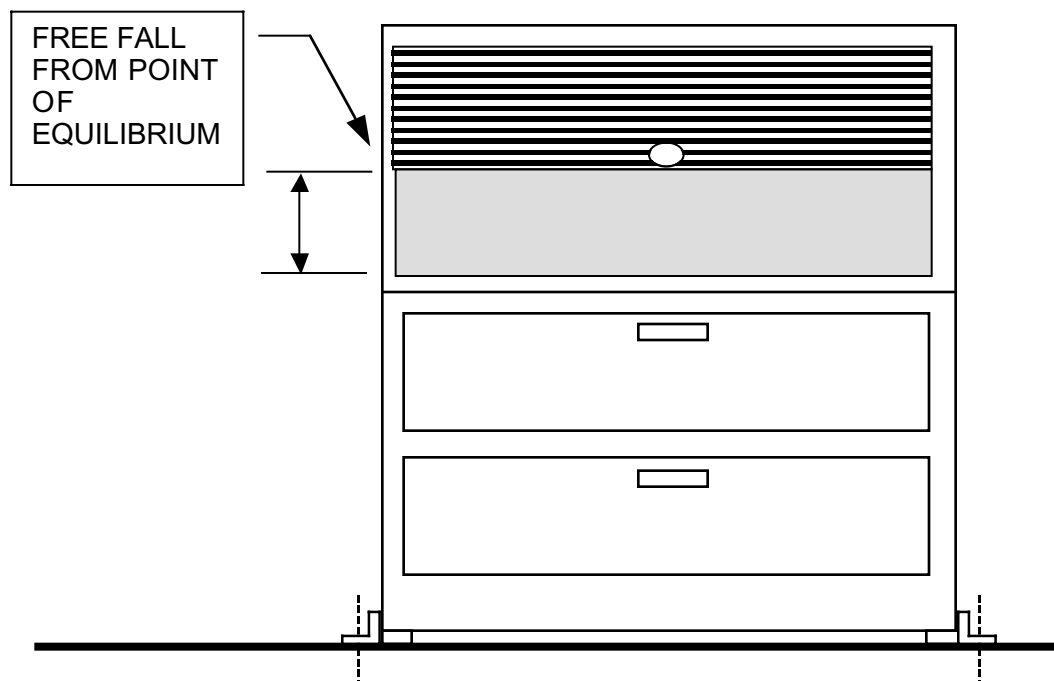


Figure 17m – Slam Test for Doors which Free Fall Open or Closed

17.13 Slam Test for Doors which Free Fall Open or Closed (See Figure 17m)

This test applies to doors which slide or roll, either open or closed, under their own weight. (This test does not apply to doors that are hinged.)

17.13.1 Purpose of Test

The purpose of this test is to evaluate the ability of doors which free-fall closed to withstand forceful (slam) closures.

17.13.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) Determine the highest position from which the door will fall freely.

17.13.3 Test Procedure

Allow the door to fall freely. Repeat for 50 cycles.

17.13.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

17.14 Door Latch Test

This test applies to all door types equipped with latches. This test may be run in conjunction with the door wear and fatigue tests.

17.14.1 Purpose of Test

The purpose of this test is to evaluate the ability of door latches to function.

17.14.2 Test Setup

- a) The unit shall be placed on a test platform, leveled, and secured against movement.
- b) Attach the door to a cycling device.
- c) Set the cycling device to operate at 12 ± 4 cycles per minute.

17.14.3 Test Procedure

Operate the latch 20,000 times.

17.14.4 Acceptance Level

There shall be no loss of serviceability to the door or its latching mechanism.

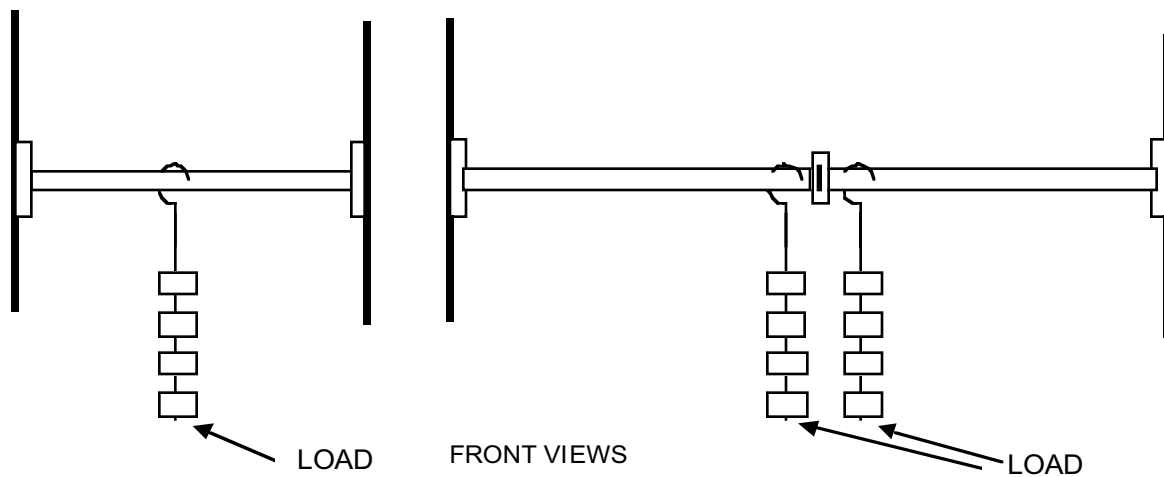


Figure 18 - Clothes Rails Static Loading Test

18 Clothes Rails Static Loading Test

18.1 Purpose of Test

The purpose of this test is to evaluate the ability of the clothes rails to withstand static loads. This test may be conducted simultaneously with the unit strength test, Section 4.

18.2 Test Setup

- a) The unit shall be leveled in its normal operating position and may be secured to prevent tipping. The method of securing shall not affect the load application.
- b) If load applications to other components will affect the functional performance of the clothes rail, load those components with the functional load specified in Table 1 (page 18). If extendible, clothes rails shall be extended during the loading test.

18.3 Test Procedure

- a) Place the rail on its supports in the unit.
- b) Load the rail per Table 1 (page 18). Concentrate this load at the weakest point(s) (See Figure 18 for loading examples). Several load applications may be required to determine the weakest point(s) of the rail and/or supports.
- c) If there are two or more sections of rail (three or more support points), simultaneously load each section with the specified load.
- d) Apply the specified load for 1.0 hour.

18.4 Acceptance Level

There shall be no loss of serviceability.

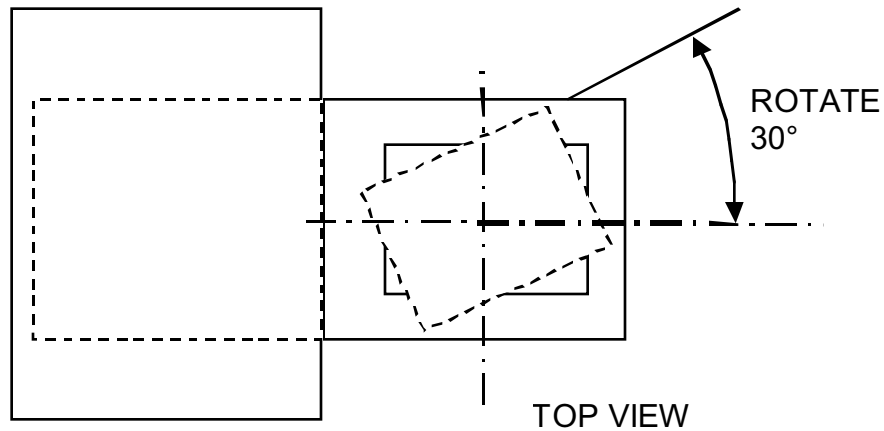


Figure 19 -- Swivel Cycle Test for Television/Video Display Terminal Surfaces

19 Swivel Cycle Test for Television/Video Display Terminal Surfaces

This test may be run in conjunction with the Horizontal Cycle Test for Television/Video Display Terminal Extendible Elements in Section 15.3.

19.1 Purpose of Test

The purpose of this test is to ensure that the swivel mechanism is capable of supporting television/video display loads during use.

19.2 Test Setup

- a) The swivel assembly shall be mounted in its normal operating position.
- b) Apply a functional load as specified in Table 2 (page 19) to the television/video display support surface.
- c) Connect a cycling device to the swiveling surface. The cycling device shall neither add load nor provide vertical support.
- d) Rotate the swivel 30 degrees (or the maximum allowed swivel distance, whichever is less) and return.
- e) The cycling device shall be operated at a rate of 12 ± 4 cycles per minute.

19.3 Test Procedure

Cycle the swivel for a total of 10,000 cycles.

19.4 Acceptance Level

There shall be no loss of serviceability to the storage unit or its components.

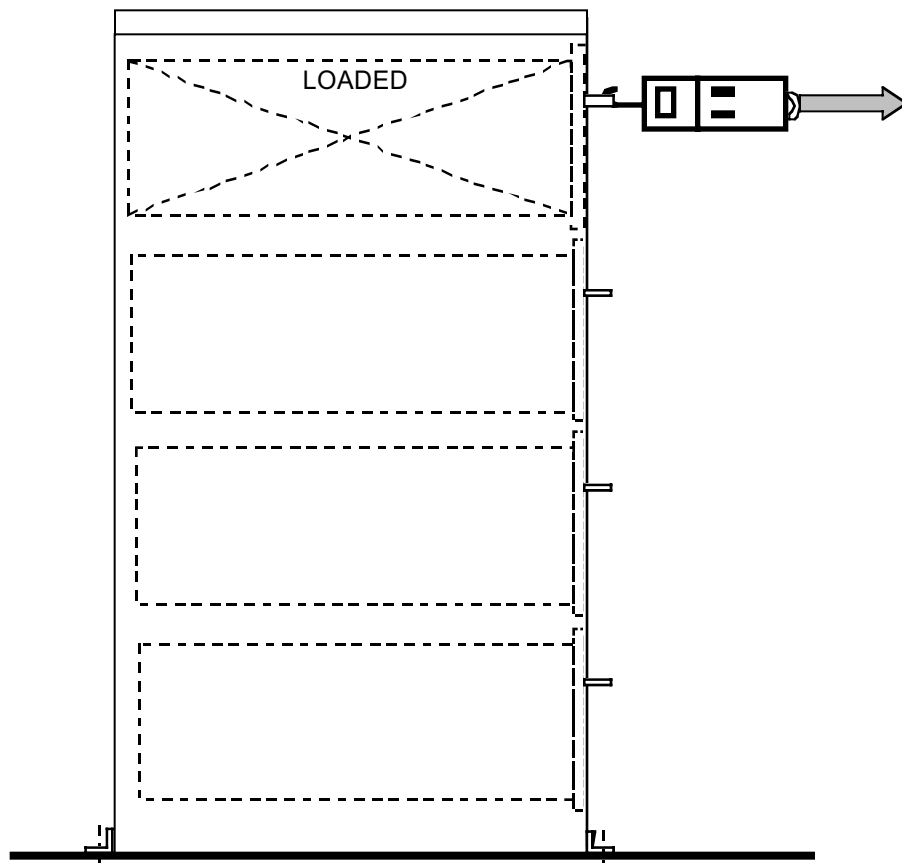


Figure 20 - Pull Force Test

20 Pull Force Test (See Figure 20)

20.1 Purpose of Test

The purpose of this test is to measure the force required to move an extendible element or door from the fully closed position to the fully extended position. This test does not apply to television/video display support surfaces/mechanisms.

20.2 Test Setup

- a) The storage unit shall be placed on a test platform, leveled, and secured against movement.
- b) Extendible elements shall be uniformly loaded per Table 1 (page 18). The load shall be configured per Section 3.7.2 (Figure 3a or 3b) if extendible elements have bottoms. The load shall be configured per Section 3.7.3 (Figure 3c) if extendible elements do not have bottoms. For extendible elements functioning as a shelf the load shall be evenly distributed front to back and left to right on the shelf surface. Any latching mechanisms shall be disabled. Doors with storage capability shall not be loaded for this test.
- c) Extendible elements shall be subjected to a one-time break-in period of 100 cycles. One cycle is defined as travel from 0 to 6 mm (0 to 0.25 in.) of the closed position to 0 to 6 mm (0 to 0.25 in.) of the fully extended position and return.
- d) Where applicable (typically for ball-bearing suspension) fully open and fully close the extendible element one time to ensure the suspension is adequately reset before performing the pull force test.
- e) A force gauge or other force measurement device shall be attached to the center of the pull area.

20.3 Test Procedure

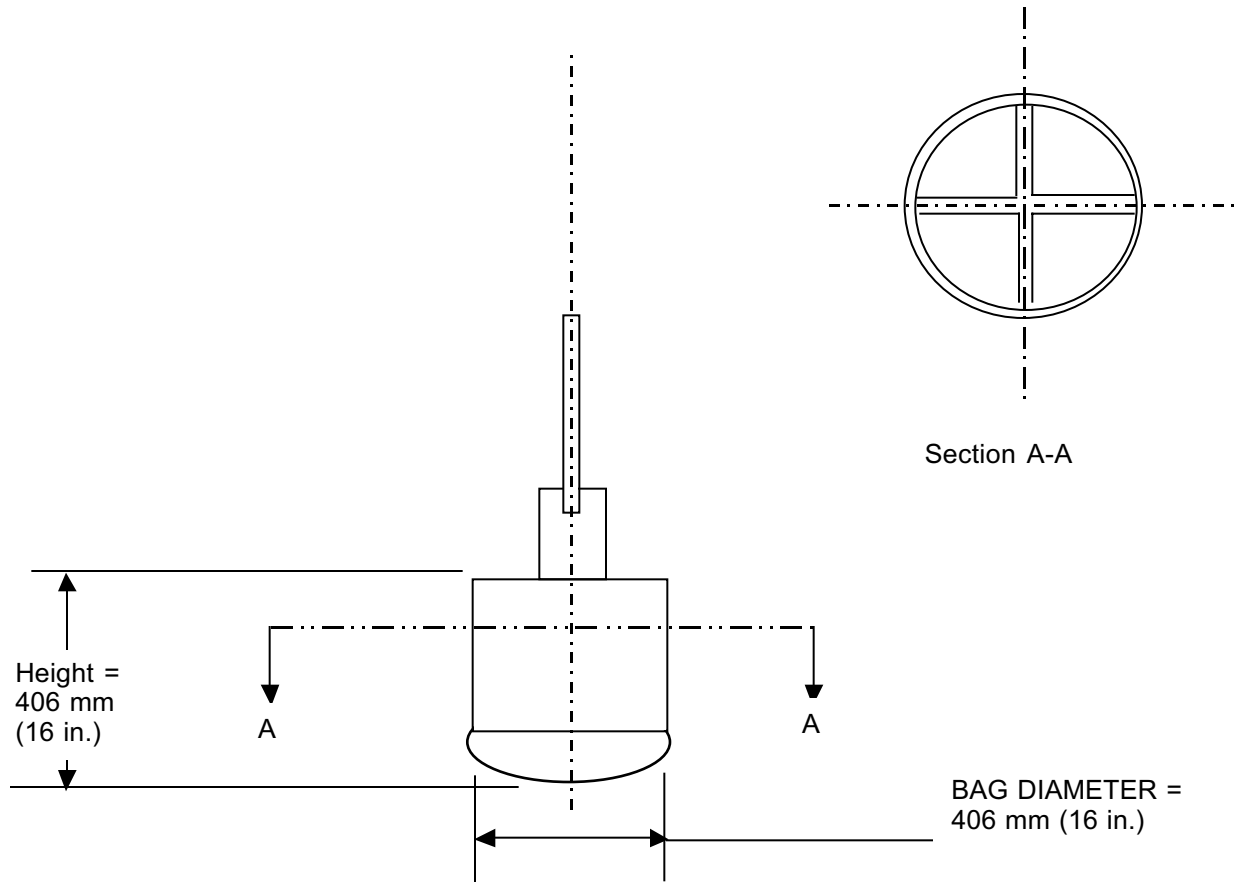
Open the extendible element or door from its fully closed position to its fully extended position while measuring the maximum force.

20.4 Acceptance Level

The applied force shall not exceed 50 N (11.2 lbf.).

Appendix A — Impact Test Bag Construction

Example: 406 mm (16 in.) diameter bag



Appendix A (Continued) - Impact Test Bag -- Typical Construction

TITLE		MAT'L		SEE TABLE		ASSY NO		DWG REV	
		FINISH							
		J.D.							
		05/03/2000		C.A.				Sheet 1 of 4	

DET NO	DESCRIPTION	MATERIAL	QTY
1	SIDE PANEL	22 OZ. VINYL	1
		COATED POLYESTER	
2	BOTTOM PANEL	22 OZ. VINYL	2
		COATED POLYESTER	
3	INSIDE PANEL	22 OZ. VINYL	1
		COATED POLYESTER	
4	REINFORCEMENT	22 OZ. VINYL	4
		COATED POLYESTER	
5	WEBBING	2" WIDE POLYESTER, ABRAS-	2
		SION GRADE, TENSILE	
		STRENGTH OF 2900 LBS.	
6	THREAD	POLYESTER #305	X
7	STEEL RINGS	3/8" DIA. STOCK x 2-3/8"	4
		WIDE x 3-1/8" HIGH	

DROP BAG

DETAIL C
(SEE SHT 2 OF 4)

DETAIL E
(SEE SHT 3 OF 4)

DETAIL F
(SEE SHT 3 OF 4)

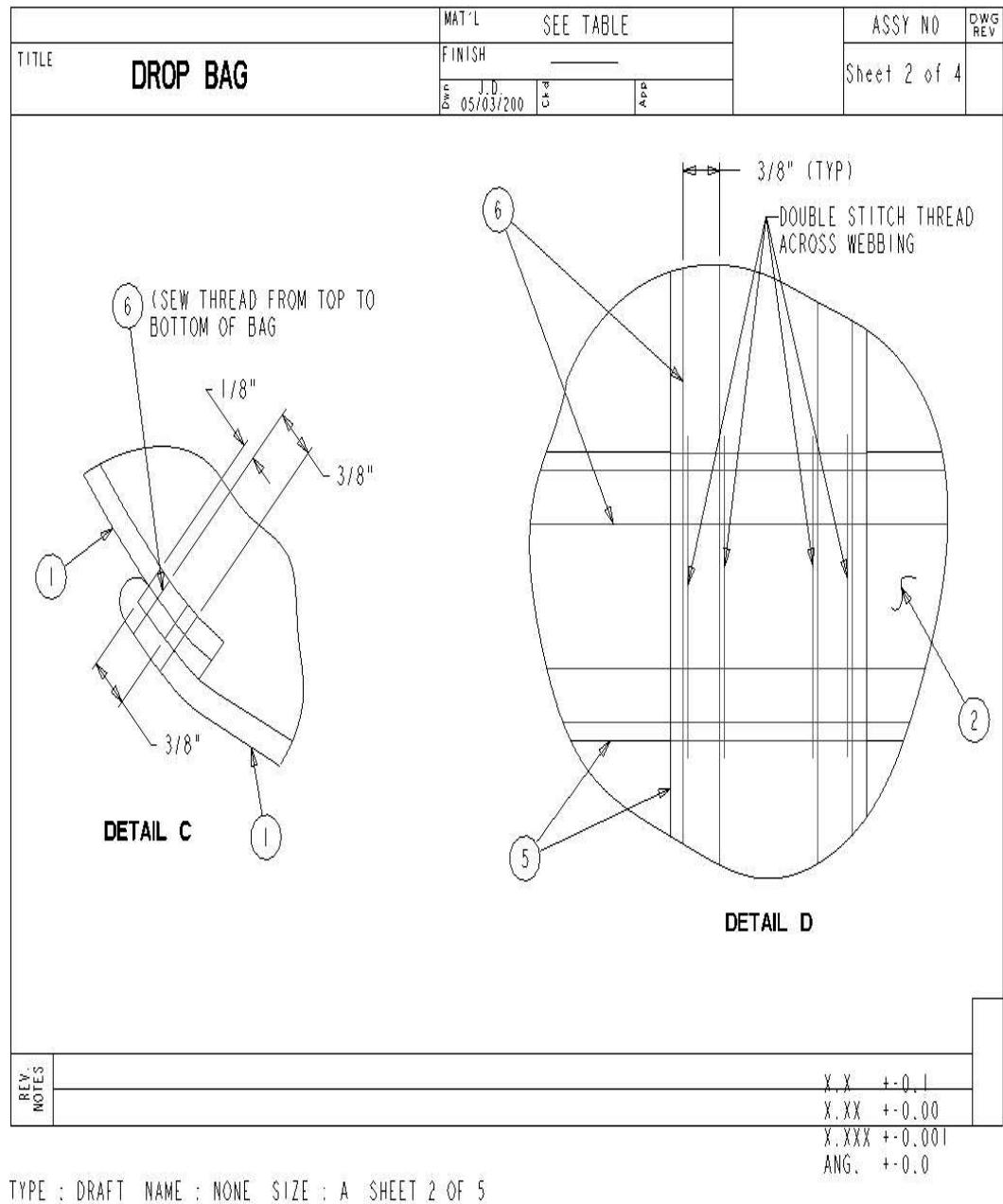
SECTION A-A

DETAIL D
(SEE SHT 2 OF 4)

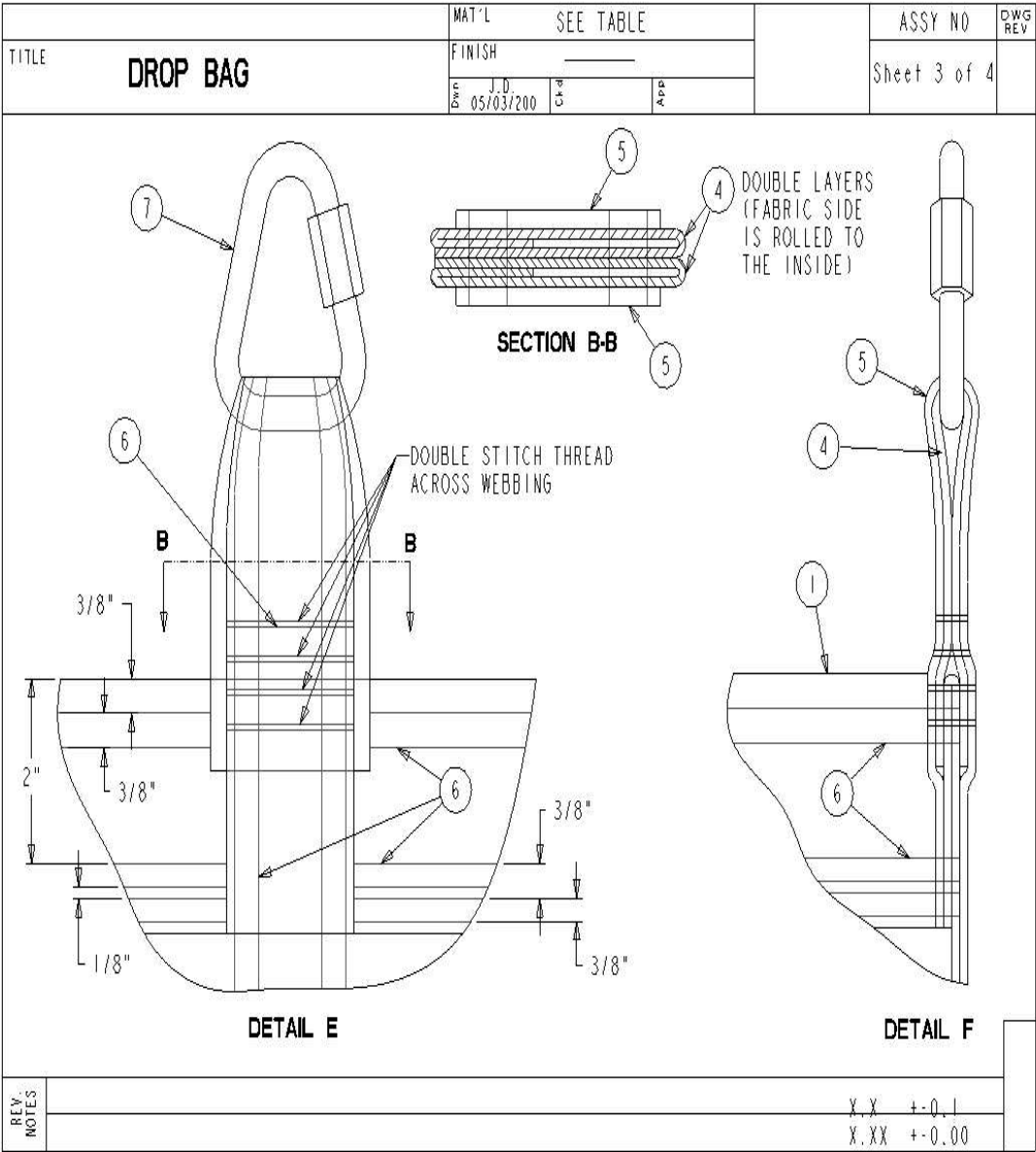
DETAIL G
(SEE SHT 4 OF 4)

REV.	NOTES	
		X.X +-0.1
		X.XX +-0.00
		X.XXX +-0.001
		ANG. +-0.0

Appendix A (Continued) - Impact Test Bag -- Typical Construction

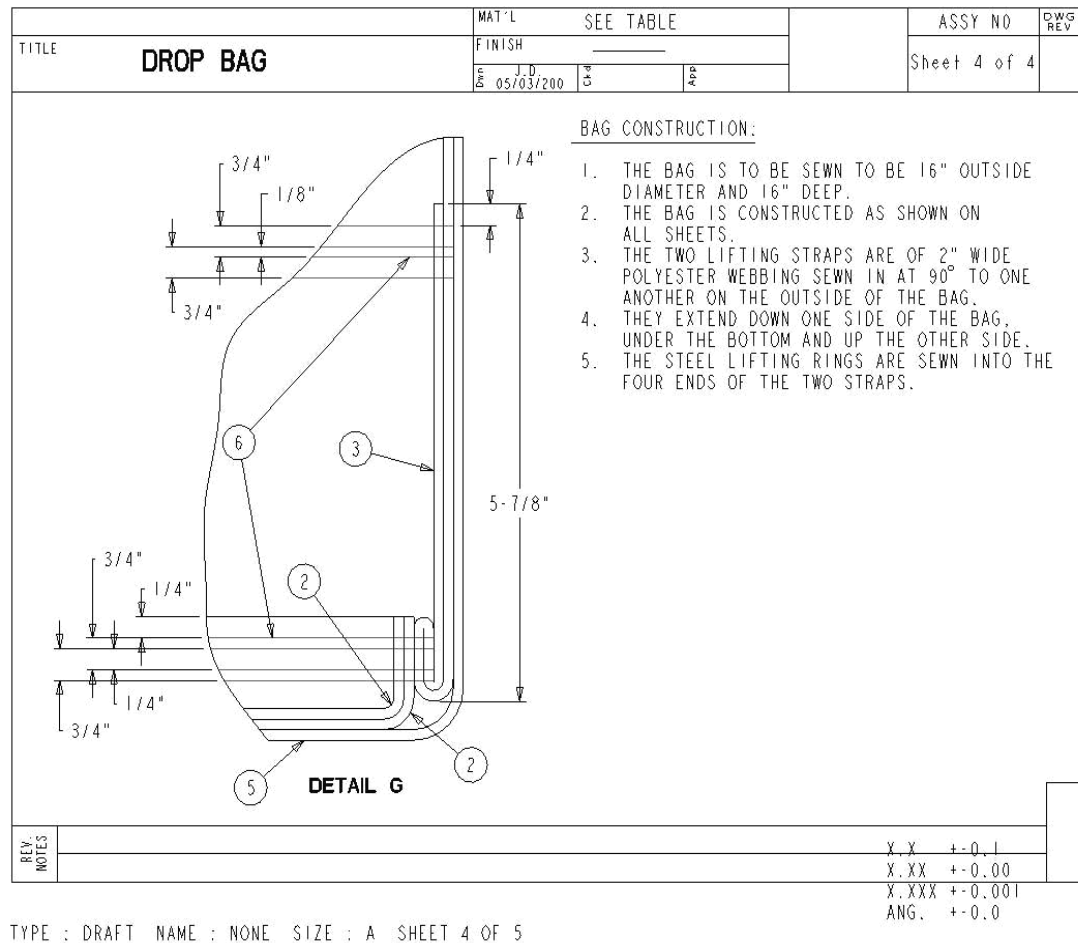


Appendix A (Continued) - Impact Test Bag -- Typical Construction



TYPE : DRAFT NAME : NONE SIZE : A SHEET 3 OF 5

Appendix A (Continued) - Impact Test Bag -- Typical Construction



Appendix B

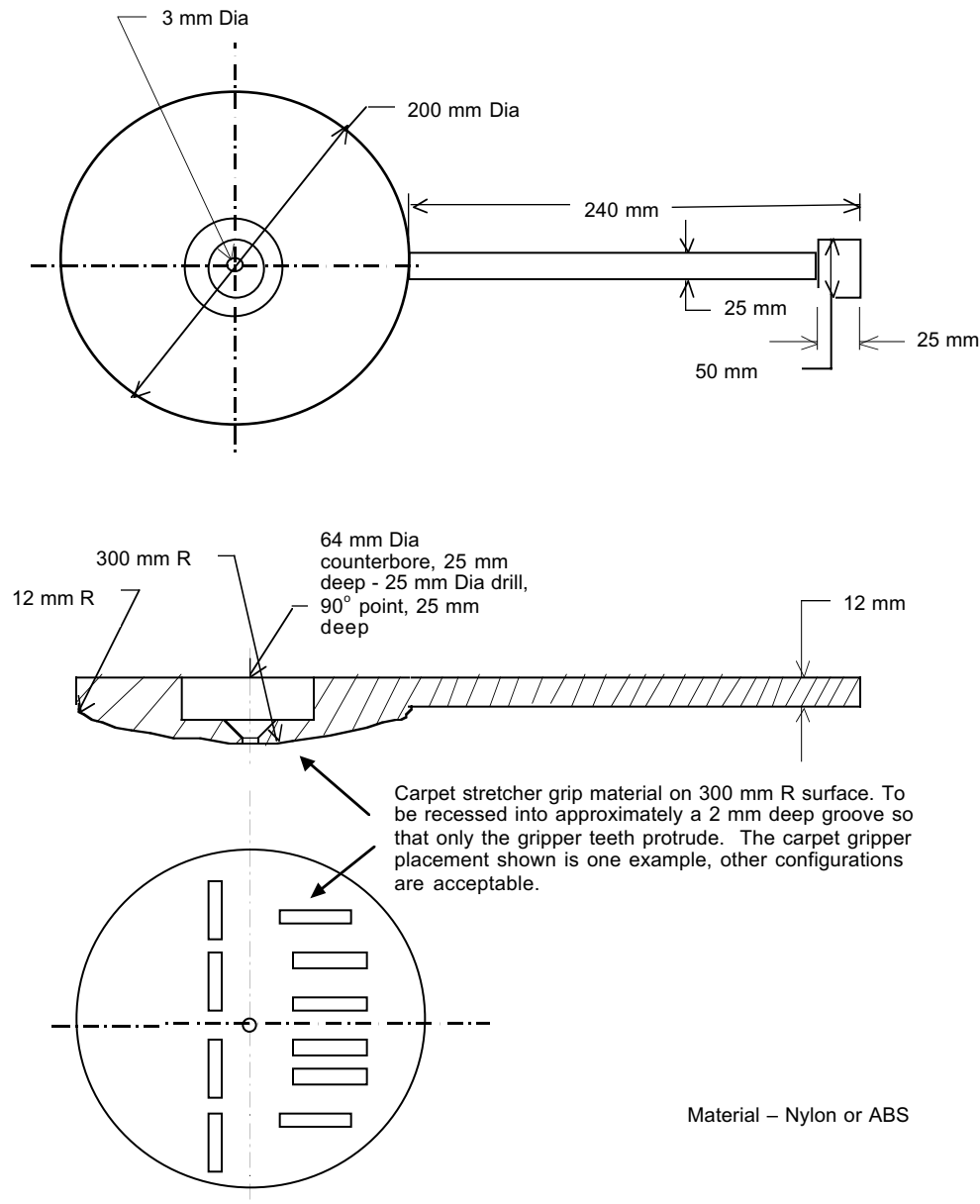


Figure 21 – Front Stability Loading Pad

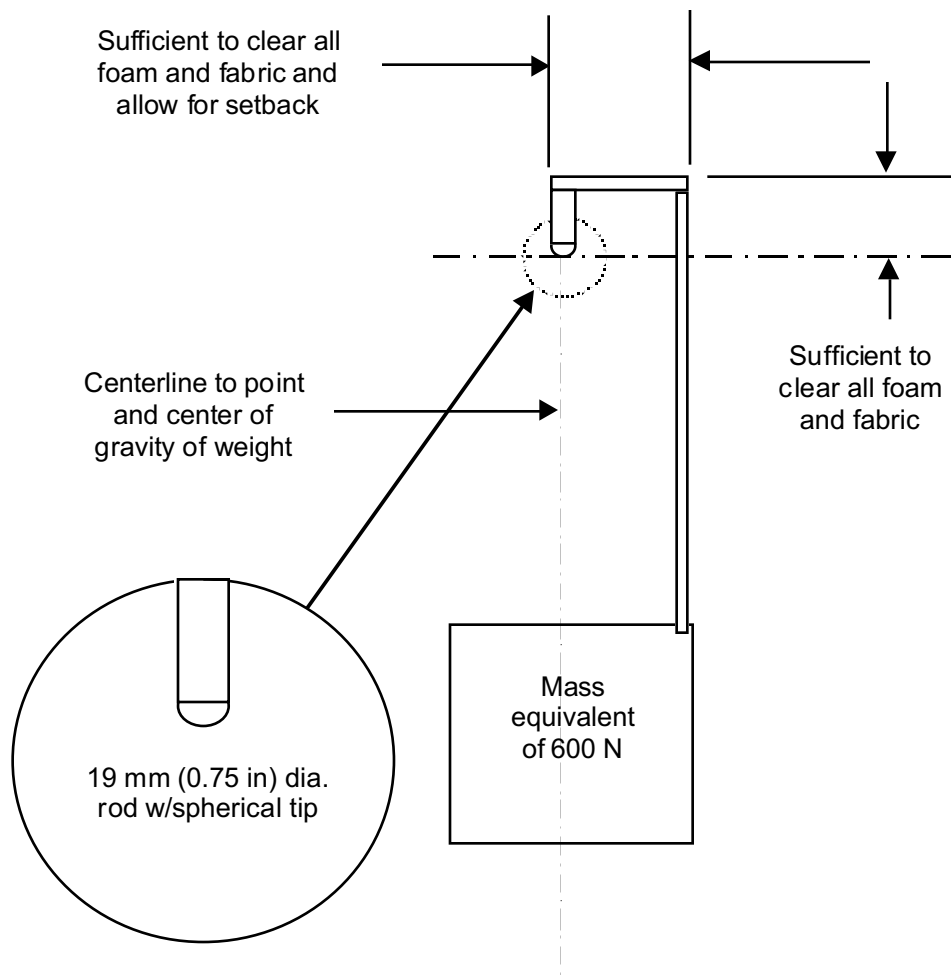


Figure 22 - Front Stability Loading Fixture

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